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The impact of Information Technology on the agility of Indian Small and Medium sized Enterprises

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Introduction

Research background and motivation

SMEs have been an integral part of Indian economy since ages since they create a lot of employment opportunities in both rural and urban areas and encourage entrepreneurship. After agriculture, small business is the second largest employer of human resources in India. Indian SMEs generate over 120 million employment opportunities from both organized and unorganized sectors. In 2019, the SME sector contributed 29 percent of overall GDP and 48.56 percent of total exports in the 2017–18 fiscal year (Tripathi 2020). In last few decades the SME sector in India had contributed significantly to the national economy through its manufacturing output and shared nearly 45 percent of total manufacturing output, and approximately 40 percent of total national export. SMEs in India also acts as suppliers to the larger enterprises as part of a larger supply chain. SMEs play a role as support units for bigger companies, and contributes significantly to the society (Sharma and Kharub 2015; Virmani et al. 2020). The markets are continuously evolving and fierce competition in today's environment (Sharma and Kharub 2015) and the reduction in demand recently has affected the income of the enterprises significantly (Mehrotra et al. 2020). According to (Ionica and Razvan, 2010), microeconomic issues such as entrepreneurial start-ups and macroeconomic performance are closely interconnected. Productivity indicates how effectively an economy uses its resources to produce goods and services at macro level. Indian SMEs has experienced major disruptions in their production and logistical supply chains in the recent years. Lack of local support for SMEs development, lack of guidance on entering new markets, and rules that discourage scaling up, have hampered the growth of Indian SMEs according to 2018–19 Economic Survey. The economic development and prosperity are however dependent on the transformation process of SMEs from private firms to well established businesses achieved through successful exploitation of new technologies and innovations that ensures sustainable competitive advantage (Klonowski, 2012). Moreover, high levels of domestic and global competition, as well as ever-changing customer demands and a need for shorter product development life-cycle, have put a lot of pressure on SMEs to be more innovative and successful in their growth and survival strategies (Kale et al., 2010). In this context, the quality of SME's

products and services plays an important role in improving their competitiveness, and also ensures their position in the supply chain (Singh, 2011).

There are variety of industries that comes under Indian SME sector. They are either service oriented or manufacturing industries. Indian SMEs produce more than 8,000 products which covers a wide spectrum of handmade, traditional, machine-made, and very recently, Industry 4.0 products. India is a destination for many natural industrial clusters, primarily dominated by SMEs (Das and Joseph, 2013). Indian SMEs operate in the form of clusters which facilitates the small individual firms to specialize in specific tasks, and to have access to special skills and services. However, a large number of these industrial cluster SMEs operates in an informal way, such as they have low-level labor standards, they duplicate the brands and trademarks/designs, breaching the fiscal/environmental rules, poorly handled inputs etc. Part of the reason is that many of them aren't aware of agile practices. Despite the significance of diversification for growth and survival, Indian SMEs finds it difficult to diversify or expand into new product and service categories according to (ADB Briefs 2021 report). It has also been observed that there is a strong link between SMEs and external environment. Specially the environmental factors such as technological, economical, global, competitive, and social factors have a significant impact on the performance of SMEs (Adeola, 2016). Whereas (Syamala D. B., et al. 2017) reviewed the research studies on numerous challenges faced by Indian SME sector and categorized them as internal and external factors which together plays a substantial role in the growth and performance in which financial, technological, organizational and government related factors are the crucial ones. Since Indian SMEs are in midst of transformation, they need continuous development and growth opportunities. However, they face challenges related to inadequate and timely finance and frequently seek external support, leading to increased transactional costs. Increased operational costs for Indian SMEs have been attributed to a lack of latest technological skills and outdated machinery and equipment. Moreover, motivating the management and technical staff is difficult for SMEs when there is a limited access to funds and capabilities. New market dynamics have emerged as a result of advancements in ICT, particularly on Internet and social media networks (Alves, Fernandez and Rapso 2016) and has created a competitive atmosphere for the position of the firms. While ICT enable SMEs to compete with large enterprises and have equal access to market benefits. Multiple surveys conducted by Indian industry organizations suggest that Indian SMEs have a low level of ICT penetration and adoption (Confederation of Indian Industry, 2015; FICCI, 2012; NASSCOM,

2010). Technology and digital knowledge gap are identified as one of the reasons for poor IT adoption and implementation in Indian SMEs.

SMEs in India face issues in production and marketing of their products due to lack of latest technology or poor technology upgradation strategies, making it further challenging to compete in a dynamic market environment. Indian SMEs can enhance their production by efficient utilization of technology. While (Dr. Gisha P. Mathai, 2015) undertook an exploratory study to assess the primary issues that SMEs in India deal with, and made useful recommendations for improvement of this sector. The author concluded that mutual sharing of technologies, the formation of a panel of advisors, determination of technological needs, awareness initiatives, adequate financial availability, and relaxation of workforce regulations can all help the Indian SMEs development and growth process. While other researchers that investigated handicraft exporters in and around Noida city in India to determine the perceived risks regarding internationalization of SMEs, claims that while exporting to international markets, a lack of infrastructure is found to be the most serious issue. Infrastructural problems need to be resolved on a high priority basis since they have an impact on SME's efficiency and profitability. Multiple other factors that contribute to slow down the growth process for Indian SMEs include poor strategic planning, infrastructural obstructions, and complex labor rules, all together impede the smooth functioning of SME units. Moreover, Indian SME industry is involved in informal recruitment and human resource management activities such as selection, training, and payment are not given a high priority. Human workforce resources therefore get effected due to lack of proper training and developmental facilities resulting in deployment of inefficient managerial team and technical staff.

Indian markets are diversified in nature and particularly deals with localized or region-specific demands and needs of customers for day-to-day basis used products and services. They need to develop high levels of competencies and responsiveness in their systems. Agile practices have a vital and positive effect on cost, lead time and waste reduction according to (Udokporo et al., 2020). But being truly agile is predicting what customers 'may and most likely want' before the competitors do, and then respond to it efficiently according to Samir Sathe, (executive vice president of Wadhwani Foundation dedicated towards small business growth, innovation, and skilling). Customer relationship has a positive impact on supply chain management, and influence the manufacturing enterprises in improving the quality of their products in satisfying their

customers (Agus and Hassan, 2012). While sensing and responding quickly to customer requirements and demands is an essential condition of agility, since these are two dynamic capabilities of customer agility (Hajli et al., 2020). Other experts expressed that Indian SMEs need to optimize and stabilize their operations, and eliminate redundancies so that they can strategize in an agile way by using latest technology to make robust efforts.

SMEs in India face tough situation due to immense competition from large enterprises as claimed by (Lahiri, 2012), while (Dr. Uma, P. 2013) researched on SMEs and economic development of India, has found that Indian SMEs must accept the responsibility for meeting global market standards, qualities, technological improvements, skills, and technical know-how. One of the critical factors for the firm's success is a deeper understanding of environmental uncertainty and how to manage it (Vagnoni and Khoddami, 2016; Vecchiato, 2015). An enterprise that faces turbulence must manage uncertainty and risk by sustaining the management's flexibility, prediction, perception, and sensitivity in relation to its internal and external environments (Kumkale, 2016). Understanding customer demands and information is a core issue for Indian SMEs that aspire to become giants in India and compete in international markets (Verma & Bhattacharyya, 2017). To attain sustainable competitiveness SMEs in India needs to create, access and commercialize new knowledge in domestic and international markets, especially in today's business environment that are highly dynamic and hypercompetitive (Ravichandran 2018). Scholars have focused on agility recently because it is believed to have a substantial role in firm's performance, in a fluctuating environment (Kale et al., 2019; Tallon and Pinsonneault, 2011; Vagnoni and Khoddami, 2016; Vickery et al., 2010). Particularly the software products and services that are built on agile development practices are highly focused on agility requirements (Wendler, 2016; Zaitsev et al., 2020). In general, SMEs in India face troubles in this regard due to low technical expertise and knowledge. For example, the major problem of SMEs in the districts of 'Rajouri' and 'Poonch' happened to be a lack of managerial expertise as studied by (Pazir & Hussain, 2013) in their research. Top management support is crucial in improving organizational agility that influence manager's attitude towards the use of Information Technology (Zain et al. 2005). Moreover, top management's support facilitates the creation of an internal collaboration, which is necessary for the growth of agile manufacturing systems (Sindhwani and Malhotra, 2017). To gain agility, it is highly important for SMEs in India to improve their technical knowledge and information database specially in the managerial team. There are multiple obstacles while

implementing agile concepts in the Indian SMEs. These obstacles are mostly related to top management inefficiency, delays in decision-making process, lack of adequate technology, bad information system usage, organizational structure and culture, and poor relationship management with suppliers (Hasan et al., 2007). An agile talent, has "a positive attitude towards problem-solving, flexibility with change, self-development, and willingness to embrace new responsibilities" (Muduli and Pandya, 2018, p. 277).

Indian SMEs need to develop an instantly available in-house talent, that is agile in nature and methods and that quickly adapt to internal and external changes. Researchers also believe that service quality must be maintained across the entire value network of the enterprise, including its employees (Gupta & Singh, 2015, 2017; Seth et al., 2008; Prakash, 2014). A culture of knowledge sharing among internal talent encourages greater coordination and communication between its internal units (Almahamid, 2018). And through effective and open communication employees are kept informed on latest technologies, operational data, corporate documentation, and changing business strategies (Sharma and Kamalanabhan, 2012). For international activities in small businesses, social capital resources such as networks, informal connections, inter-firm partnerships, and managerial links are regarded as essential resource (Pollard & Jemicz, 2010; Ellis, 2011). The network relationship with external partners in SMEs ensures access to external resources. In a recent Webinar organized by 'SME Chamber of India' and 'India-US SME Business Council' has explored various emerging business opportunities for India and US SMEs in manufacturing sector. And a common platform was created for business cooperation between India and US SMEs. Such initiatives have positive influence on Indian SMEs to improve or extend their global reach for potential consumers, market opportunities and business partners. Networking with partners allows enterprises to have access to market information, generate and share information about consumer's requirements and preferences, as well as information about the competition, in order to develop an effective strategy (Mu et al., 2016). Previous research has also found a positive link between networking capabilities and agility because it helps the enterprise to be more flexible in accessing critical resources from business partners and operate across globally (Battistella et al., 2017; Liu and Yang, 2019; Rezazadeh and Nobari, 2018; Yusuf et al., 2014). One of the indicators of firm's performance is the ability to develop a large and dynamic network (Mitrega, Forkmann, and Zaefarian 2017). According to (Shekarian et al., 2020), internal and external integration with potential suppliers and customers, is another important prerequisite for

achieving agility. In order to be agile in a dynamic environment, and boost performance it is highly necessary for Indian SMEs to focus on building strong and agile networks that can fulfill their business partners needs and requirements. Moreover, access to global markets necessitates the development of an efficient ICT infrastructure, as well as improved interoperability and standards, that promotes information exchange and communication (BIAC, B20 China, World SME Forum, SME Finance Forum 2016; OECD 2017a). Since SME industries in India face challenges related to quality and productivity of their products and services due to various internal and external factors. Adopting agile practices can support Indian SMEs in optimization of technological resources in improving productivity along with superior quality. Faster rate of industrial development can be achieved through implementing agile methods and practices. Agility supports flexibility towards changing market conditions thereby increasing the possibility to capture new market opportunities both at local and international levels. Moreover, the rapid pace of globalization and domestic competition encourage Indian SMEs to shift from old strategies to new and agile strategies. In order to compete with global brands, products and services Indian SMEs are expected to upgrade their employee skills and competencies, technical knowledge of managers, along with suitable IT architecture. Though SMEs in India immensely contribute to Indian economy but they still didn't reach their top potential due to insufficient knowledge on agile methods and practices or its execution. While there are multiple factors that can either hinder or promote agility in Indian SMEs, technology adoption and execution is the crucial one that is closely related with agility. There is a need to investigate the role of agility in Indian SMEs in the technological context especially due to the adoption of latest IT infrastructure which includes new and emerging integrated IT tools and human IT expertise.

Research objectives, problem and hypothesis

Subject of the research

Agility has been viewed as a performance enabler and one of the critical success factors that enables the enterprise to achieve deeper understanding of environmental uncertainties and how to manage them and maintain stability. Enterprises are expected to continuously try and find out new innovative ways to create new opportunities. And agility supports the enterprises to identify market opportunities and exploit them to their advantage. Since high innovation capabilities promote

enterprises to be more creative in how they use technology and networks to rapidly respond to the customers and business partner's needs, which leads to improved enterprise performance (Ravichandran 2018). Therefore, reconsidering agile methods and practices for the purpose of innovation adoption and opportunity identification, creation and exploitation to improve the business performance should be the strategic priority for Indian SMEs. A variety of agility frameworks have been proposed and used by researchers in order to determine the agility of enterprise. After analyzing various agility frameworks, the framework suggested by (Trzcieliski, 2006) is ideally suited for this research which has four key components that describes agility from four different perspectives or dimensions. 'Brightness' refers to the enterprise ability to recognize commercial opportunities and threats resulting from a systematic scanning of environmental changes. This agility component is highly useful for Indian SMEs in scanning the market-level and industry-level changes in Indian markets, which results in effective identification of market opportunities. 'Flexibility' deals with the quality and characteristics of enterprise's resources that contributes to improved variety of products and also to increase productivity of the enterprise. This agility feature allows Indian SMEs to effectively exploit various market opportunities by means of the quality of their enterprise resources. 'Intelligence' refers to the enterprise ability to analyze and predict the forthcoming market changes or variations that can be turned in to opportunities and to prepare for a targeted response for such opportunities. This agility component enables Indian SMEs to proactively respond towards market opportunities, and to make the utmost benefit out of an upcoming opportunity by preparing for it in advance. Whereas 'shrewdness' refers to the quality or ability of the enterprise to react to market changes in a very dynamic and efficient way prior to its competitors and seize the short-lived/transient opportunity and convert it in to an already used opportunity. This component of agility framework is very useful for encouraging the opportunity seeking behavior of Indian SMEs and promotes creative ways of exploiting the short-lived opportunities in Indian markets. Hence this dimension of agility is useful for opportunity creation.

The subject of research is mainly based on enterprise agility of Indian SMEs and the two crucial aspects of enterprise agility. The first aspect deals with the identification and exploitation of new market opportunities, whereas the second deals with creation of new opportunities in the Indian markets. Both of these aspects need to be analyzed in the context of innovative technologies and the scope of their applicability in the Indian SMEs and consequently the impact it creates on enterprise agility of Indian SMEs. Since the four components of the mentioned agility framework

which include brightness, flexibility, intelligence and shrewdness are supportive and useful in identification and exploitation market opportunities in a turbulent environment. Hence in the light of above discussion, the subject of the research is the agility of Indian SMEs, understood as brightness, flexibility, intelligence and shrewdness and their ability to identify and respond to existing market opportunities as well as to create new market opportunities through innovative activities.

Research objectives

Agility supports the enterprise in quick decision making as well as improving the quality of organizational response towards market opportunities. Researchers believe that SMEs need to develop and improve their capabilities such as quick decision-making, responsiveness, networking, and knowledge management in order to become agile. However, without the internal integration and interconnected internal structures within the enterprise, the ability to efficiently gather, evaluate, and utilize external information and is not possible. Agility therefore emphasizes on rearranging and reorganizing the internal resources (both technological and human resources) to effectively deal with customer responsiveness, competition levels, market opportunities and threats. In order to become agile, SMEs need to use new ways and new methods of implementing innovative technologies and take radical actions in utilizing their existing resources. Since the inter coordination of internal structures is essential to meet customer expectations and needs of the business partners and suppliers in an unstable market environment. The IT and ICT tools are highly useful in this regard, and plays a key role in effectively sharing and communicating essential data or information across all departments within the enterprise and with customers, partners, supply chain members to support agile processes in SMEs. Moreover, they have an impact on SME's internal structures and facilitates the development of new skills and competencies of employees. And by supporting the knowledge management practices such as knowledge building, acquisition, and knowledge transfer, IT contributes to common understandings and culture, as well as higher responsiveness and transparency in SMEs. The latest IT tools has achieved higher levels of flexibility and accessibility, which could prove to be valuable tools for SMEs in discovering and seizing new market opportunities. Since IT tools are also beneficial for SMEs in gaining access to external resources and capabilities that are not available within the enterprise, and hence enables to expand their access to critical human and technical resources from external partners. This creates

new methods of resource utilization, which is particularly critical for SMEs that seek opportunities in foreign markets. And by effectively implementing IT, Indian SMEs can expect to identify, create and exploit new market opportunities both in the domestic and foreign markets. While the skills and competences that are essential in dealing with customer responsiveness and in introducing new products and services, and product quality can also be achieved or improved. Keeping in view the potential benefits that SMEs could achieve through IT implementation specially the benefits related to enhancing the agility of Indian SMEs, the aim of this research is to identify if and how IT affects the agility of Indian SMEs and which IT/ICT can improve the agility of these enterprises. The research study intends to fulfil the theoretical (scientific) objectives and utilitarian (practical) objectives.

• The theoretical (scientific) aspect aims for the following objectives

1. To propose measures for improving the agility dimensions (Brightness, Flexibility, Intelligence and Shrewdness) in the context of IT implementation in Indian SMEs.

2. To promote awareness and knowledge on agile methods of IT implementation among SME entrepreneurs, SME managers and practitioners of India in particular and for others.

3. To reduce the knowledge gap that exists in the literature on the influence of IT adaptation on the agility of Indian SMEs and to contribute to the earlier researches that has been carried out in this area and set a direction for the future research.

• The utilitarian (practical) aspect, which amins for following objectives

1. To identify the key IT technologies that practically contributes to agile business in Indian SMEs and whether those IT technologies enable them to identify, create and exploit new opportunities in Indian markets effectively.

2. To analyze and explore the correlation between the independent and dependent variables used in this research and extract new knowledge and insights from these correlations and suggest measures for improvement.

3. To identify the skills and competences of Indian SME employees that are essential in dealing with customer responsiveness.

4. To identify the IT infrastructure that is essential for introducing new innovative products and services in Indian SMEs.

5. To identify the IT infrastructure essential for exploring new markets in both local and international markets for Indian SMEs.

6. To suggest effective measures for improving the conditions and applicability of specific IT solution to enhance the overall enterprise agility of Indian SMEs.

The research gap

Multiple researchers have examined agility in the context of a specific business process or area, such as supply chain agility, human resource agility, market orientation, knowledge management, strategic alignment, organizational networks etc. Earlier researches (Yeganegi & Azar 2012; Panda & Rath 2017; Mikalef & Pateli 2017; Felipe et al. 2016) have also focused on the impact of various IT capabilities on different business aspects and agility of enterprise, and have claimed that IT capabilities have an impact on enterprise agility levels. Other researches has argued that digitalization enhances the enterprise agility (Li et al., 2021; Lucas and Goh, 2009). Several others have emphasized on the importance of organizational capabilities as drivers for creating value and leveraging digital technology for businesses (Akhtar et al., 2018; Chan et al., 2019; Jagtap and Duong, 2019; Kane et al., 2015). While others have attributed the ability to accomplish organizational agility directly to IT infrastructure (de Oliveira, S.B., et. al, 2012). However, such studies that link IT and digitalization with agility are have distinct viewpoints in general. Moreover, these researches were made in general context of an enterprise and not particularly related to specific industry or sector. And the studies that has focused on specific industry or sector, such as manufacturing, where researchers have examined what manufacturing firms can do to improve their agility (Ganguly et al., 2009; Yauch, 2011). Most importantly they were not conducted explicitly in the context of SME industry. Moreover, empirical researches that link IT capabilities with agility of enterprise are evolving overtime (Tallon and Pinsonneault, 2011; Lu and Ramamurthy, 2011; Roberts and Grover, 2012; Huang et al., 2012; DeGroote and Marx, 2013; Tan et al., 2017). Therefore, more empirical investigations are needed to expand the theoretical understanding of the relationship between a firm's IT capabilities and enterprise agility (Tallon et al., 2019) specially in the context of SMEs. While according to (Lowry P.B., Wilson D.

2016), there still exists research gaps in our knowledge of how IT resources support agility, despite the fact that modern enterprises are becoming heavily dependent on IT to remain agile and competitive in a volatile market environment.

The literature analysis carried out with respect to studies that have focused on influence of IT on agility of SMEs reveal that, though some of the previous researches have tried to address few areas that are common to subject of this research. However, there are several limitations to such previous SME researches, and contradicts to current research to a major extent and hence do not potentially hinder the direction of this research. For example, research was conducted on SMEs of Finland to investigate the role of dynamic capabilities and strategic agility. Though the study demonstrated enabling role of entrepreneurs in sensing and exploiting opportunities, reconfiguring capabilities, and innovatively modifying business models for the purpose of opportunity recognition and exploitation. And has also confirmed that digital technologies facilitated the online presence and communication with existing and new customers. However, the empirical research was based on exploratory case study of a small sample of 5 Finnish high-tech SMEs in a small open economy, Moreover, it was based on a qualitative approach and was conducted in the context of adapting to the aftermath of a disastrous situation in a country specific environment. Therefore, the results of such SME research cannot be generalized or compared to researches that were based on larger samples using quantitative approach. In another example, where quantitative research has been conducted to collect the data from a larger sample of 400 SME managers in Ghana reveals that dynamic capabilities such as 'sensing', 'seizing' and 'transforming' all of them distinctly positively influence SME's performance, while digitalization could only affect the relationship between 'transforming capability' and SME's performance, which means that digitalization and IT did not show any relation or influence between 'sensing' and 'seizing' capabilities with respect to SME's performance. Although the research was based on a larger SME sample, but it has limitations and contradicts to subject of the current research, in the areas of not providing clear view or evidence on dynamics of opportunity creation while defining the dynamic capability variables, moreover, the research is confined to a limited scope of using IT tools in their research and has not specified the actual IT infrastructure that was taken in to consideration during the research.

Some of the SME researches have focused on resource-based view (RBV) theoretical model in order to provide evidences on how firms can utilize their resources and dynamic capabilities (sensing, and seizing) to achieve digital transformation and cope with highly volatile environment. Their findings claim that there is interrelation between technological uncertainty, portfolio of technological resources, and sensing and seizing capabilities, and this connection in either way promote digital transformation in SMEs. While other SME researches has revealed that, firms are better at 'sensing' rather than 'seizing' the IT based growth opportunities. Which means SMEs are efficient in identifying the IT based opportunities rather than in profiting from them. However, the research was based on a smaller sample of a specific manufacturing sector SMEs. Though such research studies provide knowledge on interrelations among factors such as organizational resources, dynamic capabilities, and technological uncertainty, especially in the context of digital transformation of manufacturing SMEs and their level of digital maturity but in a general context. However, such SME researches have several limitations and contradicts to the current research in many aspects, such as they are based on limited number of case studies and therefore the results cannot be generalized for a larger sample of SME sectors or industries. The findings cannot be extended to higher levels and theoretical perspectives in order to investigate different factors effecting digital transformation and enterprise agility of SMEs. Their findings do not provide a better explanation on all crucial aspects of market opportunities in SMEs such as such as customer responsiveness and opportunity creation in SMEs that operate in diverse sectors.

The literature analysis reveals that though previous SME researches have focused and analyzed a few aspects of the current research subject and were also successful in explaining their research results but within a limited and specific context. However, they were not able to successfully establish the interrelations between all the variables of IT and agility that are relevant to this research such as IT infrastructure, IT competences and the agile capabilities including sensing, creating, and exploitation of market opportunities, and customer responsiveness in SMEs. They did not provide enough empirical evidences on all aspects of the mentioned IT and agility variables, moreover they did not provide enough insights on interconnections between the IT and agility variables and the measures/actions that need to be undertaken to improve these interconnections. Furthermore, previous researches did not provide enough empirical evidences on the relevance of various IT tools for opportunity identification, opportunity creation as well as opportunity exploitation in a volatile environment. This research gap becomes even more wider

and evident in case of Indian SMEs, since the concept of IT and agility in Indian SMEs is relatively a fresh research topic and has not been extensively researched previously. Moreover, the agile attributes such as 'brightness', 'flexibility', 'intelligence' and 'shrewdness' has never been examined by SME researches specially in the context of exploring the market opportunities in Indian SMEs.

Problem statement

There is an evident research gap with respect to IT's role and influence (which include the physical IT infrastructure, various IT software solutions, and the IT competencies of workforce) on the agile aspects of the enterprise (such as opportunity sensing, opportunity creation and opportunity exploitation) in Indian SMEs. However, in order to fulfil the research gap there is a need to explore and identify various IT tools that are being used by Indian SMEs and which of these IT tools are commonly accessible to Indian SME and which of them are deployed more frequently. It is also essential to know which of these IT tools are compatible with one another, and how does they integrate among Indian SMEs. Moreover, the functionality of these IT tools mainly depends on the internal enterprise capabilities such as how well the managers deploy it and operationalize it, and how well the employees execute or implement them, as well as external market environment such as the competitive pressure from rivals, new innovative technological trends, customer's demands to update and improve the services etc. Since the method or ways in which these IT solutions are used have a profound effect on agility aspects of the enterprise such as sensing and responding to market opportunities as well as to create new market opportunities. Hence the innovativeness and creative ways of IT implementation from both managerial side as well as the employees is highly needed to achieve and leverage the benefits of agility. In order to analyze the agility levels of the enterprise it is essential to use certain agility framework that defines agility in a specific and measurable way. Hence it is important to choose the agility framework that is suitable and reliable. Since agility framework is crucial to examine the research results from a specific dimension of agility that offers better perspective to results and based on which conclusions and improvement measures are suggested. In view of aforementioned ideas to fulfil the research gap, the following research problem statement is formulated.

The relationship between the types of ICT and the scope of their use and agility (Brightness, Flexibility, Intelligence and Shrewdness), and the ability of the enterprise to respond to market opportunities and to create market opportunities through innovation activities.

Research hypothesis and questions

To narrow the research gap following research hypothesis are developed and proposed.

Hypothesis (H1)

IT capabilities of Indian SMEs that include the key IT tools implemented and the technical skills of needed from SME manager and employees have a significant role in identifying market opportunities as well as to leverage those opportunities in Indian SMEs. Hence the following research hypothesis is proposed.

H1: IT capabilities have positive influence on sensing and exploitation of opportunities in Indian SMEs.

Hypothesis (H2)

Since customers are the key entities in commercial business activities, therefore their response towards SME is crucial in order to deliver suitable products and services according to their taste and preferences. Hence the following research hypothesis is proposed.

H2: IT capabilities have positive influence on customer responsiveness in Indian SMEs.

Hypothesis (H3)

Since the IT capabilities of Indian SMEs (IT tools and technical expertise of managers and employees) plays a critical role in creation of market opportunities in Indian markets. Hence the following research hypothesis is proposed.

H3: IT capabilities have positive influence on opportunity creation in Indian SMEs.

In order to verify the research hypothesis H1, H2, and H3 the following research questions need to be answered.

RQ1. How effective is the Indian SME's IT infrastructure in successfully sensing market opportunities?

RQ2. How effective are the IT skills and competencies of Indian SME employees in dealing with customer responsiveness?

RQ3. How effective is the Indian SME's IT infrastructure in introducing new and innovative products and services in Indian markets?

RQ4. How effective is the Indian SME's IT infrastructure in exploring new markets in both local and international level?

Structure of the dissertation

The dissertation starts with the introduction chapter in which the research background and motivation is presented, followed by objectives of the research including theoretical and utilitarian. Later the research gap is discussed, followed by the problem statement. The research hypothesis and research questions have also defined in the introduction chapter. The first three chapters of this dissertation consists of theoretical framework which majorly discuss about SMEs in Indian economy, agility of the enterprises, and Information Technology. The first chapter which is about SMEs in Indian economy provides an overview and role of SMEs in the Indian economy. Factors such as employment creation, workforce, employee skillset of Indian SMEs, and statistical information on Indian SME industry's growth rate and its effects on GDP are discussed in detail. Some of the important sectors within the Indian SME industry and their significance to nations economic growth and business have also been highlighted. The second chapter deals with agility of the enterprises with respect to SMEs viewpoint, in which some of the important aspects of agility such as organizational, strategic, workforce, supply chain, agile manufacturing has been discussed. Later, the indicators of agility such as drivers, enablers, capabilities are discussed along with agile practices and different agility frameworks including the framework that is used for this research study is also discussed in the same chapter. The third chapter of this dissertation is about the Information Technology used in SMEs, specially with respect to IT prioritization factors in SMEs such as strategic, organizational, technological, financial etc. Later the categorization of different IT tools with respect to SMEs are discussed, in which SMEs are categorized in to three main groups depending on the type of IT tools they use such as basic, advanced, and highly advanced. The operational aspects of various IT tools and their significance in SMEs are discussed

in detail later, which provides a general idea of how IT tools are useful in managing enterprise resources.

The fourth chapter of this dissertation is dedicated towards the research part. This chapter has two main sections, the first one is about the 'research model and methodology', while the second is about the 'research results.' A general overview of the research model is presented in which the pattern of literature analysis conducted on two major areas of the research i.e., 'Agility' and 'Information Technology' in the context of SMEs is described. A model that is developed based on semi systematic literature analysis and the target area or focus area of the research has also been defined or identified in this subsection. Later the methodology of this research is mentioned in detail in a sequential order, in which choosing the research approach, choosing the primary data collection instrument, defining the independent and dependent variables, choosing the model for questionnaire, and method adopted for collecting responses are some of the important issues that have been discussed in this subsection. Whereas, the first two subsection of the 'research results' deals with empirical results data of both dependent and independent variables, in which the results are presented in statistics though numeric data in tables as well as in graphical representation. A few important interpretations are made point wise on the statistical data corresponding to the Likert scale responses received. The next subsection is the discussion of the influence of ICT on agility dimensions with respect to agility framework used for this research. Spearman's Rank correlations are analyzed in order to discuss the correlations between independent and dependent variables specially with respect to the four agility dimensions such as brightness, flexibility, intelligence and shrewdness. Some of the crucial interpretations and insights are given based on the achieved results on various agility aspects that led to extract new and important information related to the influence of IT on the agility of Indian SMEs. The next subsection of the 'research results' is about the managerial implications such as the changes that need to be made in the use of ICT, in order to improve the agility aspects such as the brightness, flexibility, intelligence and shrewdness along with improvements in reactive and proactive dimensions of agility. For this, the Kruskal Wallis comparisons have been used to interpret the results to identify the key areas of IT or the specific IT that are needed to be improved to enhance the enterprise agility of Indian SMEs. In this subsection of research results, the focus is on four-agility dimensions in order to interpret the results correctly and to suggest the improvement in IT that could affect each agility dimension to improve the overall enterprise agility of Indian SMEs. Various improvement actions and plans

have been suggested based on the weaker areas that are identified for different IT tools used in Indian SMEs to improve agility.

The final chapter of this dissertation is focused on conclusion part of this research. The three main sections in this chapter consists of theoretical implications, limitations of this research and prospective research. The theoretical significance of this study to fulfill the research gap is analyzed and discussed in the first section. The contribution of this research study on the significance of IT in improving the enterprise agility of SMEs is highlighted. Moreover, the insights on four key agility dimensions which provide valuable information for practitioners and SME researchers has been pointed out in this section. This section is important for researchers because the theoretical aspects of this research and the conclusions made from it can have an impact in developing new theories in future. The second section is about the limitations of this research study, which mainly focus on what could have done better or what could have been avoided during the research. This section provides additional information for future researchers to avoid something or to implement few things in future. The main use of such introspection of own work can provide useful tips for other researchers. The last section of this chapter deals with prospective research, which is to give an idea for future researchers to continue this work to another higher level or to set a new direction for them in this area. This section is important and useful, because based on the results and conclusions of this research, new information is added to the literature which changes the direction of future researches in many ways.

1. SMEs in Indian economy

The SME units in India are also generally referred as MSME (micro, small and medium enterprises) and are classified in terms of their capacity of investments in plant and machinery according to MSME development Act 2006. Since July 2020, the criteria has been updated and according to the new definition, both manufacturing and service firms are defined within the same limits based on their capacity of investment and turnover levels. The MSME sector in India which is the second largest ecosystem in the world after China constitutes over 63 million enterprises that contribute around 37 percent of GDP to the Indian economy. MSMEs has been an integral part of Indian economy since ages since they create a lot of employment opportunities in both rural and urban areas and encourage entrepreneurship. The MSME sector generates employment for around 111 million people and manufactures more than 7,500 products as per (Development Commissioner Ministry of MSME, 2019-20 report), with a share of around 40 percent in the country's total exports. However, they generate over 120 million employment opportunities from both organized and unorganized sectors. In last few decades the MSME sector of India had contributed significantly to the national economy through its manufacturing output and shared nearly 45 percent of total manufacturing output, and approximately 40 percent of total national export. In the fiscal year 2018-19, the MSME industry contributed 48 percent of overall goods exports from India (Reserve Bank of India, 2020). This is due to its strong potential to contribute in employment creation, manufacturing output, exports capacity, and the country's Gross Domestic Product (GDP) (Saluja,2012). In today's corporate environment, the importance of SMEs in contributing to the nation's economic and social development is becoming increasingly apparent (Sajan et al., 2017). The importance of MSME industry to the Indian economy therefore cannot be ignored. Moreover, Indian MSME sector possess the potential for boosting the industrial growth of the country. They operate in a variety of markets conditions in India and tend to adjust their business specifications depending on the regional requirements and local demand of products and services. In general, manufacturing MSMEs deals with engineering goods and equipment, solar energy, fragrances-flavors and lifestyle products, leather products, plastic and polymer processing, gems and jewelry items, auto components, personal protective equipment, textiles products, food products, agro and horticulture products, electronics goods and components, pharmaceuticals, healthcare and bio technological products, chemicals and petrochemicals and others. While service

sector MSMEs are concerned about engineering and consultancy, environmental infrastructure facility, packaging, sports infrastructure, audio visual products and integration, IT and IT-enabled services, facility management and security services, education and training, tourism and hospitality, logistics, industrial automation etc. The percentage share by 'nature of activity' and 'employment' of different MSME sectors such as manufacturing, electricity, trade and other services as per MSME Annual Report 2020-21 is shown in figure (1.1).

Figure 1.1 MSME Annual Report 2020-21
Source: https://msme.gov.in/sites/default/files/MSME-ANNUAL-REPORT-ENGLISH%202020-21.pdf

By becoming a part of industrial ecosystem, the MSME sector provides comparatively huge employment opportunities than large enterprises at a relatively very lower capital cost, especially in rural and remote regions. This is especially helpful in India's transition from an agrarian to an industrialized economy. India is geographically divided in to multiple states and regions. Each state or a region has its own cultural, historic and traditional importance. Depending on the region they exist, Indian MSMEs are specifically proficient in producing goods, products and services that match and fulfill the local market demands. Moreover, Indian MSME sector provides employment to 17 million of workforce which is 14 percent of India's total working population (KPMG Report, 2017). The employment growth rate in Indian MSMEs according to Ministry of MSME Annual Report 2013-14 for both manufacturing and service sectors is given in figure (1.2).

MSME – Growth rate of employment and enterprise by sector

	Growth Rate of Employment	Growth Rate of Enterprises
Manufacturing	18%	23%
Services	34%	31%

Source – Ministry of MSME, Annual Report 2013-14

Figure 1.2 MSME Annual Report 2013-14
Source: https://dcmsme.gov.in/annualreport-msme-2013-14p.pdf

MSME industry in India can be divided into two major sections 'Rural MSMEs' and 'Urban MSMEs' based on the region they operate. The percentage share of rural MSMEs is 51% while urban MSMEs is 49% according to the National Sample Survey (NSS) 73rd round conducted during 2015-16 as mentioned in the Annual Report 2020-21. The rural MSMEs mostly rely on locally accessible resources and operates from homes, with minimal machinery and capital. Innovation in product, service, and management, as well as information from outside sources, is limited due to their low investment and networks. They are generally initiated with individual interest and risk of the entrepreneur. The rural part of India is more inclined towards agriculture and play a key role in economic growth. It is estimated around 70 percent of Indian population lives in rural India. Apart from agriculture, other rural MSME industries which includes Khadi and Village Industries ('khadi' is a hand-spun and woven natural cotton cloth promoted by Mahatma Gandhi during Indian freedom struggle), handloom, handicrafts, general merchandise commerce, small stores, petty traders, and services such as transportation, communication, banking, input supply, and marketing of farm and non-farm producers are all examples of rural MSME industries (Singh, 2009). Village Industry is defined as any rural industry that is situated in rural region and produces goods or provides services with or without using power and has a fixed capital cost per artisan or worker of less than Rupees 0.1 million. According to ministry of MSME, village industry is classified into six major sectors. They are i) Agro Based and Food Processing Industry (ABFPI) such as village oil industry, fruit & vegetable processing industry, pulses and cereals processing industry, bamboo, cane and reed industry, spices and condiments processing industry, medicinal plant collection and processing industry etc. ii) Mineral Based Industry (MBI) such as hand-made pottery, glazed & ceramic pottery, pottery as home décor, pottery for food industry, stone cutting and polishing industry etc. iii) Wellness & Cosmetics

Industry (WCI) that include soap & oil industry, aromatic oils & fragrances industry, cosmetic and beauty products industry, hair oil and shampoos, toiletries industry, bathing soap industry etc. iv) Hand Made Paper, Leather and Plastic Industry (HMPLPI) which is involved in hand-made paper and paper products, paper conversion, leather, plastic, natural fibre etc. v) Rural Engineering and New Technology Industry (RENTI) that specially concentrates in bio-gas, non-conventional energy, bio-manure, vermi-compost industry, carpentry and blacksmith industry, agricultural implements and tools, electric & electronic products, dry dairy, household metal utensils & articles manufacturing vi) Service Industry which offer maintenance and servicing of electrical and electronic goods, farm aggregators (pre & post Farming) for small businesses etc. Recently the rural MSMEs in India are showing satisfactory growth in production and sales due to the Internet penetration and other technological reasons. Information technology plays a vital role in the transformation of MSMEs which aims at continuously strengthening the small businesses especially in rural India. A year wise growth in production and sales of the MSMEs for Khadi and Village industries according to MSME Annual Report 2020-21 is shown in table (1.1) and (1.2).

Year	Production (in Millions)	Sales (in Millions)
2016-17	411102	499916
2017-18	464547	566722
2018-19	561670	710770
2019-20	653430	846643
(Till 31-12- 2020)	537050	704593

Table 1.1 Village Industries: Production & Sales
Source: https://msme.gov.in

Year	Production (in Millions)	Sales (in Millions)
2016-17	15208	21466
2017-18	16266	25102
2018-19	19633	32151
2019-20	23242	42112
(Till 31-12- 2020)	13447	18772

Table 1.2 Khadi Industries: Production & Sales
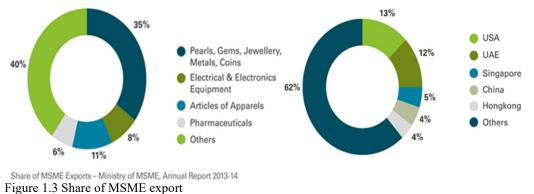Source: https://msme.gov.in

Rapid industrialization of urban regions in India on the other hand lead urban MSMEs to improve their manufacturing capabilities through new and advanced technologies which includes upgrading their basic MSME infrastructure. According to the general conception, MSMEs that operate in urban region have wider access to resources and are perceived to be more agile than the rural ones. This can be linked to various factors such as access to technologically skilled employees, wider range of market and information access, technology advancements and its usage in business and greater network connectivity with multiple business partners, suppliers, vendors etc. However, it is important to note that each MSME is unique and different from others with respect to its business needs, market space in which they operate and the access to resources. The concept of 'Cluster' in MSMEs is therefore important which involves a transition from isolated enterprises to a network of firms that mutually benefit from a successful local knowledge sharing, technology upgradations, skill sharing, community empowerment, and innovation etc. MSME clusters in India are closely co-related groups of micro, small and medium firms that are engaged in producing similar type of products and usually operate within the same geographical region where communication, logistics and personal interaction between the firms is easy to handle. Clusters are characterized as geographically close groups of interconnected companies and associated institutions in a particular field, linked by common technologies and skills. The Ministry of MSME in India defines cluster as a geographical concentration of MSMEs that face common opportunities and challenges to growth. These are usually concentrations of common skill-sets or industry types in certain geographical areas. Many policymakers, academics, and researchers view the concept of clustering as a critical approach for industrial development specially for MSMEs. Due to a wide range of products that are produced and developed in clusters and the technology adoption levels and markets accessed lead to a policy-oriented study (Das et al. 2007) which classifies clusters as: i) High-Tech clusters (mostly they are related to knowledge-based and technical know-hows and IT oriented), MSMEs with access to latest technologies including ICT fall under this category. ii) Traditional manufacturing clusters (they are not high-tech and also non-micro sectors such as garments, ceramics, leather products etc.), these are MSMEs that rely only on traditional methods for product production usually having a wider market than micro firms fall under this classification. iii) Low-tech micro enterprise clusters (these are usually the rural artisanal clusters that involves in producing handicraft/handlooms products and other artisanal products that require man-power). Some of the benefits of clusters that are acknowledged and

identified in the literature are information and knowledge spillovers at the firm level, sharing of services and technology, multi-skilling of employees which improves job opportunities. Clusters also attracts new customers and public investment by offering high quality products and services. MSMEs can benefit from knowledge spillovers in clusters by acquiring new know-how about new products, and new production techniques that are not usually accessible through markets. The agglomeration of MSMEs in clusters can save the cost on information access, goods and labor. The cluster dynamics which boost the human capital and improves technological capacities of the enterprise is also helpful in developing employee-level skills for workers and small producers (UNIDO, 2004). However, different factors both internal and external such as of intra-community ties, business connections, technology sharing, support from specialized institutions, trust factor, network capacity, cooperation between business entities etc., all determines the MSME cluster development and its effectiveness. Among which technology and information sharing plays a vital role that enables the MSME in a cluster to be more adaptive, flexible and reactive towards the dynamic market environments. It's obvious for a market of certain products to be constrained by local or cultural needs, or by a lack of cost-competitiveness, or due to increase in material procurement or transportation costs; in such conditions, upgrading the local technological capabilities of these clustered MSMEs can encourage product diversification.

The Ministry of MSME has first initiated the industrial clusters interventions in the year 1998, and later continued through its MSME Cluster Development Programme. Some of these interventions include technology upgradation, skill development, export promotions, capacity building, marketing development etc. The aim of this initiative is to support the MSME's long-term viability and growth by resolving common concerns related to technology improvements, quality and skill development, easy access to markets and financial allocations among others. Creating or upgrading the infrastructural facilities in the existing or new industrial clusters of MSMEs is covered within this program. Facilitating the network development among cluster stakeholders, customers, suppliers, and employees as well as developing a 'service ecosystem' in clusters is also a primary goal of this initiative. The MSMEs that are part of these clusters in specific regions can leverage the benefits of a coordinated approach of production and marketing while much focus is on manufacturing similar type of products or one specific product. This type of approach is especially suitable for attracting the international markets and can lead to raise Indian MSME product standards to the world standard of specialization. Hence encouraging the

MSMEs to share information, ideas, and research within the clusters can help the integration of global value chains. India offers a great market space for foreign stakeholders to enter and market their products and services. At the same time, collaboration with foreign firms can provide opportunities for the Indian MSMEs to expand and establish their business internationally. An ecosystem therefore is necessary that works on 'Connect, Collaborate, and Conduct' formula in which certain platforms must allow the firms to connect at the initial level of their engagement. Later on, the ecosystem must allow these business parties to collaborate with each other through formal business procedures which ultimately leads to conduct the final business. Such environment is not only feasible for sharing and switching to new technologies but also creates high quality of employment. However, the technological advancements in the recent years have created a path for Indian MSMEs to not only expand their business in domestic markets but also in global markets. In the case of medium-sized enterprises in India, access to financial support is crucial factor in setting up adequate technological infrastructure that meets the global standards. Since access to market-relevant information has become easier due to the technological advancements recently, MSMEs now have a potential advantage to get financial help from various sources including the support from government schemes that are specially directed towards uplifting and upgrading Indian MSME industry. Such support initiatives are carried either through banks or regional offices. The Development Commissionerate is responsible for implementing such policies and various schemes for providing infrastructure and support services to MSMEs. The Ministry of MSME vide Gazette Notification had notified that all MSMEs can provide their firm's information to the central government through online web portal known as MSME databank. It will help the MSMEs in availing the benefits from appropriate scheme and funding policy that is meant for them. It will also help in the access of current information and status of MSMEs. The Office of Development Commissioner (MSME) has introduced a web-based application platform called 'MyMSME' which is also available through a mobile application in order to track and check the details of MSME schemes. The 'International Cooperation Scheme' which aims to promote MSME exports in the international and global markets plays an important role to remain globally competitive. Moreover, this scheme is also essential for MSME industry to coup with challenges emerging out of technological changes, demand variations, new markets, etc. This scheme also encourages MSMEs to continuously update themselves. Although due to the globalization, Indian MSMEs face many challenges related to agility and dynamic adaptability. Indian markets have

enormous opportunities in term of investment at both domestic and foreign levels. It is due to various schemes and policy initiatives from the ministry of MSME that provides opportunities of exposure to international markets, latest technologies, experience sharing and best management practices in the international marketspace. It is in this continuation ministry of MSME has entered into long term agreements, 'Memorandum of Understanding/Joint Action Plan' with 19 countries. Some of which include Mexico, Uzbekistan, Sri Lanka, Algeria, Egypt, Republic of South Korea, Indonesia, Vietnam, Sweden and UAE.

Indian MSME exports play a vital role in strengthening the economy. With more than 63 million MSMEs that are spread across different geographical regions significantly contributes to the economy with nearly 40% of India's overall exports. Of which approximately 6.11 % of the India's manufacturing GDP and 24.63 % of the GDP from the services sector. India's 'merchandise exports' during the fiscal year 2020-21 has recorded around US$ 301.38 billion, which is an increase of 49.66% over in April-December 2020. Similarly, 'services exports' were US$ 177.68 billion which is 18.39% higher than in 2020-21 during this period confirmed by ministry of MSME. However, the government of India (GOI) envisioned the goal of US$ 400 billion of merchandise exports in 2021-22. While the exports of services led by 'Information Technology' and 'ITeS' (Information Technology enabled services) sectors have grown significantly in the last decade. The product-wise export's share of MSMEs, and the percentage share of few major destinations of India's exports as according to the Ministry of MSME and Ministry of Commerce in Annual Report 2013-14 is shown in the figure (1.3).

Share of MSME Exports – Ministry of MSME, Annual Report 2013-14
Figure 1.3 Share of MSME export
Source: Ministry of MSME, Annual Report 2013-14

The percentage share of some of the major destinations of India's exports includes USA, China, UAE, Singapore, Hongkong and others. In order to make India a preferred destination for manufacturing in the international markets and become a global manufacturing powerhouse, it is

essential to enhance its exporting capacity and ensure localization. This can be achieved through raising India's competitive advantage by improving MSME's competitiveness. Merchandise Exports from India Scheme (MEIS) is an incentive program that ensures trade and export of manufactured goods or products into foreign markets as according to Foreign Trade Policy (FTP) for 2015-2020. India has recently launched India's SME Forum portal 'IndiaXports' to further enable the international exports by SMEs globally. This portal is primarily meant for creating an information and knowledge platform for Indian MSMEs on exports, including all of the relevant information needed for all 456 tariff lines, as well as trends in exports, export procedures, and so on according to the Ministry of MSME. 'IndiaXports' has already rendered its services to over 30,000 MSMEs and enabled them to start exporting and targets more than 0.1 million MSMEs in India. 'IndiaXports' focuses on hidden and undiscovered exporting potential of MSMEs that need support and assistance such as informational and cost support, and intend to increase the number of exporting MSMEs as well as increase the overall exports of all the MSMEs in India. The exporting capacity or potential of MSMEs can differ from one state/region to another in India. It is mainly due to different factors such as technological infrastructure, access to latest and updated information or knowledge, its workforce and the technological skills they possess, interaction with other business counterparts etc. However, the competitive advantage of a regional or state-level MSME's export is majorly influenced by its pool of technological knowledge. Updated information database and greater knowledge pool can lead to increased technological benefits. A region's export performance may also be determined through the technological structure of its industrial base (Pradhan and Das, 2013). Modern technology is critical for the development of MSME as well as for the growth in exports and the government has already realized its importance according to (Mukherjee S., 2018).

Urban regions and cities have particularly become an essential source for global competitiveness, as they happen to be more creative and productive (Rothwell et al., 2013). Urban regions and cities provide numerous advantages related to agglomeration of manufacturing units or firms, proximity demand, variety in access to urban assets, all of which creates favorable conditions for innovation (Athey et al., 2007). Due to which states/regions which have larger urban areas maybe more advantageous than others for conducting export related activities. The regions that possess greater number and extent of special concentrations (clusters) of production units may utilize the regional information and knowledge flows, workforce pooling, input sharing and

demand proximity to gain competitive advantage in exporting. It has been noted recently, the international business research has started to emphasize on the subnational spatial heterogeneity that may have a significant role in the internationalization activities of the firm (Beugelsdijk and Mudambi, 2013). The growth in the national exports can therefore be viewed in terms of the state-level/regional competitive advantages in exporting activities. However, there are disparities in the regional share of exports to the total national exports which can be determined through the regional distribution of FDI (Foreign Direct Investment). FDI plays a key role in the export growth of numerous developing host countries including India. India has recorded the Foreign Direct Investment inflows of worth USD 54.10 billion during financial year 2021-22 in India. The FDI inflows of the last three consecutive financial years is presented in the table (1.3).

	Financial Year	FDI inflow (in USD billion)
1.	2018-19	62.00
2.	2019-20	74.39
3.	2020-21	81.97

Table 1.3 Foreign Direct Investment inflows
Source: Reserve Bank of India

The regions that manage to host large amount of FDI inflows are more likely to contribute in higher exports than compared to the regions with lesser FDI inflows. Apparently, the states/regions with higher FDI's inflows attracts the foreign firms.

2. Agility of enterprises

2.1 The concept reviews

2.1.1 Agility

Environmental volatility and rising uncertainty in global markets, combined with exponential technological advancements, have prompted businesses to adjust their capacity in order to respond quickly and flexibly (Shams et al., 2021; Tallon and Pinsonneault, 2011). In this context, agility was first introduced to the business world by Brown and Agnew in 1982 in order to discuss how quickly organizations might adapt to the fluctuations and changes (Walter, 2021). The idea risen to prominence among practitioners and researchers in the early 1990s when it was applied to the business world, where the requirement for organizational transformation in the face of dynamic and shifting market conditions required speed and swiftness. However, the origin and history of agility may be traced back to the manufacturing industry, where in order to adapt to the changes in the supply chain, flexibility and agility were absolutely crucial. Academic interest in agility and flexibility has been growing steadily (Brozovic, 2018; Combe, 2012; Harsch & Festing, 2020) from a wide range of academic fields, including management and strategy oriented (Xing, Liu, Boojihawon, & Tarba, 2020). Various researches have published on defining agility in the last two decades. Agility has proven to be a successful method in reacting to rapidly changing customer requirements (Labaf and Bigdeli, 2015). Agility has been viewed as an organization's capability in response to adjust quickly and effectively to a variety of changes in the environment. Agility has been characterized by various authors in different ways depending on the context of its applicability including as a process, as a combination of systems, information technologies and strategies (Lowry and Wilson, 2016). However, there isn't a consensus among scholars on a common definition for characterizing agility (Nabass and Abdallah, 2018). According to (Teece et al., 2016) agility refers to a firm's ability to quickly but efficiently reorganize and redeploy its resources in response to internal and external changes and is considered as a critical success factor, since it provides innovativeness and a competitive advantage in a complex global business environment. Similarly, (Roberts & Grover, 2012; Tallon & Pinsonneault, 2011) claimed that organizations with agility may quickly implement strategic changes to their structures, methods, and outputs to adapt, persist and even gain competitive advantage. Agility has been defined by

(Gligor et al., 2015) as the capability to overcome market turbulence and respond quickly to the customers. It is generally considered as a continuous ongoing process where firms need to develop new capabilities in order to remain highly agile (Holbeche, 2018; Kane et al., 2015; Phillips and Linstone, 2016). However, agility is a collection of capabilities rather than a single capability (Holbeche 2018), such as being able to adopt to new changes, continuously learning and responding with suitable actions quickly and efficiently at both individual and organizational levels. Moreover, agility is an enterprise-level capability that ensures quick response to the opportunities that emerge in markets. Whereas (Gunasekaran et al., 2018, p.1) defined agility as 'the ability to thrive and succeed in a competitive industry of rapid and unpredictable changes, as well as the ability to adjust swiftly to frequent market changes driven by customer-based products value'. A more comprehensive definition of agility was developed by (Ganguly et al., 2009), according to which "an effective combination of responsive capabilities and knowledge management in order to adapt to any unexpected (or unpredictable) change in a rapid, efficient and accurate manner in both proactive and reactive business / customer needs and opportunities without compromising the cost or the quality of the product / process". There are several other definitions of agility among which researchers such as (Skare and Soriano, 2021) argued that in present turbulent environment, enterprise's agility is a survival tool, while (Weber & Tarba, 2014) described it as the ability to maintain flexibility in the face of new unexpected circumstances. Similarly (Chan et al., 2019; Ravichandran, 2018) argued that agility is one of the essential qualities of the enterprise in order to be competitive. Majority of researchers however agrees that agility is the firm's ability to sense and respond to the external changes with relatively high degree of speed and at the same time seize new opportunities (Ravichandran, 2018; Roberts & Grover, 2012; Tallon & Pinsonneault, 2011), while (Conboy K., 2009) believes that controlling the change is a basic prerequisite for achieving agility where creation of change, pro-action prior to change, reaction to change, and learning from change are the features of agility. An agile organization is one that is capable of managing change and is sensitive towards the types of changes that are taking place both within and outside of it (Williams, et al., 2013). Agility has been explored by multiple sectors, including in corporate strategies, technology, supply chain management, and sustainable production management etc. (Tseng and Lin, 2011). Moreover, in the literature, agility has been examined from a variety of perspectives. For example, operational agility allows enterprises to recognize and utilize business opportunities within their existing business model, whereas strategic

agility refers to the ability of an enterprise to identify and seize both internal and external opportunities (Sull, 2010). Some of the important and most commonly explored perspectives of agility in a dynamic environment are organizational agility, manufacturing agility, supply chain agility, strategic agility, workforce agility.

2.1.2 Organizational Agility

Researchers generally claim that organizational agility first emerged during the 1991 Lehigh Report of the Iacocca Institute. Organizational agility has caught expert's interest as an overall enterprise phenomenon just recently according to Wendler (2013). Many researchers believe that organizational agility is a multidimensional and sophisticated subject which has been approached through distinct viewpoints. One group of researchers (Bottani 2010; Cai 2013; Charbonnier-Voirin 2011; Eshlaghy et al. 2010) analyze organizational agility from the standpoint of the enablers and capabilities that assist enterprises in achieving agility, while (Gehani 2010) view organizational agility as main practices that agile enterprises use in their day-to-day operations. Researchers such as (Lu & Ramamurthy 2011a; Nijssen & Paauwe 2012; Singh & Sharma 2013) applies a sense-response dimension approach to organizational agility, focusing at how organizations engage with a changing environment. Due to the hyper-competition, erratic consumer demands, time-to-market pressures, intensive globalization, and technological advancements, businesses are confronted with environmental uncertainty (Huang et al. 2012; Nazir and Pinsonneault 2012; Tallon and Pinsonneault 2011). An enterprise capability to cope with quick, relentless, and uncertain changes and survive in a competitive context with constantly and unpredictably evolving opportunities is referred as organizational agility according to (Lu and Ramamurthy 2011: 932). Organizational agility is a term used to describe the firm's capabilities to thrive and succeed in a dynamic and unpredictable environment (Vinodh et al. 2012a). Due to the fact that global changes occur very rapidly, organizational agility plays an important role (Heckler, J., and A. Powell. 2016). Organizations are supposed to understand and interpret agility in the best way possible, hence they are required to identify the internal organizational factors that might influence agility since this will help to manage and increase the level of agility of the enterprise. Some of the methods that firms adopt in this direction include creating independent market-oriented teams that can respond rapidly to avail new opportunities, allowing value to new developments and to reflect the desired culture and firm's identity, and exercise self-discipline to

accelerate change are all useful ways of increasing organizational agility. (Ravichandran T., 2018) defines organizational agility as the ability of the enterprise to promptly respond to changes while maximizing the opportunities. However, organizations must create a psychologically secure workplace environment where staff members feel empowered to assess challenging opportunities. Consequently, they are resilient, and actively participate in decision-making while rapidly adapt to the changing business environment (Muduli and Pandya, 2018). Organizational agility is also dependent on the ability to manage customer relationships, business processes, and relationships with other partners according to (Lu and Ramamurthy, 2011; Roberts and Grover, 2012; Tallon and Pinsonneault, 2011). Some of the researchers (Côrte-Real et al., 2017; Mikalef & Pateli, 2017) has investigated how organizational agility affects competitive advantage while other assessments were emphasizing on individual factors and how they affect organizational agility. According to (Vazquez-Bustelo et al. 2007), business environment turbulence has a direct, positive impact on organizational agility (OA) and acts as a positive regulator between OA and firm performance. As a result, OA has a larger impact on firm performance in a more turbulent environment (Tallon and Pinsonneault 2011). In order to successfully adapt to external factors such as turbulence and changes, firms require agile organizational enablers, capabilities, and practices. For example, according to (Ngo and Vu, 2020) the sensing and responding capabilities of the firm towards customer's expectations is an important factor in achieving organizational agility. According to (Chen et al. 2015; Mao et al. 2014), organizational agility describes the capability with which an enterprise responds to the eminent changes in the market through innovative and quick solutions that transform these market changes into opportunities, while according to (Cai et al. 2013) organizational agility allows a successful integration of resources, expertise, and partner relationships by accurately and swiftly detecting changes in the market and quickly informing such changes to the enterprise. Speed and creativity were mentioned as two essential elements of organizational agility by (Lu & Ramamurthy, 2011a), where 'speed' refers to the quick realization and accurate response to market developments and 'creativity' focuses on the quality of the response (Cai, 2013).

Organizational agility consists of three fundamental components according to (Pavlou & El Sawy, 2010), they are (i) sensing agility (ii) decision-making agility and (iii) acting or practicing by means of agility and its methods. According to (Park, 2011) sensing agility refers to an enterprise ability to quickly examine and monitor the events and environmental changes such as

shifting customer preferences, new competitor's activities, and new emerging technologies. Determining the core capabilities is a major motivation behind the need for organizational agility and at the same time, assessing the business environment and seizing opportunities is another significant factor (McCarthy et al, 2010). Organizational and managerial capabilities are crucial since they can either encourage or slowdown the firm's ability to achieve organizational agility (Nijssen and Paauwe, 2012). While agile capabilities refer to the organization's ability and capacity to take the actions that are necessary in achieving agility. Organizations with agile capabilities can adapt to change and gain a competitive advantage, while according to (Leite and Braz, 2016) organizational agile capabilities play a significant role in the development of innovative products. Researches have addressed agile capabilities such as responsiveness or reactiveness, quickness or speed, innovation or creativity, knowledge management etc. at multiple occasions. These distinct organizational agile capabilities of the enterprise are categorized by (Charbonnier-Voirin 2011) in to three essential groups. The first one, is the capability to deploy a quick response to the change which is based on reactive flexibility and relates to the ability to coordinate existing resources. The second capability is to analyze the market, relates to an organization's ability to observe market developments and recognize the opportunities. The ability to integrate organizational learning, which is the third capability in (Charbonnier-Voirin 2011) paradigm, refers to an organization's capacity to match employee experience and skill sets with organizational goals. Similar organizational capabilities and have been identified by other researchers that assist organizations in overcoming challenges driven by environmental change such as reactiveness/responsiveness, flexibility/adaptability, quickness/speed, intelligence (Eshlaghy et al., 2010) and helpful in achieving organizational agility. Though the essential agile enablers or capabilities may not be available for all organizations, however, it is important to note that organizational agility is perceived as a process during which an organization constantly adapt to continuously changing environments and situations and set specific goals to achieve them, by implementing different strategies in a most efficient and effective way. Research studies reveal that organizational agility was initially introduced in the context of manufacturing industry. OA is conceptually distinguished by researchers from agile manufacturing systems, where organizational agility is a performance capability, and agile manufacturing is a cluster of similar practices (Attafar et al., 2012). OA is one of the important factors that improves the efficiency of the enterprise and facilitates in searching crucial information and knowledge to deliver novel products and services, as well as to

respond effectively to competitor's moves, leading to a higher organizational performance (Cegarra-Navarro et al., 2016). The organizational and managerial techniques are critical in this regard since they can either promote or hinder a firm's ability to achieve organizational agility (Nijssen and Paauwe, 2012). Furthermore, to analyze the market demands and generate insights, organizational capabilities of the enterprise has been recognized as critical requirement for 'organizational agility' (Brusset, 2016; Gligor et al., 2016; Lu and Ramamurthy, 2011; Tseng and Lin, 2011). For example, employees are more likely to take major decisions when given the opportunity to generate creative ideas and integrate them with strategic decisions, which implies the firm's decisions not just rely on statistics but also on feedback of its employees who are directly involved (Suzuki et al., 2017). However, the managerial team of an enterprise needs to understand that the organization itself cannot be agile on its own, but its human resources can support enable (Wendler, 2014).

2.1.3 Agile manufacturing

Globalization has accelerated the competition in the manufacturing industry and raised the consumers expectations for highly innovative products with greater quality at lower prices according to (Dubey and Gunasekaran, 2015; Thilak et al., 2017; Goswami and Kumar, 2018). In the manufacturing industry, agility has been recognized as a successful practice for fostering responsiveness and efficiency to overcome business uncertainties, meet high variability, increase customer satisfaction, and achieve organizational goals (Dumrak et al., 2020). Globalization of markets necessitates for a greater extent of responsiveness that may be achieved through implementation of agile manufacturing (Dubey and Gunasekaran, 2015). Agile manufacturing has emerged as a crucial factor for organizational success in the frequently changing global markets (Matawale et al., 2016). Moreover, rapid industrialization has set the stage for the adoption of new, innovative methods and tools including agile manufacturing (Lokhande and Sarode, 2020) in order to gain competitive advantage. According to (Nabass and Abdallah, 2018), agile manufacturing is "the firm's unique capability to reorganize its internal activities and procedures by applying suitable managerial and manufacturing methods and tools in order to respond to market fluctuations." Agile manufacturing, has evolved from various already existing systems of management and technologies, including lean manufacturing and flexible manufacturing (Pullan et al., 2010; Thilak et al., 2017), as contended by (Saleeshya and Babu 2012; Routroy et al. 2015).

Similarly, (Iqbal et al. 2018) mentioned that AM is allegedly closely related with other systems, such as lean (TQM and JIT) along with management, and infrastructure enablers both internal and external, are all antecedent to agile manufacturing. However, lean production typically responds with limited resources towards competitive pressures in much stable markets, whereas agile manufacturing system responds to uncertainties caused due to the constant market changes. Lean manufacturing, according to numerous researchers, is not sufficient enough to overcome market turbulence and uncertainty (Khalfallah and Lakhal, 2020). Agile manufacturing has been investigated by various researchers in the past from different perspectives. For example, (Kumar et al. 2016) investigated into the AM awareness for organizational change considering Indian manufacturing firms, and claimed that the understanding of AM of Indian manufacturers is significant. Whereas (Dubey and Gunasekaran 2015) developed a framework on agile manufacturing. In order to improve the agility of manufacturing firms, (Potdar et al. 2017) developed a benchmark, while (Khatri et al. 2018) identified the main predictors of AM. The impact of agile manufacturing on the business performance and the operational performance aspects such as cost, quality, delivery, and flexibility were investigated by (Nabass and Abdallah, 2018) and concluded that agile manufacturing has a positive and significant impact on business performance and on operational performance of the considered dimensions. Moreover, implementing agile manufacturing principles enables an enterprise to adapt to changing consumer needs while saving time and decreasing the cost of manufacturing new products and processes (Vinodh et al., 2010). One of the primary issues that manufacturing industry is dealing with is continuously fluctuating customer demands (Udokporo et al., 2020a). Agile manufacturing has been viewed by the manufacturing industry as a significant method for achieving sustainability in a dynamic business environment and in responding to unpredictable consumer demands (Vazquez-Bustelo et al., 2007). Responding quickly is the only way to deal with the business threats and capitalize on the emerging new business opportunities (Denning, 2019). Manufacturing agility is the perfect mix of organizational capabilities and industrial characteristics. Manufacturing agility emphasizes on dynamic approaches in managing business to satisfy customer demands for high-quality products at lowered prices delivered with in short time period. In this context, there are multiple agile manufacturing enablers and attributes mentioned in the literature, that are useful. However, some of the common AM enablers and facilitators include leadership support, flexible

workforce, organizational-culture factors, supplier-related factors, customer-related factors, innovation, Information Technology, manufacturing automation.

1) Leadership support

Top management such as managers/owners are required to provide an environment that is conductive for agile manufacturing implementation according to (Virmani and Sharma, 2019). In order to achieve agile manufacturing, which requires reconfiguration business processes and implementing new methods, top management's support and commitment are essential (Hasan et al., 2007; Sindhwani et al., 2019). In this context, many quality experts and practitioners have underlined the necessity for managers to be aware of agile manufacturing. Moreover, agile manufacturing implementation requires in-depth knowledge of both existing business practices and agile manufacturing (Udokporo et al., 2020). Proactively sensing changes in the business environment and having the ability to identify and successfully take needed actions to make an impact are the requirements for a quick decision-making (Gao et al., 2020). The senior management must be willing to accept employee suggestions and effectively disseminate information among staff members (Vaishnavi et al., 2019), since the management resources are responsible of building a cooperative relationship between customers and suppliers (Moradlou and Asadi, 2015).

2) Customer-related factors

Agile manufacturing is basically customer-oriented, whose decisions and actions are influenced by its clients. According to (He et al. 2014), customers and suppliers are the two most important external sources for obtaining knowledge and creative ideas for the creation of new products and the modification of current ones through network connections. Moreover, a strong relationship between the manufacturer and the customers facilitates the prediction of demand information, which significantly cuts down the time and expense associated with designing and production planning (He et al., 2014).

3) Supplier-related factors

Agile manufacturing emphasizes on establishing a long-term collaboration with its suppliers due to the fact that a trustworthy relationship between the buyer and supplier will transform in to a seamless and quicker flow of information and materials which will improve agility as a result.

(He et al., 2014) investigated the integration of suppliers and customers on the performance of a new product development. They claimed that early supplier collaboration in the product design process can lead to a rapid development process, reduced team work, more affordable design options, and higher performance.

4) Organizational factors

Organizational effectiveness in order to adapt interorganizational operations with their main suppliers is one of the most essential success factors to overcome the business environment volatility (Lee et al., 2020). In order to ensure smooth sharing of ideas and knowledge throughout the organization, (Sindhwani and Malhotra, 2017) emphasizes on the need for a flattened organizational structure. Whereas, when it comes to maintaining agility at the organizational level, (Nijssen and Paauwe, 2012) investigated on how organizational structures can assist or hinder an enterprise. A change in ambition, practice, and the managerial system is necessary to bring agility in the organizational structure according to (Nold and Michel, 2016), while (Potdar and Routroy, 2018) stated that businesses should seriously consider transparent communication at all levels, decentralization of authority, and adaptation in order to enhance agility at the organizational level. The implementation of agile manufacturing is primarily motivated by an unanticipated transformation in the business environment (Hasan et al., 2007). In this context organizations must be prepared to significantly change their organizational structure, manufacturing system, and business processes in order to overcome this hurdle. To reach the appropriate level of agility, an organization's structure and culture must undergo drastic adjustments (Hasan et al., 2007). Moreover, communicating the change throughout the organization is crucial at all levels of individuals, groups, departments, and segments of employees (Vaishnavi et al., 2019). A strong and supportive organizational culture can ensure a healthy working environment for employees that can facilitate in accepting change more easily.

5) Workforce flexibility

Human resource management methods greatly influence on efficient implementation of agile manufacturing as claimed by (Digalwar et al., 2020). Good human resources can contribute to agility according to (Potdar et al., 2017a), if they are motivated and trained to become multiskilled, and deployed at proper locations and in right numbers. Whereas underutilization of manpower acts as an obstacle in an agile manufacturing system. Agile manufacturing goes beyond the

conventional perspective of an employee's skill set, emphasizing on the development of a new set of interpersonal skills such as inter-departmental collaboration and the applicability of knowledge in different environments. The most valuable resource in the agile factory is its empowered workforce (Aravind Raj et al. 2013; Vinodh et al., 2012). Empowerment implies that employees have some control over decisions affecting their work environment, performance, and the development of the organization (Iqbal, Huq, and Bhutta 2018; Marodin and Saurin 2013). As technology advancements and industry standards alter employment structures and increase employee scope and responsibility, empowered workforce are the primary enablers of competitive advantage (De Groote and Marx 2013; MacDonald and She 2015) empowering self-organizing teams with autonomy, agile organizations may accelerate innovation and provide actual value to its consumers (Denning, 2016). Empowering and engaging the workforce promotes innovation, which improves consumer satisfaction by resulting in the delivery of more innovative and economical products (Dubey and Gunasekaran, 2015).

6) Innovation

Agile manufacturing requires more knowledge deployment and access than compared to other conventional production systems since it needs to innovate faster and better to adapt to the changing business environment and the highly demanding needs of the customers (Potdar et al., 2017). Since agile manufacturing aims to produce more innovative products and quicker than competitors, the firm's capabilities for product innovation and production flexibility are particularly significant for achieving agility (Zhang, 2011). The potential challenges to achieving manufacturing agility include a lack of interfirm operations that are transparent, efficient, and flexible (Lee et al., 2020). Inter-organizational cooperation on innovation has been considered as a moderator in studies of human resource flexibility (e.g., Martinez-Sánchez et al., 2011). According to (Roscoe et al., 2020), collaboration between businesses and employee flexibility are the two factors that facilitate agility to achieve improvement in manufacturing. Organizations with a higher level of external cooperation on innovation can offer better organizational processes when it comes to identifying, disseminating, and incorporating relevant external and internal knowledge (Clausen, 2013). This exchange of knowledge in turn may stimulate new ideas for innovative products, methods, and enhanced processes, which may result in better innovation performance and a greater competitive advantage.

7) Information Technology

IT serves as the manufacturing industry's nerve system according to (Samizadeh et al., 2019) while emphasizing that the role of IT in enhancing integration and agility within a corporation in today's competitive markets. Utilizing IT increases knowledge sharing both inside and outside of an organization, ensuring that the right knowledge is available when and where it is needed (Cabrilo et al., 2020). Manufacturing companies according to (Potdar et al., 2017a) must be ready to adapt new technologies and inculcate change management in order to become agile. In order to compete and satisfy customer's requirements from all aspects, intelligent integration of tools and processes is highly essential for designing agile manufacturing. Adoption or integration of different technologies has been identified by several researchers as a key prerequisite for agile manufacturing design (Dubey and Gunasekaran 2015; Kang et al. 2016; Zhang et al. 2014). Information technology is helpful to integrate industries after restructuring the existing system. In addition to the many operations planning and control technologies, developments in IT has inspired extended enterprise thinking, which called for businesses to collaborate and operate as seamless chains of resource coalitions for the manufacturing of complex products (Brusset 2016; Theorin et al. 2017). The contribution of IT to technologies that allow for the effective and efficient sharing of information was recognized by (Dubey and Gunasekaran, 2015). In contrast, (Gunasekaran, Subramanian, and Papadopoulos, 2017) examined the significance of Big Data in agile manufacturing, particularly managing in turbulent market environment and aiding organizations in maintaining their competitiveness and achieving their performance goals. Although, issues with security, compatibility, and adaptation prevent IT from being used for agile manufacturing according to several authors (Liu et al. 2013; Macke, Rulhoff, and Stjepandic 2016; Tse et al. 2016). However, advancements in ICT have greatly influenced the development and execution of operations, intensity of customization level and the extent of supply chain integration (Monostori et al. 2016; Shariatzadeh et al. 2016; Smit et al. 2016).

8) Manufacturing automation

Manufacturing automation refers to the whole range of tasks that machines and equipment can accomplish with little or no human involvement. Following the advancement of ICT and the internationalization of supply chains, modern manufacturing technologies such as automation, robots, and other approaches are now applied globally (Caggiano and Teti 2018). The integration

of data across business processes has now become easier by the deployment of automated human processes and information and communication technology (ICT). This results in enhanced management of customer interactions, process control, product verification, manufacturing simulation, safety systems, and product traceability. As a result of these inspirations Big data, cloud computing, and the Internet of Things (IoT) have been developed (Gunasekaran et al. 2018). However, three alternative choices for manufacturing automation (mass automation, flexible automation, and intelligent automation) can be proposed depending on the amount of human interaction required by a machine and the range of tasks that a machine can be programmed to carry out. In mass automation, machines are designed for an in-built mechanism to execute a specific task and cannot be modified, reconfigured, or reprogrammed for any other task. Although it consumes valuable time to reconfigure and switch over, flexible automation offers the advantage of being adaptable and capable of performing a wider range of operations. Intelligent automation, on the other hand is mostly computer-controlled and has built-in diagnostics and closed-loop feedback systems (Waters 1996). They function as interconnected networks of CNC machines, feeders, controllers, actuators, and sensors that are integrated but still independent. They can be configured to execute a variety of machining and assembly tasks without the time and effort required due to the distributed computer systems and advanced network communications. The strength of the agile factory lies in its intelligent and adaptable machinery. This is due to the fact that the costs of items manufactured by intelligent machines are not volume-sensitive (Ramesh, Jyothirmai, and Lavanya 2013). Another aspect of intelligent automation is that it necessitates a significant amount of knowledge work, particularly when reprogramming equipment for various unique manufacturing scenarios (Pullan, Bhasi, and Madhu 2010). Intelligent automation as an agility enabler which influences competitive advantage. However, the core elements of intelligent automation can be a wider range of automated processes, intelligence and flexibility of machines and plant mobility.

2.1.4 Supply chain agility

In today's turbulent and uncertain business environment, supply chain agility (SCA) is crucial for maintaining competitiveness (Sangari et al., 2015). Market globalization and intensifying competitive pressures are two factors that motivate firms to improve their supply chain to fulfill consumer demands (Chowdhury & Quaddus, 2020; Ebrahimian et al., 2018). Agility has a direct

impact on the various supply chain processes, including purchasing, production, and delivery, which enhances the supply chain's overall performance (Damghani and Tavana, 2013). Supply chain agility (SCA) is defined by (Gligor et al. 2015) as a firm's capability to swiftly modify its supply chain strategies and operations. According to (Swafford et al., 2006), supply chain agility is a capability with an external focus that emerges from supply chain operation's flexibility. The SCA provides quick and effective responses to operational changes, such as those affecting manufacturing, market promotion, procurement, and delivery. SCA also ensures a company's ability to compete and offer customer responsiveness in uncertain market conditions (Ngai et al., 2011). SCA according to (Brusset, 2016) is an operational capability that results from the capability to coordinate network processes, systems, and routines on both the demand-side and supply-side. Supply chain collaboration has been identified as a characteristic of agile enterprises because agile manufacturing and design puts focus on the strength and capabilities of network partners (Lai et al. 2012). According to (Gligor et al., 2013), SCA is exhibited by an enterprise's cognitive and physical capabilities, which allows to identify changes, opportunities, and threats in a quick manner (alertness), access pertinent data easily (accessibility), acting decisively (decisiveness), quickly implementing the decision (swiftness), and alter its range of supply chain techniques and activities as necessary to carry out its strategy (flexibility). (Dubey et al. 2018) defines SCA as a supply chain's ability to recognize transient, temporary changes in the environment of supply chain and the market and to quickly and flexibly react to those changes. Whereas according to (Fayezi et al., 2016), SCA is a strategic characteristic that enables firms in sensing and quickly responding to internal and external threats through the successful integration of supply chain relationships. (Tarafdar and Qrunfleh 2016) describes SCA is a supply chain strategy focused on providing timely and effective response to changing customer needs. Numerous authors including (Dubey et al. 2018; Eckstein et al. 2015; Tarafdar and Qrunfleh 2017), claim that supply chain agility is a critical element for surviving and thriving in a competitive environment, since agility enables quick and flexible response (Gligor and Holcomb 2012). Supply chain agility helps a firm in responding rapidly to market fluctuations and other uncertainties, which helps it to become more competitive (Dwayne Whitten, Green, and Zelbst 2012). Moreover, businesses with an agile supply chain are more customer-oriented, better able to balance supply and demand, and able to achieve shorter cycle times. In order to respond quickly and effectively to market fluctuations and related uncertainties, supply chain managers need to quickly adjust their

supply chain strategies and operations (Gligor et al., 2016). A list of multiple dimensions can be used by the supply chain manager in deciding what areas of their operations and strategies should be modified in order to enhance the supply chain agility (SCA) of their company (Gligor et al., 2013). Apparently, a quick change in the supply chain is often expensive (Patel et al., 2020b). When it comes to responsiveness and reducing the threats, agility is valuable (Braunscheidel & Suresh, 2018).

Agility is the fundamental component of supply chain needed for resilience in turbulent and unstable markets (Soltany et al., 2018). Both the concepts supply chain agility (SCA) and supply chain resilience have been established as crucial components of supply chains at the global magnitude (Gligor et al., 2015; Hohenstein et al., 2015). Both the agile and resilient concepts improve the efficiency of the supply chain performance. According to (Camarinha-Matos, 2014), agility refers to the ability to quickly and effectively deal with unanticipated changes in the competitive environment, whereas, resilience refers to an organization's capability to withstand and cope significant turbulence or disruptions in its supply chain and recover to its original state. The driving force behind agility is the unstable and dynamic environment, whereas resilience is motivated by the disruptions and disturbances that occur suddenly at any time in the supply chain or in the modern market environment (Lenort and Wicher, 2012). According to (Scholten and Schilder, 2015) enhancing supply chain visibility can improve the supply chain resilience. These authors get in more details about the significance of supply chain partners collaboration as a way to improve visibility and, ultimately, build a more resilient supply chain. The evaluation of supply chain agility is critical since it indicates the strategic agile position (Vinodh and Prasanna, 2011) in a highly competitive business environment (Vinodh et al., 2010). The supply chain's participants must be able to quickly coordinate their collective capabilities to react to the changes in supply and demand (Gligor and Holcomb, 2014). The significance of both supply and demand for a supply chain's agility has been highlighted by (Brusset, 2016; Dubey et al., 2018; Fayezi et al., 2016), since the coordination of supply-side and demand-side activities is necessary in modern supply chains. Previous researches have revealed that sensing and responding to market changes in supply and in demand can be performed either proactively or reactively. That is, the company's supply chain can be modified either in anticipation of change or in response to change after it has already occurred. The reactive responsiveness consists of a defensive measure that is primarily undertaken in response to a threat (Gligor et al., 2013) which is the dominant perspective in the majority of

definitions. On the other hand, proactive responsiveness has been linked to opportunity-seeking behaviors, particularly disruptive ones, as well as with terms such as "alertness." and "predictive capacity" (Fayezi et al., 2015).

The factors that influence in achieving supply chain agility are known as supply chain enablers (SCA). Though the SCA have been also referred to as capabilities, drivers, antecedents or critical success factors (CSF) by various authors on different occasions. Two different SCA enablers, reactive enablers and proactive enablers can be further classified. Reactive SCA enablers are the defensive methods that let the supply chain react to the situations after they happen. The 'reactive SCA enablers' are impact-driven and designed to mitigate the effects of unplanned incidents. They are mostly focused on the demand side of the supply chain. Four key enablers have been identified for an effective SCA in the reactive approach. They are strategic flexibility, demand management, contingency planning, and strategic orientation. Whereas, 'proactive SCA enablers' mitigate risks and serve as a preventive mechanism by anticipating potential opportunities or threats (Braunscheidel and Suresh, 2009; Tse et al., 2016). They are mainly related to the supply side of the supply chain. Proactive SCA enablers are also focused on synchronizing operational capabilities and identifying market changes. Strategic operational alignment, market sensitivity, strategic sourcing, organizational change culture are four essential SCA enablers that are meant to assist in identifying changes. There are three other essential SCA enablers that are required in both modes and, depending on how they are used, may fit into either mode. They are supportive information technologies, collaborative partnerships, distribution and logistics capabilities. However, potential threats can be minimized with the support of a collaborative partnership according to (Braunscheidel and Suresh, 2009) and through information sharing it becomes flexible to anticipate possible opportunities. Collaborative partnerships can also be used to quickly restructure assets and resources that are already aligned (Ngai et al., 2011; Sangari and Razmi, 2015) to offer a synergetic response. It has been noticed that Information technology serves as an important SCA enabler for both modes, reactive as well as proactive. Because IT facilitates in gathering of precise market data, enhances operations and inventory (Brusset, 2016; DeGroote and Marx, 2013), improves sharing of information and connectivity between its supply chain participants (DeGroote and Marx, 2013; Liu et al., 2013; Sangari and Razmi, 2015), encourages flexibility (Ngai et al., 2011), assists in creating effective connections with suppliers (DeGroote and Marx, 2013; Yang, 2014) by coordinating and integrating operations in manufacturing,

logistics, and distribution (Swafford et al., 2008). IT integration refers to identifying information systems on the basis of how much information is shared during various tasks and supply chain segments as well as effectively creating a virtual supply chain (Kabra and Ramesh, 2015). By sharing information about the necessary construction schedules, production excellence, estimations, and inventories, IT integration makes it simpler to organize the supply chain operations and to prioritize the supply chain activities (Qrunfleh and Tarafdar, 2014). The relationship between information integration, information infrastructure flexibility, and the SCA was investigated by (Bargshady et al. in 2016). The results demonstrated the significant role of information integration and IT infrastructure flexibility in the supply chain agility (SCA), and claimed that an enterprise's IT capabilities can improve the supply chain agility.

2.1.5 Strategic agility

Most of the previous researches have conceptualized "strategic agility" as an organizational capability, more precisely as acting rapidly, decisively, and effectively in anticipating, initiating, and taking advantage of the change. Strategic agility is the ability of the firm to quickly adjust and rearrange its strategic orientation in response to changing needs, opportunities, and trends (Battistella, De Toni, De Zan, & Pessot, 2017). Agile enterprises, as mentioned by (Tallon and Pinsonneault 2011), must be able to "easily and quickly alter their strategy" (p. 473) with respect to processes, business partnerships, and customer responsiveness. While according to (Clauss, Abebe, Tangpong, & Hock, 2019) it is the ability of a firm to continuously reinvent itself and to maintain its flexibility without compromising efficiency. In order to respond to external uncertainty and turbulence and pursue new opportunities, it is often assumed that a great number of well-established firms may need to reinvent themselves and introduce innovative ideas into development (Weber & Tarba, 2014). An organization that operates in a turbulent environment needs take a number of measures to be strategically agile. Because these measures are related to the strategic core of the firm and include systematic and persistent improvements, they are distinct from regular organizational changes (Weber and Tarba, 2014). However, a growing number of businesses may need to attain strategic agility and significant strategic reorientations, in order to be flexible and adaptable while still being purposeful and consistent in their efforts. This is due to the fact that they encounter more diverse and rapid competition, especially because of emerging markets as sources of new knowledge and innovative skills, and due to new business models

resulted from digitization and other digital disruptions (Doz & Kosonen, 2010). In order to be strategically agile, an enterprise must constantly monitor its internal and external environments, collect and utilize information quickly, and react to the changing market conditions in a rapid manner (Kumkale, 2016). The environmental changes could be turned into opportunities by reconfiguring and rearranging the organizational structure and its strategy by the enterprise in accordance to response to those changes (Shin, Lee, Kim, & Rhim, 2015). Agility can surely be achieved by reconfiguring organizational structure according to (Denning, 2017), and by introducing new marketing techniques combined with continuous product and service improvements. However, to execute strategic decisions according to the environmental changes, entrepreneurial teams need to be well-defined, motivated, and effectively deployed in the right composition and context. They also need to be agile enough to quickly adapt to changes and take necessary corrective actions while having an appropriate sense of timing (Glassman, Zell, & Duron, 2014). A strategically agile enterprise might transform its culture in response to external market changes, quickly learn about these changes, and capitalize these external changes by modifying its products and services in order to accommodate these changes (Braunscheidel & Suresh, 2009). According to researches, organizational culture plays a critical role in helping organizations to strategically respond to business opportunities and achieve superior performance (Felipe, Roldán & Leal-Rodrguez, 2017; Bakhsh- Magsi, Ong, Ho & Sheikh-Hassan, 2018; Kamau & Wanyoike, 2018). Strategic management experts have also highlighted the critical role played by organizational culture and strategic agility in helping organizations to take advantage of environmental business opportunities, control dynamic market pressure at global level, and implement measures that will improve firm's performance (Appelbaum, Calla, Desautels & Hasan, 2017; Kitonga, 2017; Nejatian, Zarei, Nejati & Zanjirchi, 2018). From a global perspective, cultural aspects on entrepreneurial behaviors have an impact on how entrepreneurs manage uncertainty at both individual and at team levels (Liu & Almor, 2016). Moreover, the corporate language from a multicultural perspective might influence the development of strategic agility (Brannen & Doz, 2012).

The development and usage of meta-capabilities as well as their inherent characteristics have been extensively studied in the literature on strategic agility (Fourné et al., 2014; Doz and Kosonen, 2010; Anna et al., 2017). The essential strategic agile capabilities and the organizational areas that needs strategic changes are often known or recognized, but how to put them in a practical

way to achieve strategic agility is often overlooked (Morton et al., 2018). It is not surprising that Information Technology and Big Data capabilities have been established by the majority of studies as the main facilitator or enabler in achieving strategic agility given the growing usage of ICT and the newly evolving concepts such as Industry 4.0 and the Internet of Things (Tan et al., 2017; Queiroz et al., 2018; Ghasemaghaei et al., 2017). Strategic agility can amplify the advantages of technological capabilities on the firm's exploration of innovation activities (Zhou & Wu, 2010). However, in order for IT to have an impact on strategic agility, it depends up on the organizational environment and the nature of information that must be converted into relevant agility indicators (Mao et al., 2015). For example, (Rialti et al., 2018) has demonstrated that Information technologies and Big Data Analytics contributes to organizational ambidexterity and ultimately to strategic agility, where 'organizational ambidexterity' is about exploiting existing competencies while simultaneously exploring new opportunities. Researchers have also extensively investigated on organizational business models and how they affect strategic agility. The rapid advancement of new digital technologies has created a scenario where businesses are compelled to simultaneously develop revolutionary new business models and solutions to address the potential threats posed by new entrants in the markets (Bican & Brem, 2020). According to (Klammer et al., 2017), strategic agility could be a valuable addition to the conventional business models, because it extends the perspective on required capabilities for organizational restructuring in contrast to just only focusing on strategic orientation. Additionally, studies have suggested that organizational improvisation can have an impact on strategic agility (Hadida, Tarvainen, & Rose, 2015). An effective improvisation is a synergistic tool that can address and even benefit from the periodic conflicts, such as proactively responding to unexpected events and opportunities in real time while maintaining the value of prior knowledge, plans, or routines (Cunha, Miner, & Antonacopolou, 2016). Strategic agility not only include specific strategic improvisational activities, but also more complex collective improvisation that last over time (Zheng et al., 2011). Strategic agility is described by (Glaister, Ahmmad, and Gomes, 2015) as "timely decision-making to execute business strategies ahead of or in reaction to existing environmental trends". Strategic agility differs from traditional strategic management, as it puts more emphasis on strategy operations that allow for "redirection and/or reinvention of the core business without losing momentum," (Doz & Kosonen, 2008). In contrast to more generalized strategic advantage, strategic agility focuses on the factor of rapid change while sustaining momentum (Doz & Kosonen, 2010).

2.1.6 Workforce agility

Workforce agility refers to the capability that adapts in a situation when things change rapidly but without indication. Human resource management represents the dynamism that agile firms use to operate (Jackson et al., 2014) and reevaluates how human resources are managed in the modern workplace (Hansen et al., 2019; Harsch & Festing, 2020). The human resources of an organization that exhibits agility-promoting attributes according to (Alavi et al., 2014) is workforce agility. According to (Wendler, 2013) review of the literature, 19 out of the 33 agility frameworks that were evaluated claims that people play an explicit role in achieving agility. Workforce agility is an essential component of firm's agility (Glinska et al., 2012). An agile workforce enhances the firm's competitiveness as well as profitability (Ravichandran, 2018). An agile enterprise, typically involves an agile workforce that can be trained to deal with complexity and ambiguity (Doeze Jager-van Vliet et al., 2019; Muduli, 2016). While according to (Sherehiy and Karwowski 2014), workforce agility refers to "an organization's ability to respond quickly to changes in the internal and external business environment and to respond proactively with respect to the changes in order to seize opportunities that become available as a result of the change". Implementation of solutions in uncertain situations can be risky and typically necessitates some kind of planning in advance. Only an agile workforce is capable of managing the variety of unanticipated and dynamic changes in a turbulent and uncertain business environment, and is able to proactively develop practical solutions (Muduli, A. 2016). However, while dealing with turbulent environments, organizations and their workforce sometimes need to implement new and innovative solutions that could show unexpected results (Sheffield & Lemetayer, 2013). Such situation can happen due to the 'informational ambiguity' which has been conceptualized as unfamiliarity, complexity, and inconsistency of information. Such unexpected situations occur more often in the environments where there is a need for agility. Therefore, an agile workforce is expected to tolerate certain amount of risk in their activities (Sheffield & Lemetayer, 2013), which also emphasizes the significance of being tolerance to ambiguity in being agile while taking decisions corresponding to work-related tasks (Storme, Celik, & Myszkowski, 2019). An agile workforce, being an organized and dynamic skillset, can adapt quickly and effortlessly to benefit from new opportunities and market conditions, and enable organizations with most appropriate skills and knowledge when needed (Sherehiy, B., Karwowski, W. 2014; Muduli, A. 2013). However, agile

growth and transformation are perceived to be challenging since it demands for employees to transform the way they think, communicate and work (Carroll, N., Conboy, K. 2019) and deal with the challenge of leaving conventional methods and adopting the 'new' working methods. Therefore, agile transformation is considered as a "people transformation" (Eden, R., Jones, A.B., Casey, V., Draheim, M. 2018). In some ways due to this, employees are seen as an organization's intellectual capital and its hidden value (Popescu, C.R. 2019). Agility has been conceptualized in to different forms at various levels within an organization. For example, 'organizational agility', 'team agility', and 'individual agility', all of which are helpful to sustain a rapidly changing environment (Pulakos et al., 2019). However, in order to become agile and sustainable, the management of an organization must realize that agility can only be achieved through its employees since it is a unique attribute of individuals according to (Wendler and Dresden, 2014).

Workforce agility has been frequently described as an individual-level concept, since it indicates a particular employee's specific conduct or competence. Hence, it has also been labeled as "employee agility". The most important qualities of employees who have the potential to become agile are, "learning and self-development, problem-solving skills, comfort with change, new ideas, and new technologies" according to (Alavi, S. Wahab, D.A. A., 2013). Therefore, it can be inferred that employee agility originates from their intensity of knowledge, attitude towards learning, and development of their organizational support activities (Al-Kasasbeh, A.M.; Halim, M.A.; Omar K. E-HRM, 2016). Although for developing or fostering of workforce agility, different approaches have been suggested in the literature, including staffing, training, coordination, collaboration, incentives, and empowerment (Qin, R.; Nembhard, D.A. 2015), while other researchers mention them as "involvement, teamwork, compensation, organizational learning and training, and IS" (Muduli, A. 2016). The most important factor for the achievement of a task for agility was found to be the identification of the "right talent", i.e., the individuals with a high potential for agility, according to a study of executives, analysts, partners, and policy makers (Catalant, 2018), while assigning employees with agile goals, and tools to monitor their performance also promotes agility (Doeze Jager-van Vliet, Born, & van der Molen, 2019). Whereas, (Harsch and Festing 2020) has emphasized the significance of learning and innovativeness as essential qualities of agile talents, since these qualities are essential for meeting work expectations in a turbulent market environment. Due to the shorter lifecycles of skills and the necessity to respond rapidly to fluctuating market and customer demands, active learning

methods, such as 'learning agility' have become more prominent in such situations (de Jonge et al., 2012; DeRue et al., 2012). Moreover, there is a constant pressure to acquire new capabilities quickly and flexibly, so that employees are better able to change their behavioral patterns according to the changing demands (DeRue et al., 2012). At the same time, agile employees work in a dynamic atmosphere which is built on the requirements of rapid innovation and the constant search for new opportunities (Felipe et al., 2016; Tseng & Lin, 2011). Innovative work behavior (IWB) of the employees is therefore crucial in such situations according to (De Jong & Den Hartog, 2010). Moreover, in an agile environment individual respond with one another regardless of their position or status. An employee with an innovative attitude proposes creative solutions to deal with unexpected changes triggered from the customers as well as can resolve ambiguous situations more quickly (Muduli 2013). Agile employees need to be an enthusiastic knowledge seeker, and to accomplish the goals or solve problems they must keep themselves well-informed (Muduli 2013).

One of the important features of an agile environment is the agile team, which is responsible of creating and modifying the product. Agile teams are the self-managing and self-organizing teams that are essential for rapid responsiveness and flexibility of the enterprise. An organized teamwork environment promotes or strengthens workforce agility. Teamwork related factors have been analyzed in the literature to a great extent, for example by (Moe, N.B., Dingsøyr, T., Røyrvik, E. 2009) and (Lingard, R.W. 2010). Some of the earlier research specifically targets the quality of agile teamwork (Ramírez-Mora, S.L., Oktaba, H. 2018). Agile teamwork factors such as 'mutual trust' and 'performance monitoring' as indicated by (Strode, D. 2016) have demonstrated its influence on teamwork quality. According to (Lindsjørn, Y., et. al, 2018), 'teamwork quality' is found to be correlated with 'performance in' some situations, which is significant for the organizational growth. Collaborative and diverse teams are also beneficial to higher-quality teamwork (Melo, C.O., et. al, 2013). The teamwork environment is generally characterized as 'internal', 'external', 'intra-group' and 'cross-functional' teamworking environment. Collaboration with other teams, functions, and organizations is one of the key characteristics of an agile team. Effective collaboration ensures a seamless transfer of information and expertise across group borders. Collaborative teams usually operate much faster than a group of non-collaborative individuals, consequently shorter times of task completion is generally a desired feature of collaborative teams. According to (Muduli 2013), collaboration promotes a positive work environment. Agile teams are claimed to collaborate in cross-functions and organize themselves

to achieve a common objective through iterative learning cycles (Conboy 2009). Though, cross-training at an individual level may decrease an employee's productivity, whereas, a cross-trained workforce is better equipped to work as a collaborative team (M. Nijssen, J. Paauwe 2012). Although a lot of businesses try to adopt agile teams, it is not totally understood how they adapt the agile methods of working in their teams (Moe et al., 2010). Finding the right type of leadership is considered to be one of the key success factors for developing an agile self-organized team (Gren et al., 2019). Also, it is not yet clear on which specific type of leadership that agile teams require. Majority of the research on leadership in agile teams however have different views between a leader serving as a mentor or a guide and defines appropriate limits, and other researchers such as (Hoda et al., 2013) considers an independent team that organizes its own operational work rather than a formal head of the team. While some other studies (Srivastava and Jain 2017) suggest that the entire team takes on leadership responsibilities. On the other hand, (Backlander 2019) draws the conclusion that literature on 'agile team' and 'leadership' are closely interrelated because empowered leadership encourages team processes, for instance team learning.

Workforce agility has become a critical need for businesses since an agile workforce enhances a firm's dynamic capabilities (Teece et al., 2016), ensures achievement of strategic goals, effectively utilizes new technologies, compete effectively in markets by utilizing its expertise. However, different factors and agility enablers are engaged and responsible in achieving these. A number of organizational agility enablers has been empirically identified by (Eshlaghy et al. 2010), among which the direct relationship between organizational agility and human factors including leadership, teamwork, empowerment, improvement, and organizational commitment has been confirmed. Talent management is considered as dynamic capability that promotes workforce agility (Collings et al., 2019). Talent management refers to the practice of managing talent which includes selecting, recruiting, hiring, training, and supervising employees to fulfill their business goals including strategic sustainability (Scullion & Collings, 2011). Talent management promotes proactivity, adaptability, and resiliency among employees to boost their agility. An effective utilization of talent management is therefore a workforce agility enabler. However, to meet challenges of turbulent market environment, leaders encourage employees to use critical thinking and creative skills (Mainemelis et al., 2015; Shafi et al., 2020). Transformational leaders foster a culture of engagement and employee empowerment which results in employee agility (Muduli, 2017). A transformational leader can therefore be considered as an enabler of workforce agility.

Whereas, employee autonomy has been demonstrated by (Sherehiy and Karwowski 2014) to be one of the most significant enablers of workforce agility. Similarly, spontaneous collaboration has been cited as an important enabling factor of an agile workforce, and suitable coordination plans can enhance workforce utilization and productivity (E.S. Gel, et. al, 2007). The momentum gained by the cross-sector collaboration might assist the enterprise in finishing tasks undertaken from time to time. However, a team work environment is highly suitable to promote workforce agility that is handled by an agile team to manage internal, external, intra group and cross-functional team working. The best strategy for surviving and achieving long-term success is to increase the workforce's organizational knowledge and learning capability, which is an internal resource (Alavi, Abd Wahab, and Norhamidi 2010). According to (Naranjo Valencia, Sanz-Valle, and Jiménez Jiménez 2010), organizational learning is the process through which new knowledge is generated and insights are collected through experiences of employees in an enterprise. Sharing information across the enterprise is one of the benefits of organizational learning, while it also creates knowledgeable employees which are a valuable asset for an agile enterprise. Moreover, the quality and depth of this knowledge base can influence the workforce innovativeness and awareness for new ideas. The resulting improved competencies can serve as workforce agility enablers. According to some research, rapid communication helps employees be more agile (Baran &Woznyj, 2020). Existing literature on information systems and communication, recognizes its significance to agility by ensuring quick and easy access to essential internal and external information, which subsequently enables opportunity recognition and customer responsiveness (Felipe et al., 2016; Harsch & Festing, 2020; Nijssen & Paauwe, 2012), however, the significance of ICT on workforce agility has been little discussed.

2.1.7 Enterprise network agility

In order to maintain and improve competitiveness and enterprise agility, firms need a mechanism that will enable them to go beyond their enterprise borders in search of new resources and competencies. The network structure of an enterprise offers an acceptable way to achieve this. Moreover, in order to access and gain reliable, non-redundant, and valuable information, an enterprise must maintain a superior network structure. A superior network structure when combined with internal resources, capabilities, and information, will enable the enterprise to respond to uncertain environmental changes thereby enhancing agility. According to (Gulati et al.,

2011), network resources give businesses access to both external resources and market-based entrepreneurial opportunities. Market trends and business opportunities can be scanned and analyzed by utilizing network resources. As single connection cannot supply all the resources needed in current business environment, which is marked by high unpredictability and unstable socioeconomic situations, therefore enterprises engage in networking activities to get competitive resources from outside (De Leeuw et al., 2014). The inter-enterprise networks consist of collaborative relationships between the firm's suppliers, customers, competitors, and other relevant entities across the sectors. SMEs frequently integrate with its external partners to acquire necessary or additional resources. By collaborating with network partners, an enterprise may have access to market information, produce and share information about the requirements and preferences of its consumers, as well as information about its competitors, allowing it to develop a strategic plan (Mu et al., 2016). Research on strategic networking have shown that SME's network connections make it easier for SMEs to access external resources, as well as information, and opportunities, which enhances their competitive advantage. If SMEs are involved in a collaborative network with other enterprises, it also facilitates the generation of new ideas and to introduce new products in the markets. Moreover, the rising complexity of technology dynamics can be effectively managed by businesses through inter-firm relationships (Hoang and Rothaermel, 2010) which is useful in being more innovative. Inter-firm relationships, according to (Zeng et al., 2010), has a positive and significant impact on how well SMEs do in terms of innovation. SMEs integration with collaborative networks can lead to enhanced bilateral innovation process. Building networks between enterprises has therefore recently gained prominence in strategic practice (Yang et al., 2018).

To achieve agility, entrepreneurs are expected to resolve two major challenges. Since a single organization cannot supply all resources; therefore, they must first expand their current expertise to include additional capabilities such as creating technological solutions in a new open software ecosystem through network partnerships (Aguirre et al., 2019) to acquire competitive resources from outside (De Leeuw et al., 2014). Secondly, to meet the needs of the market while focusing on the fastest way to deliver business value to customers, which involves addressing the personalized and localized customer requirements by integrating new and existing infrastructure (Haveman and Vochteloo, 2016). Whereas networking capability enables enterprises to identify and use essential resources that span organizational boundaries in order to produce products that

meet the demands of consumers and the market according to relational theory (Mu and Di Benedetto, 2012; Parida et al., 2017; Vesalainen and Hakala, 2014). Earlier researches states that, networking capability is a combination of the abilities to identify networking partners and manage and use networking connections (Mu and Di Benedetto, 2012; Mu et al., 2016). By utilizing networking capabilities, businesses can leverage the opportunity to use strategic network resources from network partners, enabling them to integrate and optimize various levels of expertise, capabilities, and information that is regarded as strategically important (Mu and Di Benedetto, 2012; Mu et al., 2016; Vesalainen and Hakala, 2014). Moreover, it has been determined that the 'network quality' in SMEs is a unique and irreplaceable relational resource that help SMEs to be competitive (Rezaei et al., 2015). Where the idea of 'network quality' is the assessment of a SME regarding how effectively is the network collaboration outcomes have fulfilled its expectations. By emphasizing on seller-buyer relationships, (Srinivasan et al., 2011) confirmed the positive effects of SME's 'network quality' on its supply-chain performance. Since studies on supply-chain management have acknowledged that SMEs may obtain the resources they need by maintaining collaborative network relationships with supply-chain partners thereby overcoming their operational challenges. Networking capability enable enterprises to get information and skills quickly and consistently, which in turn, makes an enterprise strategically agile since it is well positioned in its strategic network core. SMEs with strong networking capabilities can effectively combine their external and internal activities and resources, as well as eliminate conflicting goals and collaboration uncertainties (Kaur et al.,2011). If SMEs maintain a superior network position in its inter-enterprise network, the performance of SMEs in a dynamic business environment can be improved. Because with this positioning, enterprises may seize opportunities in a highly rapid manner and effectively deal with potential threats and competitors (Battistella et al., 2017). Therefore, to enhance enterprise agility, it is crucial for agile enterprises to use inter-enterprise networks and networking capabilities to access and leverage the external competitive resources and benefits.

2.2 Indicators of agility

2.2.1 Agility drivers and enablers

To address essential features or aspects of agility depending on the context and applicability different terms are frequently associated with agility. These terms may include agile drivers, agile enablers, agile capabilities, agile attributes, agile characteristics, agile indicators etc. What is more significant is the role played by this agility driven terms and therefore they need to be simplified in order to understand their relevance in business environment. These terms need to be carefully applied when used in the agile enterprise context. Different types of environmental changes have been suggested in the literature as driving factors for enterprise agility. Some of the common external factors that encourage enterprises to stay or become agile are rapid changes in market; extreme competition among rivals; fluctuating customer preferences and demands; advancement in technologies; factors related to social and economic variations etc. These external factors that encourage or drives the enterprise to utilize its internal resources in response to adapt to the changes in the environment are referred as 'agility drivers'. The agility drivers not only support the enterprises to achieve competitive edge during turbulent and unpredictable situations but also helpful in gaining stability. However, agility drivers may differ according to the firm's area of interest, the circumstances in which it operates, and they also differ in the way the drivers have an impact on the enterprise (Eshlaghy, A., et. al, 2010). Whereas, 'agility enablers' are the resources that the enterprise has at its disposal to adapt to these changes to become agile. Agility enablers have also been referred to as 'agile drivers' by many researchers. For instance, (Vinodh et al. 2012b) have mentioned 'five agility enablers', the same five points have also been mentioned as 'five major drivers of agility' (Vinodh et al. 2012a). However, to make a clear understanding we distinguish 'agility drivers' as the external factors that trigger or force the enterprises to adapt to the environmental changes which may include changes in market conditions, competition, customer requirements, technology, social factors etc. Whereas the internal factors, resources and abilities that the enterprise have and utilizes to adapt to those changes are the 'agility enablers.' Agile enablers may also be referred to potential resources that an enterprise have such as its human competencies, organizational abilities, technological infrastructure etc. Agile enablers may include from any functional area of the enterprise including infrastructure of the enterprise, processes, technology, human resources, networks according to (Charbonnier-Voirin, 2011). However, according to (Eshlaghy et al., 2010), agile enablers can be classified in five major groups which include changes in the market, competitors, customers, technologies, and social factors. In order to successfully implement agility enablers, the components or features of the organizational

structure need to be flexible and easy to adapt to both internal and external changes according to (Eshlaghy et al., 2010), the authors also emphasize on structures that have decentralization of knowledge and management with risk-taking attitude along with teamwork. Enablers are essential for the growth of organizational agility (Charbonnier-Voirin, 2011), however, there isn't a specific set of agile enablers that will suit to all enterprises. Different firms have different characteristics and environments and go through a chain of transformation that are unique and possibly exclusive to that individual firm. Therefore, each individual enterprise needs to identify their own set of agility enablers depending on their existing resources, experience and conditions in which the enterprise operates. However, there are few common changes that occur in the environment, that generates certain general effect for all enterprises. Based on that, agile enterprises try to leverage their agility enablers to develop agile capabilities. Agile enablers, are sometimes also referred to as agile providers, since they act as operational tools in developing agile capabilities.

2.2.2 Agile capabilities

Relying on the internal structural components is not enough for enterprises that are seeking to be agile. They also need to effectively utilize their core capabilities. The major drivers of the need for enterprise agility are searching for core capabilities on one hand, and assessing the business environment and seizing opportunities on the other (McCarthy et al, 2010). Enhancing agility requires both individual and enterprise-level capabilities according to (Mudalige et al. 2019). Agile capabilities refer to the ability of an enterprise to cope with the external changes in environment by detecting and responding to those changes effectively. They also refer to what an enterprise is capable to do in response to external changes that occur in the environment in order to remain agile. Agile capabilities have been characterized by various authors in multiple ways. Moreover, different terms have been used by to describe agile capabilities. Some of them include responsiveness, quickness, innovativeness, competency, flexibility, adaptability, and quickness/speed etc. Whereas, flexibility, responsiveness, and quickness are considered as essential drivers of enterprise agility and are referred to as dynamic agile capabilities (Abdelilah et al., 2018). On the other hand, (Charbonnier-Voirin 2011) categorize the main agile capabilities in to three important groups. i) The ability to quickly respond to change, which mainly deals with managing existing resources of the enterprise, also based on reactive flexibility. ii) The enterprise ability to recognize market changes and opportunities. iii) The organizational ability to align

employee skills and experience with that of the organization and is referred as the aptitude to integrate organizational learning. In contrast to earlier methods, (Lee et al. 2015) extracted an additional set of important agility capabilities from earlier literature. They are proactiveness, radicalness, responsiveness, and adaptability. Where 'proactivity' involves anticipating the upcoming market opportunities and being responsive in order to seize new market opportunities prior to the actual competitors. 'Radicalness' is the capacity of the enterprise to "initiate radical strategic actions by adopting new business models to enter in to new marketplaces" (Lee et al. 2015, p. 405). 'Responsiveness' is the ability to respond quickly to new market opportunities due to the shifts in customer demand or the external environment. And 'adaptability' involves staying updated with industry's best practices which is relevant to business models (Lee et al. 2015). However, the sense-response dimension of agile capabilities is majorly focused by many researchers since it divides the agile capabilities in to two major divisions and simplifies the definition. Based on the sense-response framework, the agile capabilities of an enterprises can be classified as sensing capabilities and responding capabilities.

1) Sensing capabilities

An organizational agility driver or catalyst for the change usually happens externally. For instance, changes in customer preferences, competitive behavior changes among rivals, and industry-level changes, all of which influence the enterprise externally. In order to totally benefit from such changes and utilize them as opportunities, the enterprise needs to first identify these changes and acknowledge them. Such capability of the enterprise is majorly depending up on sensing abilities specially the skills, talent, knowledge and experience of the employees who work there. Sensing capability is referred to as the firm's ability to quickly detect and monitor events and changes in the surrounding environment that include consumer preferences variations, new competitor strategies and moves, new technology (Park, 2011). However, there are a different types of sensing capabilities that contribute to achieve agility of an enterprise. 'Awareness' is considered as connected to the sensing capabilities which enables the enterprise to sense, notice and anticipate changes in the environment. Awareness is also responsible to notice and focus on the internal abilities of the enterprise in order to cope with external changes. Another crucial sensing capability is 'competence' which mostly relies on the knowledge and experience of the employees. This 'competence' capability is responsible for evaluating the internal abilities of the

enterprise to avail benefits from the external changes. The 'speed' component in the sense-response framework according to (Singh & Sharma, 2013) represents the rate at which different changes are generated, while 'speed' also shows how quickly an enterprise can sense market changes and adapt to them.

2) Responsive capabilities

To achieve enterprise level agility just depending up on sensing abilities is not enough. The concept of 'change response' refers to how an organization reacts to external market changes (Fayezi et al. 2015). However, it is assumed to be a complex process since it needs effective evaluation and action towards the external factors which is performed mainly by the internal resources and abilities of the enterprise in response to the environmental changes. Responding capability is referred to the ability of an enterprise to successfully match internal abilities with external changes in the market and customer needs. While (Feng et al., 2010) describes 'responsiveness' as the reactive or proactive capability of an enterprise to 'detect, respond to, and recover from' internal and external changes. The responding capabilities require both the enablers and capabilities to act together in order to seize new opportunities or respond to the threats in the environment. The responding capabilities of an enterprise have various dimensions, and it is performed effectively when certain aspects of the enterprise meet specific criteria or requirements. For example, the enterprise needs to have a flexible structure that allow easy shifting or moving of resources. As it concentrates on internal mobility to provide a rapid response to the changes, it is reactive by nature (Lu & Ramamurthy 2011b). Moreover, the organizational culture and external networks needs to be adaptable for new changes, new strategies, and provide more power to the customers. In the sense-response framework, the concept of 'flexibility' represents the intensity of variation in changes according to (Singh & Sharma 2013), which deals with the ability of the enterprise to adapt to the changes by altering its practices, products, which is the structural aspect of organizational change. However, it is not very simple, the enterprise needs to decide what action is best suitable to seize the opportunities among several other possible actions during the change. In such situation, the enterprise needs to pro-actively identify and evaluate the opportunities which are available, coordinate and integrate with other functional areas, network partners, reconfigure existing resources and learn from past mistakes (Holsapple & Li, 2008). The literature analysis suggests different types of responding capabilities. For instance, the ability of an organization to

perceive changes in the external environment and how these changes impact the organization's internal dynamics is referred to as 'change expectancy' (Fayezi et al. 2015). Whereas, the 'reconfiguration' capability refers to the ability of the enterprise to rearrange its workforce, resources, equipment, partners, processes and operations in order to adjust and adapt to both internal and external changes in the environment. In order to adapt to market changes, an enterprise must be able to learn from its previous mistakes, gather and share knowledge, and enhance its employee competencies which is represented by 'learning' capability of the enterprise. Learning capability, which is crucial for innovativeness of the enterprise not only includes internal expertise but also the ability to utilize the knowledge gained from external sources. The 'coordination' capability refers to the coordination of internal resources such as, motivating the employees and mobilizing them to adapt to the changes, develop and encourage new culture resulted from the change etc. While 'cooperation' capability deals with searching and exploring the external networks in order to support and cooperate with its network partners including suppliers, distributers, business entities etc. which aims at improving the organizational agility by adapting to external changes.

2.2.3 Agility practices

Numerous organizational resources, factors and managerial practices have been focused by various researchers that contribute to enhance the overall enterprise agility. Having the resources and abilities is not sufficient enough for an enterprise to adapt to rapidly changing environment and to capture market opportunities. They need to be appropriately used or implemented to gain competitive advantage. Otherwise, agile enablers and capabilities are of no benefit if they are not exploited in a meaningful manner. Agile enablers and capabilities are often interconnected and interdependent on each other and usually operate in the form of enhancing or compensating each other. However, they need a proper action that can trigger their applicability. Agile practices are the consequence of such actions that combine organizational resources such as enablers and capabilities in to effective and meaningful activities. Agility practices therefore cannot be implemented without agility enablers (ex. proper infrastructure), and agility capabilities (ex. skills and know-how). For example, relying on IT infrastructure itself without a skillful and knowledgeable workforce cannot be agile to the changing environment. Similarly, talented and skillful employees alone cannot deliver competitive edge without proper organizational resources

such as IT infrastructure. Although, compensating agility enablers with capabilities is possible in some situations. For example, an enterprise lacking some technology or equipment to adapt to changes in business environment, can sometimes be compensated by its employees' skills and abilities and vice versa. Agile practices are also helpful in such situation where agility enablers or capabilities fall short for some reasons. Agility practices can be unique and distinct for each individual enterprise since it usually depends on what agile enablers and capabilities does that enterprise have. In order to effectively identify and seize opportunities emerged from market changes, it is critical to align the agility enablers with agility capabilities to cope with agility drivers. Lack of such effective alignment can act as a hurdle for achieving enterprise agility. Agile practices ensure and support the alignment of agility enablers and capabilities to react to the agility drivers, and is also crucial for gaining strategic competitive advantage. The literature suggest that researchers have mainly emphasized on four aspects of agile practices including workforce, customers, partners and the organization itself (Charbonnier-Voirin, 2011; Gehani, 2010) with the motive to improve the flexibility and adaptability of the structures, processes and technology of the enterprises. The agility practices may cover a wide range of areas, including team-building and integration, quality assurance, transformation, and collaboration activities, as well as education, welfare, and technology (Hasan et al. 2013). However, the implementation of these practices also depends up on the effective functioning of agility catalysts which include people, processes, product, information, and structures (Hasan et al. 2013). Agility practices are expected to be supportive and helpful in enhancing certain characteristics of particular agility enabler if in case they lack, and in developing the capabilities that are essential for improving enterprise agility.

2.2.4 Agility of enterprise

An extensive literature review on the dimensions of enterprise agility reveals that a variety of frameworks and models have been proposed by researchers in the past in order to determine or propose different ideas to measure enterprise agility. Many frameworks and models evaluate agility and its aspects in various contexts; as a result, their composition and structure may vary from one another. However, according to (Wendler, 2013) there are four major categories under which various agility frameworks can be divided. They include agile manufacturing, agile software, agile workforce, and agile organization/agile enterprise. Moreover, agility frameworks are interlinked and share common attributes for their majority of the domains such as

organizational skills, organizational culture, workforce, consumers, and technology (Wendler, 2013). Despite of extensive research made on majority of agility domains; each research has mainly focused on its own particular domain. For example, studies on the impact of an agile workforce have been conducted in both the agile manufacturing and agile software development fields. However, in agile manufacturing, the attention is on the employees of manufacturing firm, whereas in software field, it is on the application developer. And hence, it is crucial to recognize domains and analyze them as distinct research areas. Although the concept of enterprise agility started along with the development of agile manufacturing idea, however organizational or enterprise agility gained much attention only recently, which demonstrates that the influence of agility on the whole organization or enterprise is also a crucial subject, rather than just focusing only a particular functional or structural area (Wendler, 2013). Moreover, the literature unfolds that there is no proper agreement on definition of agility, which makes empirical research further challenging (Wendler, 2013). Frameworks for organizational/enterprise agility are still poorly defined and conceived, because it is a challenging task to create an organizational framework that is consistent and adaptable to different types of organizations or enterprises. However, three major approaches or frameworks are generally used for investigating organizational/enterprise agility, depending on the dimensions of emphasis. Since these frameworks are interrelated with each other, they have a similar approach and concepts to interpret the agility of an enterprise. One group of researchers, studies agility from the viewpoint of enablers and capabilities that support the enterprises to reach agility. The second batch of researchers, identifies key operational practices used by agile enterprises on a daily basis. While the third group of scholar's views agility from the standpoint of how firms react to environmental changes by using the sense-response frameworks.

Among several frameworks and agile models, the 'agility enabler-capability' framework has been majorly focused by researchers due to its significant role in determining enterprise agility. The 'enabler-capability' framework has its roots in agile manufacturing, where it is often required to change existing processes and activities to adapt to changes in customer demands or market conditions. Agile enterprises are characterized by both enablers and attributes according to (Lin et al. 2006; Bottani 2010), while agile attributes are also known as agile capabilities. In a dynamic business environment, an agile enterprise always tries to leverage its enablers, capabilities and drivers in order to adapt to changes in environment. The premise that an agile enterprise may acquire a competitive edge in a turbulent environment is the basis for the agility enabler-capability

framework. For example, by using agility enablers, capabilities, and drivers (Lin et al. 2006) connects their fuzzy logic model to concepts of agile manufacturing which was later utilized to introduce a model for agility development by (Tseng & Lin 2011). In another research (Eshlagy et al. 2010) highlights the differentiation between agility enablers, capabilities, and drivers by applying path analysis method and recognized 12 factors among which, the most crucial are the leadership, organization commitment, and job satisfaction that have an influence on organizational agility. However, more recent research contends that agility is not a single individual quality but rather a collection of capabilities and drivers (Vinodh et al., 2012). While numerous key enablers influence the agile attributes. Previous researchers contended that the agile attribute "workforce agility" can be influenced by enablers such as 'employee status,' 'employee involvement,' 'teamwork,' 'creativity,' and 'rapid production and delivery'. They believe that, in order to improve enterprise agility level, firms need to combine these enablers and adapt to consumer needs and changing requirements. In an empirical study, (Bottani E., 2010) examine the attributes of agile enterprises and what tools they employ. While (Charbonnier-Voirin A. 2011) offers an in-depth agility measurement scale based on both qualitative and quantitative research that provides a scale made up of four components which include practices directed towards (managing change, valuing human resources, cooperating with others, and creating value for consumers).

The sense-response agility framework requires an enterprise to possess agile attributes such as speed, adaptability, change culture, responsiveness, low complexity, quality, and product customization, which are supportive to detect market changes and respond appropriately by altering its products, policies, and strategies (Kamau, Mwania & Njue 2018). The application of Information Technology can have a major effect on the achievement of sensing and responding capabilities to the changes in environment (Huang, et al., 2012). For example, in their research (Nazir, Salman and Pinsonneault, Alain 2012) perceives a link between IT and enterprise agility through an electronic integration dimension. They describe how knowledge exploration (i.e., gaining new knowledge from the environment, which supports external integration), and knowledge exploitation (i.e., implementing and sharing the current knowledge inside the firm, that facilitates internal integration), act as intermediaries between IT and two agility capabilities (i.e., sensing and responding) to influence agility. They also analyzed how knowledge and process variables are connected with IT and agility relationship. Their framework explains by using agility quadrant, how an enterprise moves from one situation to another, and in which quadrant is the

enterprise currently resides. First, by accomplishing internal integration, a stagnant enterprise can take the first move toward agility. This internal integration enhances the enterprise responsiveness and supports the coordination of internal activities, which puts the firm in a responding firm quadrant. While the transition towards an agile enterprise quadrant will be made possible by further enhancements in the external integration. However, the sensing ability is the first step (sub-process) of sense-response framework in order to achieve enterprise agility. While the second sub-process in sense-response framework is the ability to use the internal and external organizational resources (capabilities and enablers) in reaction to the environmental changes. According to (Singh & Sharma 2013), the idea of intensity of change variation (flexibility) and rate of generating a variation of change (speed) can be used to understand the sense-response framework. The ability of an enterprise to adjust its processes, products, services, or practices in response to external factors is demonstrated by the 'flexibility' component, which reflects a structural aspect of the organizational change. While the second concept 'speed', refers to how quickly an enterprise can perceive and respond to changes in the marketplace (Singh & Sharma, 2013). Moreover, in sense-response framework just sensing capability is not sufficient to achieve organizational agility. The enterprise must also possess other capabilities that allow for an internal change. These abilities can differ from one firm to another; however, these capabilities are commonly referred as responding capabilities in a sense-response framework. This ability is referred as operational adjustment agility according to (Lu & Ramamurthy 2011b), because it relies on internal restructuring or shifting to respond with quick reaction to changes and it is reactive by nature. Although enterprise/organizational agility frameworks are not independent from each other. Moreover, enabler-capabilities, sense-response and agile practices frameworks depends on the capabilities and enablers that an enterprise possess. For instance, without the necessary infrastructures (enablers) and expertise (capabilities) organizational agility practices cannot be implemented. Similarly, sense-response framework focus more towards organizational capabilities. For instance, capability to detect transformational shifts and changes in the environment, and capability to react to these shifts and changes by using appropriate enablers that the enterprise has in its capacity.

The resource-based view (RBV) framework emphasizes on wide variety of equipment used by the enterprise along with its internal resources as a means for competitive advantage. It is debated that a firm's performance is not solely dependent on having these resources; instead, it also requires suitable employees with the right managerial and employee skills who can leverage

the potential of those resources. When RBV concepts are applied to the domain of IT, having IT alone does not provide a competitive edge. Since IT is a commodity without any strategic relevance as described by (Carr, 2003) whereas, the strategic value of IT can be obtained only by its appropriate and efficient usage. Considering the earlier researches and resource-based view (RBV), agility of three constituent components (IT-infrastructure, IT-organization/IT-processes, and IT-staff/IT-management) leads to overall IT-agility of the enterprise. IT-agility refers to a company's IT department's capacity to react swiftly (ideally in real time) to shifting functional needs and capacity demands, as well as to maximize the strength of information technology in order to expand or even completely redesign the enterprise approach towards business. And in order to manage or maintain IT-agility it must be measurable. However, currently it is not possible to precisely measure the IT agility, particularly IT infrastructure agility by using physical or observable variables. By looking at IT infrastructure of enterprises, it is possible to argue that not all of its IT infrastructure's components are equally important sources of competitive advantage. For example, some hardware or standard software components, may not be so strategically advantageous. Whereas, if the whole IT application systems landscape is taken in to consideration, the requirements of resource-based view (RBV) approach can be satisfied according to (Nissen, V., Rennenkampff, A. 2013).

Earlier agility frameworks deal with several issues and challenges specially with the aspects of conceptualization of agility in different domains. Unfortunately, conceptual ambiguity is prevalent among organizational or enterprise agility research. Lack of construct clarity and a lack of distinction from similar or related constructs are two key issues faced by researchers on agility. Since different perspectives demand for different evaluation methods, it is therefore crucial to establish a clear or detailed description (Podsakoff et al., 2016). Lack of understanding on dynamics of agility drivers can also result in poorly implemented strategies for dealing with change, which often leads to negative outcomes (Um, et al., 2017). Moreover, each individual sector applies the enablers, attributes, capabilities, and practices that are useful for that particular sector or domain and hence identify agility in a unique way. Therefore, it is necessary to adopt an agility framework that is consistent and effective. Since the literature analysis suggest that IT is not merely a reactive enabler, but also serves as a proactive function for the enterprise. From the literature perspective the most relevant agility frameworks in the direction of this research include 'enabler-capability' framework, 'sense-response' framework, and the 'resource-based view'

(RBV) framework. Instead of adopting to one particular or preferred framework, integrating the relevant frameworks can offer a better model and suitable approach for analyzing enterprise agility. Based on this conclusion, the framework originally suggested by (Trzcieliski, 2006) is ideal for our research which is based on the following attributes and dimensions of agility. They include Brightness (Trzcielinski, S., Trzcielinska, J., 2017), Flexibility (Trzcielinski, S., 2015; 2016a), Intelligence (Trzcielinski, S. 2016b), and Shrewdness (Trzcielinski, S. 2016a).

1) Brightness

The fundamental idea behind the brightness of an enterprise is closely related to sense-response framework and particularly focuses on sensing ability of the enterprise in order to identify the changes in the market's environment (both opportunities and threats) instantly for the benefit of the enterprise. However, brightness of enterprise is not about just merely focusing on sensing capability for identifying external changes but it also aims for certain targeted outcomes or preconceived objectives or goals. According to (Trzcieliski, 2006), opportunities are independent from the enterprise, and are short-lived occurrences with limited survival period, and that are an essential requirement for achieving a targeted outcome or an intended goal. And the quality of an enterprise to identify the market opportunities and environmental threats immediately which (Trzcieliski, 2006) named this agile component as 'brightness'.

2) Flexibility

Although flexibility is defined differently depending on the context it is used. However, flexibility types can be identified as expansion-oriented flexibility, operational flexibility and material handling flexibility. In the organizational perspective, flexibility is the degree to which an enterprise is capable of changing or adapting its position (de Haan et al. 2011). While (Bernardes and Hanna 2009) defines it as a system's ability to update its status with extendable change options. However, to be flexible, an enterprise needs to have a range of options at its disposal which is explained by the identification of 'range flexibility'; where 'range' reflects the dimensions of change with diversity of options in terms of size, volumes, products and resources. Earlier researchers think that the first step in formulating the concept of flexibility is to identify different change options, and the next step should be to operationalize these options. Since we discuss the concept of flexibility in the context of IT and enterprise agility, it is important to consider other researcher's definition with regards to IT flexibility (or IT infrastructure flexibility).

IT flexibility as defined by (Hafeez et al., 2018), is the capacity to effectively manage the flow of information, system development, IT configurations, and time utilization in order to manage change both inside and across the enterprise. Whereas, IT flexibility as described by (Cameron and Green, 2015), is the capacity of an IT system to make significant changes in business operations and effectiveness in terms of cost, time, and performance. The infrastructure-based approach to refer IT flexibility is effectively explained by the conventional resource-based view (RBV). The RBV claims that businesses have special resources that give them a competitive edge and improved long-term success. Here the resources are referred to as a collection of important assets and beneficial capabilities that the enterprise control in order to obtain a competitive edge. The definition provided by (Liu et al. 2013 p. 1455) in this context is especially relevant which states that the ability of an enterprise to build a complete range of technical resources (e.g., computing platform, communication networks, crucial data shared, and the critical applications for data processing) which serves as the basis for IT applications development, is referred to as flexible IT infrastructure. However, in the context of opportunity recognition (Trzcieliski, 2006) describes flexibility as the ability to expand the range of resource utilization of the enterprise, allowing to access a broader range of opportunities. The ability of an organization's resources to expand in utilization, or the number of assignments it may accept, is referred to as its supply elasticity. And hence this supply elasticity nature is referred as flexibility according to (Trzcieliski, 2006).

3) Intelligence

Intelligence when used in the context of business, it is referred as business intelligence (BI). However (BI) is viewed differently depending on the application area (Li et al., 2013; Thiagarajan et al., 2012). Though the functions of BI may vary depending on the domain, it is typically a data-driven decision support system that integrates data collection, data storing, and analysis to provide input to the decision-making process (Tanko and Musiliudeen, 2012; Javier et al., 2012). While BI collects or gathers data from various sources (such as people, processes, and analytical tools) and converts it into information for enhanced decision making, it also offers its stakeholders various levels of knowledge based on their information requirements. Moreover, the BI components may change from one application tool to another depending on the business requirement (Martin et al., 2011). These resources include a variety of methods and technical tools for gathering data; to make

data accessible from various sources; and analyzing it so that data managers can make effective managerial decisions (Delen and Demirkan, 2013). For example, a typical BI application tool may have multiple components such as analytical tools, data visualization and analysis, dashboard, data warehouse, ETL, data mining, score board, CRM, ERP, OLAP etc. Whereas, BI uses a variety of data mining and analytical methods to extract information or knowledge from huge volumes of corporate data (Cheung and Li, 2012). While according to (Trzcieliski, 2006) the resources that an intelligent enterprise may utilize include, Materials (instrumental technologies such as ICT tools); Finances (such as funds received); Humans (such as employees and managerial teams); and Knowledge (skills, experience and competencies of employees, staff and managers). Intelligence is the ability of an enterprise to evaluate the market conditions and formulate targeted responses in order to effectively utilize its resources. This is done either to neutralize or reduce the negative effects of the environmental threats, or it is done to take advantage of the opportunities. The purpose of Intelligence is to convert the band of resource accessible market opportunities into the band of accessible opportunities (Trzcieliski, 2006).

4) Shrewdness

Opportunities by nature are temporary and short-lived events. The environment uncertainty in which the enterprise operates determines how long the market opportunity will be available. This timeframe of opportunity further decreases as the environment gets more dynamic, particularly in a competitive market. Therefore, it becomes more difficult to seize the opportunities that have shorter duration and that have a narrower band. Shrewdness refers to an enterprise ability to seize opportunities very rapidly and exploit them to its advantage (Trzcieliński, 2006). Moreover, shrewdness has the ability to convert a band of opportunities that are accessible into a band of opportunities that are already being exploited. Although shrewdness is conceptually related with sense-response framework, particularly with responding ability of the enterprise in order to avail the opportunities when they appear due to changes in the environment. However, shrewdness is not only quick but also very radical and proactive by nature and convert the potential opportunities in to already availed opportunities. This phenomenon is expressed by (Trzcieliński, 2007) in a graphical representation which is shown in figure (2.1).
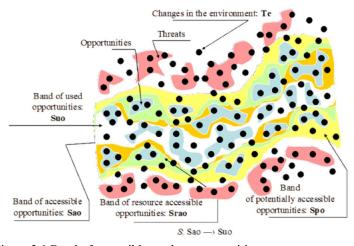
Figure 2.1 Band of accessible market opportunities
Source: Agile enterprise: concepts and some results of research, Stefan Trzcieliński, IEA Press, 2007

Though there are different opinions on which characteristics, and in what combination, can assist an enterprise to attain the desired level of agility (Saleeshya et al., 2011). The four aforementioned attributes of agility 'brightness', 'flexibility', 'intelligence' and 'shrewdness' as mentioned by (Trzcieliński, 2006) are useful in analyzing the enterprise agility particularly in the context of Indian SMEs.

3. Information Technology

3.1 Typology of Information Technology – the SMEs led-view

3.1.1 Information technology and business environment

Our quality of life has improved as a result of technological advancements, and this trend is anticipated to continue. Information technology has evolved rapidly and has now penetrated in every aspect of individuals and businesses. It has offered both businesses and individuals with new opportunities. Many tasks can now be accomplished more successfully and efficiently. For instance, information sharing and searching, better communication, social network connectivity, learning opportunities, business planning solutions, database tools, and opportunities for business training etc. Management practices have also evolved dramatically in recent years as a result of intense and rapid technological advancement. According to Dion (2012), new technological advancements are restructuring the business sectors, and each organization will need technology to compete successfully. The concept of on-demand business integrates information technology and business to increase responsiveness, efficiency, and profitability of the enterprises according to Tohidi (2011). Specially the digital transformation of business that has a very dynamic history. Digital business transformation basically involves creation of new business models, processes, functions, software applications, and systems that can trigger and generate higher profits, revenues, efficiency, and a greater competitive advantage, through the use of latest technology. The digital transformation ability of the enterprise can strengthen the workforce capabilities, creativity and efficiency while customers can have more personalized product experience. And to achieve it, an enterprise needs a business platform that is supported by technology and which can show better results (Bradley J., et. al., 2015). Digital business basically involves the integration of latest digital technologies into all sections and areas of business, which changes and improves the way the enterprise performs. However, digital transformation of business is based on key elements such as IT infrastructure, IT skilled employees, organizational structure, business models, digitization in operations, digitization in products or services, digital channels that enables client interaction (Kane, G., et. al, 2015). The digital transformation can be perceived through the changes that takes place in customer behavior, business processes and models (Kane, G., et. al, 2015). Information technology is critical for business performance because it have a direct impact on the methods that

are used to create and exploit opportunities so that businesses gain profits. Many researchers believe that businesses can develop real assets when they integrate information technology with new methods and styles of doing business in which managing relationships, managing resources, and exploiting information in a creative way are crucial ones. In order to achieve it, the technology implementation capabilities need to be aligned with business strategies. Such alignment requires both extending product planning from technology users to business users and obtain inter-functional planning information in real time. However, it has been proven to be challenging for majority of businesses to achieve that level of coordination. In business environment, the training and development activities are becoming highly significant since managers or top executives have the responsibility to exploit technology to its fullest extent possible for the benefit of their enterprise. Managing all business tasks and activities is essential for the technology to operate according to its purpose of deployment. Studies on significance of technical training claims that the effectiveness relies on the manager and his team.

Information technology encompasses a wide range of technologies that are used to manipulate data or information. For instance, tools for maintaining and transferring data, machine and software equipment. Whereas, Information Communication Technology (ICT) refers to an extended form of information technology (IT). It emphasizes the importance of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers, enterprise software, middleware, storage system, and audio-visual systems, which allow users accessibility to store, transmit, and manipulate data. According to (Apulu, Latham & Moreton 2011; Mpofu & Watkins-Mathys 2011; Ongori & Migro 2010) any technology that supports communication as well as the electronic means of collection, processing, utilization, and transmission of the information is the definition of ICT. While (Rouse 2005) claims that ICT is an umbrella term that includes any communication device or application, such as radio, television, cellular phones, computer and network hardware and software, satellite systems, and so on; as well as various services and functionalities associated with them, such as video conferencing, information sharing, distance learning, a variety of video and audio transfer services such as emails, phone calls, and the internet network etc. (Education-Portal 2012). Others agree that ICT is a broad field that encompasses virtually all technologies that can receive, store, and transmit signals electronically. However, from an economic and managerial standpoint, there are a variety of ICT perspectives that need to be considered. Such as, ICTs have been classified as a social

construction, an information provider, infrastructure hardware and software, and a business process and system. ICT is being utilized by many businesses as on effective solution to cope with competitive marketplace and create a profitable business. In fact, ICT is considered crucial for an enterprise to develop a long-term competitive advantage. Businesses are increasingly relying on ICT tools to complete various tasks in order to meet customer demands (Kadadevaramath et al., 2015). However, it is also evident that businesses face challenges with utilizing the contemporary technology and Internet-based tools to run an efficient organization (Martinez, Gabriel and Navarro, 2010). In the modern world, all businesses implement technology, but some of them use technology more intensely than others. It depends on what kind of economic activity and in which marketplace the enterprise is involved in. Hence the intensity and type of technology that an enterprise deploys can differ from one firm to another.

3.1.2 Information Technology prioritization in SMEs

For SMEs to develop from domestic to global markets, entrepreneurial actions are essential which includes identifying and seizing business opportunities through the use of latest technologies which can lead to create new distribution channels, new products, new services and customer segments. It has been well acknowledged that ICTs have a significant impact on SME's productivity, organizational growth, profitability, and competitiveness (Consoli, 2012; Taylor, 2014). The impact of IT and IT-enabled services on various sectors, particularly SMEs, which have the potential to grow and lead the economy to the forefront, has a significant impact on Indian trade (Kumar, 2019). For the SMEs that adopt ICT, it is crucial that they must also adjust their organizational structure, and implement necessary internal changes such as restructuring, employee training and reorganizing them. However, these effects will only become more apparent when SMEs adopt ICT more efficiently and on a wider scale (Martins & Oliveira, 2008). On the other hand, (Consoli, 2012) argued that the potential of ICTs is not being fully utilized by SMEs. At least three requirements must be satisfied in order to take advantage of ICT adoption, to improve services, and to explore new business opportunities according to (Ashrafi 2008) which include a particular infrastructure, a skilled ICT workforce, and ICT investment budget. In general, ICT adoption in SMEs may include technology applications, hardware or software used for the purpose of improving efficiency, effectiveness, or growth of the enterprise (for example, internet, e-commerce, basic automation tools, electronic data integration, information systems, decision

support systems, software applications, mobile phones, computers networks, etc). However, the selection and prioritization of IT and ICT tools in SMEs is a complex process and is usually depends up on multiple factors that needs careful consideration before deployment. Some of these factors associated to IT prioritization in SMEs are

1) Business related and operational factors

The drivers of ICT adoption in SMEs constitutes of 'business-related factors' which are based on external competition, organizational capabilities, know-hows and financial strength of the firm and also include IT infrastructure (Wymer & Regan, 2005). These factors are related to daily business activities involving work processes, information flow, customer interaction and communication, implementation of more complex productivity goals through efficient utilizing ICT tools. In order to sustain the market competition, SMEs need to be quick and responsive towards adopting new technologies (Ramos, I. et. al., 2022). More importantly satisfying the business needs and goals such as product development and improvement, customer service improvements, employee skill improvement through efficient use of ICT. However, it's been observed that SMEs are mostly inefficient in managing their risks, which leads to disfunction of the system (Smit and Watkins, 2012) and ultimately effects many areas and departments of the business. This has been linked to lack of resources that SMEs frequently struggle with when compared to large enterprises, which makes it difficult for them to quickly identify and eliminate risks (Henschel, T. Durst, S. 2016; Gatzert, N. Martin, M. 2015). This can be avoided by developing an effective information sharing system that results in a better resource utilization with the help of ICT tools. ICT technical skills are essential for effective ICT implementation. To leverage the operational benefits from ICT and to gain long-term competitive advantage, both technical ICT skills and managerial ICT skills are necessary. Managerial ICT skills include the ability of the manager to build ICT applications in order to support and coordinate business processes with other organizational resources (Celuch K. et al., 2007). In their research, (Bayo et. al., 2013) examined how internal and external coordination and communication affects the operational performance and the final results. They revealed that ICT resources are positively linked with operational performance. Similarly (Ye and Wang, 2013) argues that ICT enables the enterprise to operate more effectively in terms of improved operational performance and customer responsiveness. Moreover, implementing ICT in supply chain management (SCM) improves

operational performance of the enterprise in terms of flexibility, cost, quality, and delivery (Miguel and Brito, 2013). Manufacturing SME owners and managers have a positive attitude toward ICT, since they believe that ICT can improve operational efficiency (Somuyiwa and Adewoye, 2011).

2) Strategic factors

Information technology adoption in SMEs is significantly influenced by the strategic orientation of the enterprise. This is in line with the idea (Huy, L. E. et. al., 2012), that the strategic orientation of a business enterprise is a factor that have an influence on the adoption of technology. For example, maintaining a strong business relation with business partners, supervisors, IT service providers, office representatives, external suppliers, vendors etc. as part of a business network is considered to be a strategic factor. And to execute and maintain such network connectivity with various partners, vendors and service providers, a viable IT based infrastructure is highly essential. These network-based interventions are beneficial for customers as well, since it creates complex relationships among multiple stakeholders and business partners with potentially competing interests. Moreover, SMEs are in need to develop new business strategies and procedures that involves ICT usage in order to remain competitive (A. Ferrari 2012). ICT tools are supportive in introducing new and effective business strategies in response to competitor's market strategies to excel in competition and to boost productivity and growth. Many experts believe that ICT adoption can positively influence and support the strategic objectives and visions of SMEs. However, in order to leverage the advantages of IT to its full potential, top management need to identify and utilize the strategic value of IT and must be aware of the strategic opportunities that IT brings to the enterprise in order to exploit it. In a recent study (Dharmadhikari and Basak 2016), claimed that a firm's IT strategy must be in line with its overall business strategy to experience continuous commercial growth. The authors further claimed that top managers are now are aware of the importance of the integration of products, markets, and technology with strategic plans. The ability to modify the business strategies with existing ICT competencies was found to have vital influence on the level of ICT adoption and utilization in SMEs (I. Fillis and B. Wagner, 2005). However, most of the top managers and executives in SMEs are assumed to be unaware of the latest technologies and are often incapable to introduce new strategic plans. Therefore, in such scenario IT professionals needs to be hired who are competent enough to identify the information needs of the enterprise and can develop a suitable IT strategic plan which aligns with the overall business

strategy. An IT strategic plan may involve components such as hardware and software requirements for computers; changes that are needed to be made to the existing system, architecture and procedures; restructuring and redefining the system, processes and architecture; scheduling the operations to be performed and resource requirements etc. Some of the important aspects that are required to be covered during strategizing an IT plan for SMEs must include: considerable market research to utilize IT applications across many operations; training employees to improve their IT application skills; core processes should be identified and IT applications must be prioritized accordingly; creation of a reliable IT infrastructure; formation of teams for IT deployment at various levels; ensuring top level management's commitment and support for IT applications; connecting various departments and the supply chain through effective networks; managing frequent communication and close interaction with clients and suppliers etc.

3) Organizational factors

The ICT utilization as part of IT deployment can be useful in accomplishing organizational goals and in creating or developing new talent and capabilities for SMEs. Researchers claim that administrative IT capabilities, IT learning, and IT practices, are important determinants of whether SMEs embrace or reject IT. From a managerial perspective, the ICT implementation helps in improving business efficiency by making optimal usage of resources. An effective utilization of ICT architecture and tools by all its members, staff/employees are only feasible with sufficient IT knowledge and technological skills. For instance, (Huy, L. E. et. al., 2012) pointed out that the enterprise's resources and its employee expertise are major factors that determine the adoption of e-commerce. Therefore, necessary training must be offered to the employees on IT implementation since it may have wider impact on many departments and sub-departments within the firm. In general, top management support is critical in maintaining the relevance of potential changes through an articulated organizational vision and sending signals to all members (employees) about the importance of the newly adopted technologies (Low, C., Chen Y., and Wu M., 2011). Top management support is characterized as management's participation, as well as the motivation and encouragement it offers to embrace information technology systems (Ifinedo, 2011). Therefore, top management administration and executives plays a major role since they are responsible for the affectability and implementation of ICT. For example, multiple studies (Oliveira et al., 2014; Low et al., 2011) have suggested that top management support is one of the key elements that is

positively associated to a firm's likelihood of embracing cloud computing. According to (Lorenzi and Riley, 2013) management has a significantly greater impact on productivity of an enterprise. Whereas, developing internal ICT skills integrated with the top management's knowledge and attitude towards ICT adoption will result in achieving capabilities that are highly essential for greater success in SMEs (C. Dibrell, et. al., 2008). However, compared to large enterprises, SMEs face difficulties in implementing ICT due to a lack of skilled human resources and capital resources (Consoli D., 2012). Since SME employees are considered to have low ICT skills, and a lack of ICT skills or access to people with skills is one of the major setbacks for SMEs in adopting advanced IT according to (Packale'n 2010). More over the size of the firm have an impact on resilience of the firm in response to the external changes. Therefore, the combined effect of size and the competitive environment affects SME's needs and challenges in adopting and integrating ICT into their organizational processes (Terziovski, 2010).

4) Environmental factors

An enterprise's capacity to develop organizational capabilities through ICT usage are primarily determined by its environmental factors such as the level of dynamism in technology and market conditions, as well as complexity i.e., the market growth opportunity and resource availability in the industry. The key to survival in the market environment is being prepared for competition from the external environment. The external (industry) environment has a crucial role in the adoption of new technologies specially the adoption of IT innovation in enterprises (Hameed, M. A., & Counsell, S. 2012). The term 'external industry' refers to trading partners (such as buyers, suppliers) as well as the government schemes and regulations. It is generally considered that intellectual property, government policies and regulations, consumer protection laws, and compliance, can either facilitate or hinder SMEs ICT adoption (Al-Somali et. al, 2011). The 'supplier pressure' and 'customer pressure' also plays a significant role in the ICT adoption in SMEs. For delivering a quick response to the target customers and to minimize unnecessary delays, supplier cooperation is highly necessary for SMEs since it enables to effectively organize and carry out a wide range of tasks involving product design and development, process optimization, procurement, and product delivery (Prajogo and Olhager, 2012). The 'competitive pressure' can be defined as the degree to which an enterprise find itself as being challenged or threatened by its competitors in the industry or sector. (Alshawi, et. al 2011) argues that the competitive pressure is

an important environmental factor in determining the ICT adoption in SMEs. Information sharing and communication with customers, suppliers, business partners, external business sources become flexible and easy with ICTs which improves competitive position of SMEs. Hence SMEs need to improve their competitive strength by efficiently managing environmental opportunities by which SMEs can leverage the benefits of ICT.

5) Financial factors

The capital investment needed to deploy IT tools in order to sustain the business technical requirements is highly important. Previous research on the business value of information technology (IT) has revealed a connection between enterprise IT investment and its actual returns such as output productivity according to (Kleis et al. 2012). Investment made on IT tools and assets with strategic goals and intentions could provide the firms with a sustainable competitive advantage (Dahiya and Mathew, 2018), while investments in ICT platforms have been proved to be crucial for SME's ability to innovate (P. Ifinedo, 2011). Several studies in the past have also identified ICT security and cost as important factors that determines the ICT adoption. While according to (Ghobakhloo et. al, 2012) and (Irefin et. al, 2012), the cost occurred on IT adoption have an influence on the SME's IT adoption. However, they are two different types, 'direct' and 'indirect' costs associated with information systems (IS) adoption. For example, costs related to workforce or training is the 'indirect cost', whereas the 'direct costs' include the cost of IS adoption and the maintenance of IS adoption (Ghobakhloo, M., et. al 2011). The majority of the research about the relationship between the environment and ICT investments has been viewed with respect to large enterprises (e.g., Dale Stoel and Muhanna, 2009; Xue et al., 2012) and hence it is not specifically applicable to SMEs. However, the literature suggests that, SMEs generally have lesser financial and human resources, making them less likely to be prepared to adopt to advanced ICT and reinvent their business strategies (P. Cragg, et. al 2011). High costs of technology procurement are considered a major barrier in widespread adoption and usage of ICT (Somuyiwa and Adebayo, 2011). The impact of digitalization on SMEs can lead to benefits and future growth but are still constrained by challenges due to limited access to finance and rapid technological changes, and hence lag behind with the current trends according to (Maiti and Kayal 2017). While (Abdullah 2014) highlighted the major obstacles to ICT adoption in Indian SMEs which includes highly expensive setups and maintenance cost, the financial instability, and difficulties in obtaining

investments and cash, apart from the lack of technological and human resources which mainly depends up on the financial strength of SMEs. Whereas (Todd and Javalgi 2007) identified the factors that effects the internationalization of Indian SMEs and concluded that SMEs, unlike large enterprises, do not hold enough access to the financial resources to pursue traditional modes of internationalization such as franchising/licensing and direct investment. Moreover, the literature suggests that implementing mass customization in SMEs is highly expensive, since it involves the use of advanced technologies such as CAD, CAM, sophisticated order management systems (Pollard et al., 2016), enterprise planning and production software (Peng et al., 2011), 3D scanning and modeling systems (Gandhi et al., 2014). In order to implement these systems, it requires a significant amount of financial investment and resources to maintain. SMEs generally lack such investments which is a major barrier in adopting the sophisticated and advanced technologies. However, (Consoli 2012) emphasized that it is crucial to align ICT investments with internal capabilities and organizational procedures for the obtaining better results.

6) Technological factors

Several studies have identified that reliable technical infrastructure, skilled IT manpower, and software/hardware vendors as technological factors that influence IT adoption in SMEs. Researchers such as (Haug et al. 2011), have started to use the term 'IT readiness' to offer new perspective on the firm's capacity to exploit and benefit from its current technological profile for future applicability. By 'IT readiness', they refer to the operational processes that are necessary for both selection and execution of those IT solutions. Though there is a general disagreement on definition of IT readiness, especially with respect to IT readiness in small businesses (Molla et al., 2011). An accessible IT infrastructure along with the capable IT human resource expertise is necessary condition while adopting new technologies, which can be associated to its IT readiness. SMEs need to be specific with regards to their technological needs and relative benefits they intend to achieve through IT deployment. Moreover, SME managers must evaluate the available IT products and services that meet their requirements which ensures a better, organized and effective IT deployment and implementation. For example, SME can hire and deploy the cloud-based services, however, it is necessary that the existing IT human resources of the enterprise is capable of adopting the cloud-based services in terms of technical knowledge and competencies (Fatima, T., N., et. al, 2011). Poor ICT infrastructure, as well as lack of ICT technical and managerial

capacity, are barriers to ICTs adoption in SMEs according to (Mpofu and Watkins-Mathys 2011) that can negatively affect the business processes and overall IT readiness of the enterprise.
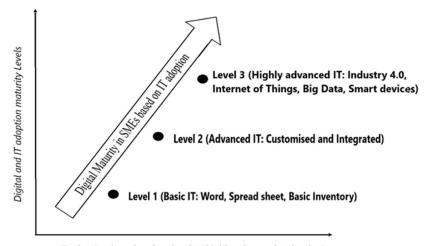
Perceived benefits can be defined as a collection of anticipated benefits that could be favorable for the enterprise. At implementation stage, the term 'perceived benefit' refers to the experience benefits and values that an already-implemented technological innovation has contributed to the enterprise (M. Ghobakhloo, et. al 2018). For example, e-commerce benefits SMEs in becoming more efficient to perform daily business operations and boost the information flow (Ongori and Migiro, 2010). So, 'improved operational efficiency' is the perceived benefit gained through e-commerce implementation in SMEs in such scenario. Previous researches have revealed that 'perceived benefits' have an essential role in the adoption of IT technologies such as CRM, ERP, Cloud and web technologies (Seyal et al., 2007; Alshawi, 2010). Whereas, the extent to which a recently adopted technological innovation is perceived to be consistent with the firm's financial terms, cultural norms, and needs of the potential adopters during its initial phase of adoption is indicated by 'perceived value' (H.J. Yazici, 2014). It has been proven that ICT adds value to SMEs (Ismail, R., et. al 2011). This value addition can be manifested in different forms such as the consumer satisfaction level, enhanced goods and services, highly effective and efficient workforce, less wastage from operations, lower costs, and reduced risk etc. SMEs are quite open towards the technologies that add value and that are seen as enhancing production and efficiency. Whereas, the concept of 'relative advantage' defines the potential benefits and disadvantages that an enterprise will encounter when it adapts or rejects a particular technology. It is possible to define perceived relative advantage as "the extent to which an innovative technology is viewed as being superior than the notion it replaces" (Rogers, 2010). ICT is more likely to be implemented when it is perceived to provide a relative advantage over the enterprise existing practices according to (Lee et al., 2004). The literature suggests that top management in SMEs such as owner/manager is more likely to allocate the managerial, financial, and technological resources required for 'advanced IT' adoption, since they have better managerial experience and knowledge pertaining to 'relative advantage' they may achieve (T. Oliveira, M.F. Martins 2010). Hence, it's more logical to argue that, advanced IT adoption in SMEs is more likely, if the top management thinks that perceived benefits are higher and can outweighs the risks of spending on advanced IT solutions and thereby provides a relative advantage.

SMEs are generally considered to be dealing with resource limitations and financial constraints in particular, due to which top management are extremely cautious when making investment related decisions and spends money carefully. SMEs view the reduction in operational costs as the 'perceived cost benefit' by implementing e-commerce activities in their business (Al-Qirim, 2007). Similarly, SMEs that intend to cut-down the cost on infrastructure and save investments on technological resources, are more likely to adopt Cloud Computing (Bhat, 2013). Because there is specific 'perceived cost benefits associated to Cloud technology implementation in SMEs such as reduced initial investment, lower maintenance costs, easy and less expensive access to latest ICT, reduction in ICT procurement and maintenance cost etc. Whereas, a sudden technological change such as upgrading the IT infrastructure with advanced ICT tools in SMEs can bring new challenges and difficulties for the enterprise. Such new and undesired challenges due to technological change or upgradation in an enterprise is referred to as 'perceived risk'. Though perceived risk is primarily used for anticipating the consumer preferences, it has also been associated to ICT adoption in order to assess the perceived risk level if a particular ICT is implemented (Biucky S.T. et. al, 2017). For example, (M. Sony, et. al, 2021) predicts that the major challenges (or perceived risk) of Industry 4.0 revolution will be its huge costs, data security issues, and technical skill acquisition issues. While (R. Kumar et. al, 2020), highlighted the perceived risks of implementing smart technologies or Industry 4.0 in SMEs as, they still find it challenging due to operational and financial issues. Though there are several 'perceived risks' involved during the IT adoption in SMEs, however they are usually assessed by top management such as the SME owner when deciding whether or not to adopt a particular ICT. Moreover, investing in novel technologies is often considered as risky which can be explained by the fact that majority of the SMEs owners or managers are inclined towards well proven, safe, and widely used IT solutions or IT tools with lower failure rates.

Compatibility and complexity are yet other factors that influence the adoption of technology in SMEs (Ifinedo, 2011). The extent to which a technology is viewed as consistent with existing values, prior experiences, business practices, and the expectations of potential users is referred to as 'perceived compatibility'. IT compatibility is a significant factor that effects the advanced IT adoption in SMEs, as many of the researches on digitization process in SMEs have claimed (B. Ramdani, et. al 2013; P. Ruivo, et. al, 2014). Studies also indicates that SMEs are more inclined towards IT or ICT adoption if those technologies are compatible with existing methods, work

practices (Chang, Park, & Chaiy, 2010) and relative products (Saffu, K. et. al, 2008). Earlier research also points out that SMEs will care less about adopting digital technologies if they believe they are not compatible with their products, mode of business operations, business strategy of their partners, and their organizational culture (Ghobakhloo, et. al, 2015). For example, SME owners or managers, would be less inclined to adopting Industry 4.0 technologies if they perceive it to be difficult to implement and incompatible, as this may require a significant organizational restructuring and may not necessarily be implemented as they were intended for. On the other hand, easy-to-understand and relatively proven enterprise applications are more effective for SMEs than complex and newly developed systems according to (Shin, I. 2006). However, managers/owners of SMEs have the responsibility to carefully assess which technology or application is most suitable or beneficial for their enterprise when determining to adopt or not a new IT (Nguyen, 2009). The extent to which a technology is viewed as comparatively difficult to comprehend and use is referred to as 'perceived complexity'. Multiple researchers have found that 'complexity' effects the ICT adoption in SMEs. The term 'technological complexity' in this context is used as a framework to describe the gradual integration of IT infrastructure. A rapid and quick ICT adoption by SMEs depends up on the technology which is easy to use and easy to understand by employees. Moreover, to maintain the supplier relationship and to customize the purchased IT, some kind of internal expertise and internal capabilities are necessary (Ashurst et al., 2012), which SMEs generally lack in many instances due to scarcity of internal resources (Hicks et al., 2010). Therefore, 'technological complexity' has been negatively associated with organizational ICT adoption in SMEs by a majority of studies. Hence, it is logical to say that less complex technologies have the higher possibilities or chances to be adopted by SMEs. 'Adaptability' refers to the ability to adjust to new conditions. Previous researches show that, it is critical for SMEs to have solutions that are adaptable to their specific conditions and requirements (Cholez H., Girard F. 2014; Mijnhardt F. et. al, 2016).

3.1.3 Information Technology categorization in SMEs

SMEs needs and requirements are unique and specific depending on the resources they have and the business and market conditions they operate. The IT and ICT adoption in SMEs therefore differs from the larger enterprises due to their unique conditions, such as resource limitations specially the limited access to technology, and more often insufficient skills and capabilities (Ghobakhloo, Sabouri, Sai Hong, & Zulkifli, 2012; Girgin, Kurt, & Odabasi, 2011). Hence, the key IT tools that are adopted by SMEs may differ from one another due to environmental, social, and economic factors. Moreover, studies indicate that the impact of ICT on the performance of enterprise differs depending on the type of technology being implemented and how extensively it has been adopted (Liang, You, and Liu 2010; Bayo-Moriones, Billon, and Lera-Lopez 2013). The categorization of IT in SMEs based on their intensity of IT usage, and maturity of digitalization can be categorized in to three main groups. They are grouped as level 1, level 2 and level 3 SMEs. A digitalization maturity model is helpful to understand this classification in SMEs based on their IT adoption and the associated digital maturity level A framework is therefore developed and depicted in figure (3.1). According to the developed SME digital IT maturity framework three levels are clearly identifiable.

Figure 3.1 IT adoption and digital maturity in SMEs
Source: Own work

Level 1: A high amount of manual data handling is possible, while moderate or low-level IT equipment and tools are also used which include desktop computers, laptops, mobile phones. Other office automation tools such as (Word, Spreadsheet, basic inventory, basic accounting software etc.) Internet explorer, websites are used depending on specific business needs.

Level 2: Enterprise systems are connected with business systems such as ERP, Cloud Computing, e-commerce, and e-payment systems at this level. As a result, data processing is automated and integrated across all domains.

Level 3: The enterprise is at most mature stage at (level 3) where all of its (level 2) functionalities are collectively present with its business systems. While it also includes advanced manufacturing technologies such as Industry 4.0 which covers, Internet of Things (IoT), Big Data analytics, Artificial intelligence (AI).

1) Level 1: Basic Information Technology adoption in SMEs

The SMEs that have limited resources, limited number of employees and fixed range of revenue or income are usually at their initial stage of IT adoption which are (level 1) SMEs. They rely on basic IT infrastructure such as an internet connection, basic computer setup with or without LAN connectivity, web browser or explorer installed on a user-friendly operating system (such as Windows), basic accounting and inventory software for maintaining the records of daily transactions, orders from customers, and other business activities. The ICT tools used in (level 1) SMEs are just for the purpose of basic communication and data processing needs. For example, mobile phones are generally used for having communication with clients, and within the enterprise with employees and management. Internet and e-mails are used for administrative functions, whereas Office automation tools such as MS Word, MS Excel, MS Access, MS Power point, MS Outlook, Image viewers, Pdf viewers and other office customization tools are used for supporting the administrative activities which are easily affordable and available in market for (level 1) SMEs. According to (Manochehri, Al-Esmail, and Ashrafi 2012) ICT platforms (such as PCs, mobile devices, the internet, etc.), provide four primary benefits to enterprises. They include greater exposure for business enterprises; providing SMEs with greater information; enabling the enterprises to get beyond the conventional trade barriers; and promotes smooth financial transactions. However, SMEs at stage (level 1) typically depends up on stand-alone information systems installed on private computers which do not share any cross functional connection among them. This is often considered as a risky situation which can lead to business-related problems and operational issues. These issues often include a lack of effective information sharing between different departments and functional areas, difficulties in maintaining large stock levels that are complex in nature and also expensive, an excessive paperwork required during the production

phase etc. This ultimately will also result in wastage of time and resources as well as mismanagement in business. However, SMEs at (level 1) may use different types of applications that are aimed to automate certain specific functions, but still there exists no integration between these applications and hence they are restricted in their business functionality. They represent as confined and restricted cells of information without any linkage to other functional areas of the enterprise. Moreover, SMEs at (level 1) often deals with shortage of professional and knowledgeable employees that have technical experience. Their total number may not exceed the limit of 49 employees. Hence, the IT expertise and confidence that is required for making IT-related decisions in these SMEs is generally very low or at a minimum level. And due to a shortage of IT skilled workforce and IT expertise, (level 1) SMEs tend not to invest in the projects that are based on integrated systems and are often uncertain and confused in choosing appropriate ICT solution for their enterprise. Moreover, the availability of numerous competitive ICT products and services in the market is further hindered by their high cost of procurement and maintenance.

2) Level 2: Advanced Information Technology adoption in SMEs

The (level 2) SMEs can be characterized as the ones that have higher information processing needs and requirements and are usually open to integrate with different types of IT and ICTs to provide integrated functionalities which enable them to efficiently manage and process business data, as well as enhance the communication process. SMEs at (level 2) are known to have accomplished process automation and integration including the automation of all of their core business functions and key departments in a synchronized manner. Information system (IS) integration solutions however have three distinct functions, which include data integration, application integration, and business process integration. Where 'data integration', helps in maintaining consistency across multiple diverse data sources. 'Application integration' can be used for integration of multiple applications or software can be interconnected through application. While 'business process integration' automates the business processes, maintains interoperability across different departments and partners, and used for highly effective decision-making within the organization.

i) Enterprise Application Integration in SMEs

Information systems (IS) are typically built to support particular business operation and function that are usually not easy to integrate, however, by using EAI it is possible to integrate.

Enterprise Application Integration (EAI) is characterized as "the unrestricted exchange of data and processes among any linked applications and data sources in an enterprise." Since SMEs frequently finds it challenging to implement Information Technology due to factors related to organizational structure, a knowledge gap of new data types (such as open data) and their usage, risk mitigation, or shortage of resources (Bidan et al., 2012; Metso et al., 2022). And there is a considerable need for integrating applications since business activities are dispersed across several applications. EAI allows an enterprise to keep using its existing systems while integrating with new ones. The advantages of the EAI features, which integrates several useful services that are needed by businesses, have gained prominence for around a decade (M. Kamal, et al., 2011; M. M., Kamal, et al., 2013). Moreover, 'Web services' and 'service-oriented approaches' have been introduced in order to enhance the interoperability of an increasing number of heterogeneous EAI systems (Kleeberg et al., 2014). In the context of SMEs, the most prominent integration solutions and concepts include Application programming interfaces (API), Middleware, Data warehousing, Web warehousing Service-oriented architecture, Integration platform as a service, and Cloud services.

ii) Application programming interface

The term 'application programming interface' (API) is generally used for referring to programming interfaces that disclose particular services of a program to external systems. There are two different types of APIs, 'Public' and 'Enterprise' API, in which the former is created as a consumer item and the latter of which is often used to link components in intra-business context (Clark, 2016). While API providers, API consumers, and API end-users are three key players where API consumers usually make use of the assets or services that API providers offer through an API, in the process of introducing new services or products. A typical example may include, Representational State Transfer (REST) interface provided over HTTP (Hypertext Transfer Protocol) in XML (Extensible Markup Language) data format. It just supports request/reply communication and has a simple setup. However, as applications get more sophisticated and scalability is desired, the system complexity also increases. Businesses that offer an API can profit from lower expenses, a larger exposure to customer base, enhanced brand loyalty, and new partners (Heshmatisafa & Seppänen, 2020).

iii) Middleware

By integrating the various types of distributed infrastructure, middleware acts as a link between applications and enables applications to interact with each other via standardized protocols (Issarny et al., 2007). While some middleware types are focused on a particular method of communication, whereas others might provide integration hubs or centers for the entire system of an enterprise (IBM, 2021). Enterprise Service Bus (ESB), is one of the EAI's own middleware options, which has a design pattern of centralized component handling communication between integrated applications. ESB was a prominent middleware offered through EAI until recently. Message-oriented middleware (MOM), remote procedure calls (RPC), object request brokers (ORB), and transactional middleware have traditionally been the most popular forms of middleware. Middleware technologies are crucial in IoT applications, particularly when it comes to reducing energy usage and latency. While EAI offers data and business process integration, as well as reusability and distribution mechanisms and it does not demand major technical skills for the integration process. The contemporary middleware solutions are rapidly being replaced by cloud-based services, such as the integration platform as a service (iPaaS) architecture (IBM, 2021). Because with the help of cloud-based models, SMEs may benefit from integration opportunities without having to buy, set up, or maintain any middleware or hardware.

iv) Data warehousing

A framework of "data warehousing" was developed in order to analyze current data for better decision-making purposes. While data warehousing allows for the integration of data, however, integration of processes is not supported by data warehousing. This is due to the reason that, no significant modifications are made to business procedures or IT systems (Bidan et al., 2012). Infrastructure related to data warehousing is often relied on the extract, transform, and load (ETL) methodology (Sharma et al., 2012). The primary objective of SMEs is operational interoperability, which data warehousing does not by itself promote. Moreover, the extent of organizational maturity that a data warehousing requires, SMEs most often do not possess. Therefore, data warehousing is less relevant in SMEs than in larger enterprises, according to (Bidan et al., 2012).

v) Web warehousing

Web warehousing can be interpreted in two different ways. The first method is that it uses data from the Web. The second method focuses on use of Web technologies in data warehousing. Although Web-based data warehouses differ from traditional ones, many of the features of

traditional data warehouses are transferred over into web-data warehouses, such as verified, aggregate information, and structured data on important business topics. With the use of Web-based DW technology, users no longer access the data warehouse through LANs (Local Area Networks), but rather over the Internet or Intranet. Another quality of Web warehouses is that they organize and manipulate the stored objects, but do not actually fetch them. Web technologies ultimately transforms the data warehouses and decision support systems in to more user-friendly, and more frequently used in data warehouses for visualizing the information. Web technology also allows end users to access a variety of information types, including structured, semi-structured, and unstructured data, which however can lead to an issue known as data heterogeneity management. At the same time, it provides huge opportunities for businesses (SMEs) to access the Web as a major source of business data, without which enterprises may have lost many opportunities. By using Web based technology, SMEs can develop capabilities that were previously the domain of their larger enterprises. Web technology help business analysts to get a significant amount of external data via Internet and then analyze website content, consumer preferences, and new trends to track competitors moves.

vi) Service-oriented architecture

In a 'service-oriented architecture' (SOA), the services are handled independently and each one represents a typical business functionality, while combining them together will create a single business process. Business processes are segmented into more compact logical units using the SOA design paradigm, which is typically meant to be utilized and reused by the business units. A broader definition of SOA is 'an architectural paradigm that encourages loose coupling, reuse, interoperability, agility, and efficiency, with an emphasis on decomposing each business process into smaller units of operations and functions such as services (Niknejad et al., 2020)'. In a SOA system, 'service providers' and 'service users' are two main entities. Where service providers offer services to use, while service users avail those services. Sometimes a service provider may also act like a user of other services, and a service user may also provide its own service to others. Though SOA was designed for extensive and complicated systems. (Andriyanto et. al, 2018; Laidlaw G., 2013) argues that SOA is a suitable option to successfully deal with the resource limitations to which SMEs are generally vulnerable. The alternative of sharing IT resources across businesses with massive amounts of data, SOA intends to offer an on-demand data storage as a

service so that a degree of business intelligence is achieved (Ren M, et. al 2008; Sharma Y, et. al 2012). Nevertheless, SMEs view it as an ideal opportunity for the designing their distributed interoperable information systems due to its flexible, adaptive, and optimal nature as a solution. And by having a well-defined architecture for business operations, this method significantly minimizes the time, effort, and expense needed to maintain and upgrade solutions (Yesiltepe M, Bozkurt OO., 2016). The components of traditional SOA model include service programs, a messaging system, and a program registry. According to (Thomas Erl 2009) service inventory is organized and structured by using three service layers which include

- Task service layer: It is a service with a non-agnostic functional context that typically reacts to the logic of the primary business function for a unique purpose; in other words, it is the core service around which other services will revolve to comply with the central process.

- Entity service layer: It symbolizes a crucial commercial entity for the enterprise (such as an invoice, client, claim, etc.) that must be independent of the technology being used and reusable in a functional context with other related commercial entities.

- Utility service layer: It presents a service layer not focused on the business, but rather in low-level technology, providing reusable cross-functional features such as event logging, exception handling, security handling, and notifications that are generic across architecture.

vii) Microservice architecture

Microservices are a type of SOA that use well-defined interfaces in their messages and are independent, single-purpose services. Recently microservices, have risen to a considerable increase in popularity. When compared to SOA, microservice architecture (MSA) is more loosely connected, fine-grained, and adaptable, and its management is divided among several teams. Smaller and mostly web-based applications employ MSA in order to accelerate the development process and improve maintainability (Rademacher et al. 2017). Even though SOA and MSA were initially intended for larger, more complicated enterprises, SMEs may benefit from them as well. Utilizing them in a collaborative architecture for SME clusters is one possibility. By this type of cooperation, SMEs may be able to function as one sizable entity and profit from economies of scale. For instance, an inter-enterprise SOA architecture for SME communities that incorporates characteristics from SOA and MSA is proposed by (Andriyanto et al., 2019) which aims for

simplification, integration, and agility. The framework seeks to solve common issues in SME communities, such as limited resources, heterogeneity, and complexity.

viii) Integration platform as a service

In a Cloud Computing environment, computing resources are transferred from inside a firm's physical limits to the cloud, where in they are made available as services through Internet. Integration services delivered via the Cloud technology provide better integration development, management, and governance. They provide a scalable, automated solution to integrate disparate systems without spending much in Middleware software or the organization's skill set. Moreover, they are simple to deploy owing to their developer-friendly application interfaces (Serrano, et. al, 2014; Ebert et al, 2017). The Cloud-based integration platforms are kind of digital platforms. IPaaS, is a recently developed integration platform for integrating enterprise applications in a Cloud-based environment, that has been offered as a solution to the problems caused by inability of enterprise applications to extend beyond the enterprise borders (Kleeberg et al., 2014). Cloud-based integrations are most frequently referred to as Integration Platforms as a Service (iPaaS) and Integration Software as a Service (iSaaS). However, iPaaS solutions are scalable platforms for more complicated cloud-based integrations with well-defined governance and development techniques, in contrast to iSaaS services, which are more user-focused and have specified endpoints, such as for mobile applications (Bolloju & Murugesan, 2012; Jankoviü, et. al, 2011). The SME literature has several instances of how cloud computing has been used for particular integration needs. Whereas, the potential for cross-system integration of knowledge management systems offered by various Cloud-based solutions was examined by (Balina et al. 2017).

ix) Business-to-business integration

Business-to-business (B2B) integration of applications and data frequently leads to efficient operations, quicker process cycle times, and increased revenues and profits. 'B2B integration' is a phrase used to describe the integration of inter-enterprise commercial activities by incorporating electronic message exchange (Bussler, 2003). It integrates internal and external processes that provides operational, managerial, and strategic advantages and allow for stronger relationships between the businesses with their clients and suppliers. The B2B integration technologies must be created in accordance with high standards because of their importance in business interactions. As a result, they frequently offer high levels of security, traceability, availability, failure-tolerance and

dependability (Kleeberg et al. 2014). In SMEs context, internal integration is primarily connected with its internal component, such as owner-manager and the management, whereas external diffusion is impacted by its external contributors, such as the trade partner and the government. (Bolloju and Murugesan, 2012) examined various frameworks that SMEs may use to implement Cloud-based B2B integration solutions and recommends that SMEs either implement a combined SaaS and iPaaS solution, or implement a SaaS solution and utilize its integration features, or else integrate the current systems using an iPaaS solutions. The three most significant types of Cloud-based B2B integration solutions for SMEs are data integration, automated file transfer, and process integration. Nevertheless, iPaaS assists in establishing consolidated integration solutions for typical SMEs that need B2B interaction with various other businesses (eliminating the need for various point-to-point and ineffective solutions), as well as enabling the integration between their own systems (both on-premise and cloud-based). Whereas (Yan et al. 2008) suggest a Web service-based B2B integration strategy for SMEs, using this method they built a B2Bi gateway to integrate the business processes with their suppliers. For SMEs, B2B interactions often involve use of file transfers for interactions between people; interactions that take place as a result of B2B trades; interactions facilitated by on-site applications including Internet EDI; and interactions through the channels required by suppliers and consumers such as EDI, portals, and specialized software installed on the computers of SMEs.

3) Level 3: Highly advanced Information Technology adoption in SMEs

SMEs at (Level 3) are the ones that deploy commercial IoT equipment such as sensors, actuators, and robotic machines that collects the production and status data of manufacturing facilities. These sensor-collected manufacturing data can be stored on a local server or in the Cloud. Whereas, IoT devices can be set up with sensors that are directly integrated into existing facilities in some case, or they may receive data from other sensors, and then analyze it or transmit it. Such advanced manufacturing environment offers the ability to control production processes autonomously and the real-time monitoring of all industrial resources is possible through online (Lu, Y., & Xu, X. 2018). The interconnectivity of products, processes, and people enabled by IoT technologies significantly improves communication and supports data exchange in real-time between workers and information systems of SMEs. Data created at the lowest level of the enterprise, straight from the production systems and human operators, is extremely valuable to the

enterprise, because this data can be utilized, processed, and refined into relevant information for higher levels of the enterprise, allowing it to be more adaptable and flexible (Mourtzis D, et al, 2016). By using Data Analytics tools which can transform data from various sources into useful information, decision-making in SMEs can be improved and become more responsive, while corrective measures on the factory floor can be executed more efficiently and effectively. Whereas, 'automation' incudes all the capabilities provided by advanced manufacturing systems, which can undertake high-productivity manufacturing processes by using intelligence integrated machines and equipment, which together becomes cyber physical systems (CPS). Innovative technologies such as CPS, IoT, Big Data, and others have the potential to convert current conventional enterprises from traditional to technology-integrated systems, including supply chain, with increased efficiency, flexibility, agility, and openness (Büyüközkan, et al, 2018). However, employees are responsible to manage and analyze data from computerized and numerical control devices (such as PLC and CNC machines), automation devices (such as sensors, actuators etc.) and turn data into clear and precise information that can be utilized into actions. There are multiple types of integrated and automated tools and equipment involved in the SMEs manufacturing environment context. Some of which include sensors, actuators, CNC machines, AGVs, PLCs, 3D Printers etc.

(i) Sensors

Sensors are the electrical devices made up of sensitive cells that may monitor physical characteristics such as light fluctuations, temperature variation, detect fires, noises, motions, or any other variation in the atmosphere (Word Reference 2016). Sensors play a key role in detecting changes in physical objects and in the automation of various applications by collecting, measuring and processing the collected data. They are helpful to monitor processes and equipment by offering data on, how effectively the systems are functioning.

(ii) Actuators

Actuators are used in IoT systems to perform basic or routine tasks on equipment so that process efficiency is improved. Actuators can be 'mechanical' that allow actions over themselves or other devices, while it can also be in the form of an 'action', that a particular object allows it to perform. Mechanic actuators could be motors, servomotors, hydraulic pistons etc., while action triggering actuators are, for example transmitting a message, control LEDs, switch on lights, or

control a robotic movement. Sensors and actuators, have been the core units for monitoring, controlling, and connecting various components used in the design of several cloud-based architectures (Sethi P, Sarangi SR 2017).

(iii) Computer numerical controller machines

Computer numerical controlled (CNC) machines are the integral part of manufacturing systems and are used to transform the raw metal workpieces into final products by eliminating excessive material in a gradual manner by using turning, drilling, and milling operations that are controlled by explicitly coded instructions (Vichare, et al 2009). The basic idea to construct a CNC machine is to facilitate in cutting the items in to precise sizes and shapes to increase the reliability.

(iv) 3D Printers

3D printers are based on rapid prototyping technology and are highly efficient tools for fast product development. By successively adding material to a geometrical model, 3D printing can build physical objects (ISO/PRF, 2015). This method of building an object in three dimensions by layering material is also known as additive manufacturing that has transformed into a valuable tool for various fields such as researchers, manufacturers, designers, engineers, and scientists etc. This method has lowered production costs, production times, and item weight, as well as waste reduction when compared to some traditional manufacturing procedures.

(v) Automated Guided Vehicle

An automated guided vehicle (AGV) is a transport vehicle fitted with an automatic guiding device, such as electromagnetic or optical, capable of moving along a predefined guiding path, with safety instructions and other transfer functions. Due to the advancements in industrial technology, AGVs have become an essential component of automated container terminals and warehouse operations. Since AGV are used for the repetitive tasks is order-picking, which involves gathering items from storage (warehouse) and delivering them to ordering terminals.

(vi) Manufacturing Execution System

MES which is an industrial software is process oriented manufacturing systems that gather and manage data from industrial operations. MES provides reports to higher management levels, and responds to changes and disturbances in real-time. The MES layer is located between the

supervisory control and data acquisition (SCADA) layer and the enterprise resource planning (ERP) layer in a traditional industrial automation pyramid. With the idea of online control of shop floor activities MES bridges the gap between planning systems (such as ERP) and controlling systems (such as sensors and PLCs) and leverages manufacturing information (such as equipment, resources, and orders) to assist manufacturing operations. MES provides transparency for the whole order chain, improved coordination of manufacturing order procedures, reduced lead times and assistance for internal material flow.

(vii) Supervisory Control and Data Acquisition SCADA

SCADA systems are used for industrial device monitoring and are utilized as control systems for industrial process monitoring. They are deployed for infrastructure and industry monitoring across various fields. SCADA include the integration of Human-Machine Interface (HMI) and data transmission and data acquisition technologies (P. Nader, et al 2014). SCADA consists of two main components, a hardware system for data gathering, communication, control, and maintenance; and a software system for data storage, elaboration, visualization, optimization, alert management, etc.

(viii) Programmable Logic Controller

PLC are used for integrating and relating the information coming from sensors that monitors the condition of a process, with the status of an actuator that can modify it. PLCs are a specific type of controller that use microprocessors. It might also be regarded as special computer for the industrial usage, although there are some major differences between PLC and an actual Computer. It is an open area controller since it is unaffected by vibrations, temperature, humidity, or noise. PLCs are designed to control machines and processes, while they can be easily operated.

(ix) Distributed control systems

The distributed control systems (DCS) concept is based on an integrated database that collects all the variables relevant to the automated process. A DCS is a type of control system specifically created to manage huge, complicated, and geographically dispersed applications in industrial operations, where the entire plant area is covered by distributed controllers. These distributed controllers are connected to high-speed communication networks which connects them to both field equipment (sensors and actuators) and working computers.

3.2 Information Technology's role in managing enterprises

A higher growth rate in productivity has been noticed by enterprises that adopt more advanced ICT and that integrates and aligns with different types of technologies (IT and ICTs) at different phases of their production process (Boothy et al., 2010). Due to this fact, ICTs are considered as major enabler for effectively trading services (in service SMEs) and also improves productivity in (manufacturing SMEs) (Manochehri, Al-Esmail, and Ashrafi 2012). ICTs impact varies depending on the type of technology (ICT) being utilized and how extensively it is being adopted (Boothy et al., 2010; Das et al., 2011). Moreover, a high number of ICTs adopted has a considerable impact on communication enhancement according to (Bayo-Moriones, Billon, and Lera-Lopez 2013). One of the major factors that drives SMEs towards adoption of sophisticated and advanced IT is the rising 'information processing needs' triggered by internal and external uncertainties or changes. These changes are generally related to market environment uncertainties, fluctuations in supply chain, changes in production control and methods, changes in the end-user's behavior or demand patterns, employee's skill management including effective knowledge sharing between employees and top-management, relationships with the suppliers and partners, competition raised by new products in the market etc. While according to (Melville, N., & Ramirez, R. 2008), 'process complexity', 'clock speed', and 'supply chain complexity' are three main industrial-level drivers of information processing needs. It is further argued that enterprises that are very rapid in adopting to advanced IT are the ones that have higher 'information processing needs', where information processing needs is often defined as the gap between the information required and the information that is actually accessible. High intensity of information processing needs necessitates the enterprises (SMEs) to improve their information processing capabilities such as IT-based production control and e-supply chain management (Melville, N., & Ramirez, R. 2008), ERP and e-commerce etc. Investing in IT could improve the information processing capabilities as well as flexibility to efficiently deal and manage with threats, and to support decision-making activities in SMEs. Therefore, SMEs with higher information processing needs along with capabilities tend to adopt more advanced and sophisticated IT, since advanced IT is a major enabler for information processing capabilities in processing big volumes of data or information. Whereas, 'Internal integration' is regarded as a crucial factor that significantly and positively affect performance parameters of the enterprise such as financial performance, productivity, and customer satisfaction

(Han et al., 2013; Jajja et al., 2018). Internal integration allows an enterprise to integrate and expand its internal resources and capabilities aiming to develop expertise and knowledge not only within a particular department or a functional area but also beyond those limits (Ebrahimi, 2015; Alfalla-Luque et al., 2015) so that customer requirements can be fulfilled. Internal integration also serves as a basis for the ability of an enterprise to successfully gather, evaluate, and utilize information from its external partners (Zhao et al. 2011). Numerous studies have agreed that, a greater level of intra-firm coordination, enhanced collaboration and real-time data sharing between business functions, coordination of logistics activities with other functional units, are all benefits that can be achieved through internal integration (Huo et al., 2015; Pakurar et al., 2019; Song and Song, 2020). For this reason, ICT solutions such as Enterprise Resource Planning (ERP), Electronic Invoice Presentation and Payments (EIPP) and Customer Relationship Management (CRM), Extended Enterprise Solutions (XES) are considered to be valuable assets as they help to improve the operational efficiency within a firm's internal structures and with its networked external partners (Sweeney and Bai, 2013) while providing a competitive advantage (Tian et al., 2020) for SMEs. Whereas, by using automated methods such as EIPP, the payment data of the purchased and sold items, can easily be shared between the suppliers and enterprise which can positively affects the external integration and performance of SMEs (Bulman and Blum, 2012; Ali and Gasmi, 2017).

3.2.1 Enterprise resource planning in SMEs

An ERP system can be viewed as an integrated software tool that consists of numerous standardized functional modules such as Procurement, Finance and Accounting, Human Capital Management, Manufacturing, Order Management, Supply Chain Management, Customer Resource Management, E-commerce, Inventory Management, Warehouse Management, and other modules which can be customized to meet the specific requirements of a particular enterprise (Laudon and Laudon, 2012) by using modular and high-quality software. ERP system integrates all functional departments and tasks into a single computing system that can accommodate the needs of various departments. The ERP solutions aim to synchronize data and processes within the enterprise, and the data is maintained in one common database. This database serves as a central repository for storing, sharing, and dissemination of information across many departments and business functions, in order to standardize the enterprise business activities and provide customers

with standard business operations by using 'best practice' methods (T. M. Rognsoy, 2017) which also helps the enterprises to enhance their services and strengthen their functional areas (Da Xu, L. 2011). Most importantly using a single database significantly streamlined the flow of information throughout the enterprise (M. Ali, Ll. Miller, 2017). However, ERP software often needs to be customized which impacts all the current business processes.

SMEs typically conduct their business activities in unique ways, hence some of their functionalities often become impractical. As a result, they are forced to either strategize on the process or define the system itself. Therefore, enterprises often have to adopt to customized ERP, which bridges the gap between capabilities of standardized, ERP packaged solutions and the needs of particular enterprise (T. M. Rognsoy, 2017). ERP customization is a series of actions that are taken to adjust or modify the system's functionality according to particular business or production environment so that the needs of an enterprise are fulfilled (J. Lee, 2018). The main purpose of ERP system customization is to achieve compatibility between the ERP system's business functions and that of the enterprise and customer needs. Moreover, ERP implementation undergo through customization in order to accommodate the size and complexity of activities in various enterprises (Baker & Yousof, 2017). ERP customization (O. Khadrouf, et al, 2018) necessitates special coding by updating or expanding its software functions in order to integrate with the current ERP systems. The capability of the existing ERP systems may be enhanced by doing so. In traditional ERP software development process, customer requirements are gathered during the requirements collection phase, and the software product is built accordingly. The enterprise typically requests the ERP provider to customize the chosen ERP solution according to particular business needs. A common justification for ERP system's customization is a functional mismatch between the capability of the standard ERP system and the existing business processes. According to (Rothenberger, M.A. and Srite, M. 2009), organizational culture, apprehension of threat from changes may also contribute to high levels of ERP customization. Other factors may include constraints or flaws in the ERP system's surface architecture (such as the user interface), or the enterprise's own chosen processes and standards, lack of expertise from vendor on product or its relevance, or employee's inefficiency in managing the internal information systems etc.

A smooth integration cannot be achieved until the ERP system has been appropriately setup by choosing the appropriate modules to implement and by defining the appropriate criteria. ERP

systems have inbuilt best practice solutions since they are developed in advance to accommodate a wide range of enterprises including SMEs. Moreover, having an ERP solution that delivers all functionalities in an integrative manner is desirable than deploying separate applications for each department (Costa et al., 2016). There are various reputed ERP systems that SMEs may deploy in their businesses such as Oracle, Microsoft Dynamic and obtain a sizable market share and competitive edge. Various organizational departments are handled by ERP software, including human resources, finance, inventories, logistics, accounting etc. For instance, supply chain management (SCM) is an integral part and a module in ERP software that can support SMEs in boosting their productivity, enhancing inventory control, and increase the sales through effective customer interactions and quicker delivery times according to (NMCC and NASSCOM, 2010). While (Prajogo and Olhager 2012) argues that ERP in supply chains activities can integrate and coordinate material, information and cash flows among its supply chain members which includes suppliers, retailers, manufacturers, and the end-users. Moreover, ERP supports enterprises to share real-time supply chain information such as real-time connectivity and integration of all its internal processes, real-time monitoring of inventory levels, delivery schedules, logistical operating data, and production planning between all of its functional units and supply chain members which leads to effective management of supply chain activities. Due to the importance of Inventory Management and Order Management modules in their daily operations, most of the SMEs start with these modules while adopting ERP, since these modules are very helpful in improving customer service and reduction inventory costs which offers a competitive advantage. Other modules such as manufacturing, warehouse management, finance and procurement can later be added depending on the business needs and business expansion. It can be very challenging without a software solution that can assist the financial information and performs basic accounting tasks for SMEs. Finance and accounting module is therefore considered as one of the important ERP modules for SMEs, since it is supportive in analyzing current financial situation and to monitor upcoming bills. The financial management module basically automates the operations associated to payments to suppliers and vendors, tracking of cash flows, billing, debit and credits information, payroll processing etc. Moreover, this module is responsible for monitoring the financial stability of the enterprise by ensuring bills are paid on timely manner, closing the books of old and outdated transactions, and comply with existing guidelines for financial reporting. Similarly, for most of the SMEs with considerable number of employees, workforce management or HRM module in ERP

is a good investment option, since employers or managers require a centralized hub to manage their employee's information such as whether the employees are paid on a timely manner or not, how many employees needed to be hired and in which functional department, information about their career growth etc. ERP enables the SMEs to efficiently manage and control their internal and external resources, while other major advantages of ERP may include, access to collaborative environments, reduced cost burden while growth in productivity, enhanced system integration with greater levels of product and process innovation and competitive benefits. An integrated ERP system enhances data consistency and accuracy across the departments. Despite the advantages, the traditional on-premise ERP adoption also pose a number of existing challenges. On the other hand, Cloud computing, service-oriented architecture (SOA), web enablement, e-commerce and other emerging communication technologies and infrastructure modifications have all been integrated into ERP systems in recent years.

3.2.2 Cloud Computing technology in SMEs

1) Cloud Computing technology

In order to increase their strategic and technological agility and responsiveness in the worldwide business environment, cloud computing gives opportunity for enterprises to purchase an on-demand IT service by means of Internet technology, either cost-free or on pay-per-use basis (Son et al, 2011). Cloud computing (CC) technology is one of the most recent developments in IT-based business models consisting of network-based user interface along with the combination of hardware, software, storage, and services. One easy definition of CC is that, it provides internet-based data exchange, along with low-cost computing and applications (KPMG, 2012). (Marston S., et al., 2011) states that cloud computing is "an IT service model where computing services (including both hardware and software) are provided to customers across a network in a self-service manner, whenever they demand for irrespective of device and location." Cloud Computing according to National Institute of Standards and Technology (NIST) allows flexible, on-demand network access to a shared pool of customizable computing resources (e.g., networks, servers, storage, applications, and services) that can be quickly supplied and released with little administration work or service provider intervention. As according to the need, server time, network storage, and additional computational resources can be easily accessed. This eliminates

the need for a person to engage with the service provider. Resources are accessible through a network or the Internet. Computational resources are accessible by means of channeled and standardized procedures, for example by using basic day-to-day devices such as mobile phones, laptops, desktops, workstations and tablets etc. Using a multi-tenant approach, the computational resources from provider are combined to serve multiple clients. These resources, both physical and virtual, are constantly allocated and redistributed in response to demand. the computational resources can be determined through the elasticity (flexibility) that is both offered as well as released. Resources can scale up and down very quickly in response to the demand. Moreover, Cloud system is managed and optimized automatically by using metering capability. And can be used for monitoring, controlling, and reporting because Cloud increases transparency for both service provider and user with regards to services that are being utilized (Mell and Grance 2011).

2) Cloud Computing deployment models

The first crucial step for an enterprise in adopting Cloud Computing technology is to select the appropriate deployment model for cloud, because different types of cloud require different skillset and resources. Many businesses that have encountered issues in executing the cloud computing technology because of choosing an unsuitable cloud model for their enterprise according to (Chauhan et al., 2012). However, previous literature suggests that there are four most popular cloud deployment models in practice. They are:

(i) Public Cloud model

In this model, a third-party service provider owns the cloud infrastructure, which is let accessible to the general public or a sizable industry group. Usually, the public cloud services are offered on a per-minute or per-hour basis pay. Enterprises only pay for the CPU, storage, or bandwidth they really use. Since it relieves the client of the obligation of equipment, application, or transfer speed charges, it is regarded as the easiest to install. It is therefore one of the cheapest methods of providing IT solutions by this model, especially for SMEs.

(ii) Private Cloud model

All the advantages of public cloud are also provided by private cloud infrastructure. However, it is used by only one particular enterprise or organization. Both the enterprise and third party are able to administer the cloud, and the infrastructure may be located on-site or off-site (since users

of this CC model may come from different sections or departments within a particular company). While in a private cloud, it is feasible for the basic cloud infrastructure to be hired, owned, or even maintained and managed by the enterprise itself, or a third party, or both at the same time (Mell and Grance, 2011). Because data processes are maintained and controlled internally by the enterprise in private cloud model, therefore they are free from network bandwidth restrictions, security breaches, and any other justifiable needs that usually might arise when using public cloud services. This makes the private cloud to be a cloud model with the highest level of security (Kim, W., 2009).

(iii) Hybrid Cloud model

This cloud is made up of several private and public clouds that are shared by major organizations with needs and interests of similar nature. The hybrid cloud uses the coordination and automation to connect with both public and private clouds. Sensitive data is retained on a private cloud managed by the enterprise, but non-critical information is used on a public cloud for peak workloads that grows on demand. This cloud model can be managed internally as well as by the third-party provider, i.e., inside or outside hosted. By utilizing a hybrid cloud architecture, customers may benefit from both the flexibility of the cloud and the advantages of a conventional IT infrastructure.

3) Cloud Computing Service models

Although there are many services being provided by cloud providers in the global public IT cloud market, most of them may be categorized as software as a service (SaaS), platform as a service (PaaS), and infrastructure as a Service (IaaS). The basis for the Cloud Computing service models is the modern data centers that primarily integrates three service models, SaaS, PaaS, and IaaS and offer them as services by allowing customers to pay only for what they consume. However, there are other could models such as Storage as a Service (StaaS), Desktop as a Service (DaaS). With cloud services implementation, SMEs can improve their IT support for organizational activities and maintain their flexibility with emerging new technologies (Dimitrakos, T., 2010).

(i) Software as a Service

This service model enables enterprises to access and use software applications that are stored and operated on a cloud-based virtual servers via internet. Since it is an on-demand software, it allows for a rapid deployment of application programs. Usually, SaaS software is purchased and then deployed on personal computers, similar to a distribution model where sellers and service providers may access the applications. Also, it is typically linked to a licensing scheme like a pay-per-use subscription. The primary benefit of SaaS is that it enables organizations to transfer the risks involved with the procurement of software while transforming IT from being reactive to proactive. The advantages of SaaS model include simplified software management, automated upgrades and security patches, software interoperability throughout the enterprise, better collaboration, and accessible from anywhere in the world (Rousse, 2010a). Some examples of SaaS providers that offer SaaS service platforms include Google Apps (email, calendar, and documents), Intuit's QuickBooks and Salesforce.com. For a majority of SMEs just SaaS solutions are sufficient for their business needs, however, if they have more complicated IT requirements other cloud service models are helpful.

(ii) Platform as a Service

This model acts like a middleware for cloud service models that provides a computing platform and stack solution which also resembles to a service model (Khurana and Verma, 2013). It allows its customers to use this platform to create and develop own custom applications utilizing the services, languages, libraries, and tools that the platform provider supports. Applications are hosted using PaaS model significantly reduce costs, complexity, and hassle of buying, controlling, and supplying both hardware and software (Salleh, et al., 2012), while eliminating the need to wait for application-specific hardware and software. Examples of service providers which offers this platform include the Google App Engine and Windows Azure, SQL database etc. Using Platform as a Service has benefits such as minimized risks by utilizing pretested technologies, encouraging shared services, enhancing software security, and lowering skill requirements for developing new systems (Jackson, 2012). Moreover, enterprises deploying PaaS model also leverage financial benefits by integrating and heavily utilizing the cloud-based platform across several applications (Oracle, 2012).

(iii) Infrastructure as a Service

This service model of cloud offers comprehensive infrastructure that support services such as database, storage capacity, networking, and other computing services. Whereas, the equipment used for supporting the computing activities, such as storage, hardware, servers, and networking tools, will be charged to the client enterprise on a pay-per-use basis (Rouse, 2010b). Customers normally do not operate or maintain the IaaS system, but they have complete control over its IaaS operations including storage, applications installed, and maybe a limited control over the selection of networking components (Khan A.W., et al., 2012). This model offers its clients a platform in the form of a computing environment or infrastructure which includes both hardware and software. Among the services made accessible to the enterprises under IaaS model include, storage as a service, data center as a service, disaster recovery, compute as a service, virtual desktop infrastructure, and cloud bursting which provides peak load capacity for different operations. Some of the benefits of IaaS cloud model are enhanced financial flexibility, a wider range of services, business agility, cost-effective growth, and increased security (Cisco, 2009). Some of the examples of IaaS are Amazon's Web Services (AWS), Elastic Compute Cloud (EC2), Secure Storage Service (S3), CenturyLink, and Rackspace.

(iv) Storage as a Service

This service model offers customers an interface for data storage and charge money according to the quantity of storage utilized. Platforms that offer services such as SaaS, PaaS, or IaaS can have access to this storage interface, or customers can directly have access to this interface. Amazon's really simple storage commercial is the best example of a direct storage.

(v) Desktop as a Service

In this service model, desktop operating systems such as Windows, and application programs can be safely distributed by means of remote infrastructure.

(vi) Analytics as a Service

'Analytics as a Service' (AaaS) is a new innovative type of service provided to the users on cloud platform for analyzing Big Data, by using big data tools such as Hadoop (Dhabhai & Gupta, 2016). Since it is a difficult task to handle, manage, and analyze vast amounts of data, Big Data is a critical technological tool that support decision-makers in SMEs to have access to data analytics information. The adoption of Cloud-based Big Data opens up a lot of opportunities for achieving

a specific mix of computing resources such as computers, storage devices, services, and software via Internet (Laudon & Traver, 2014). Therefore, 'analytics as a service' on a cloud platform is highly beneficial for SMEs in enhancing their data analytics capabilities.

5) Benefits of Cloud Computing technology for SMEs

Multiple studies (Lavoie 2015; Bask 2015; King, Hicks, and Reeves 2014; Truong 2010) have examined the impact and reasons of cloud technology deployment by SMEs and have identified the factors that caused SMEs to shift towards cloud computing. SME's precise awareness of their ICT requirements is crucial, since their critical need is a solution that will adapt or transform according to their changing business requirements. Moreover, it should be less risky in all aspects, because SMEs need a low-risk, less costly method that effectively reduces information gaps. Due to financial limitations, SMEs generally prefer selectively invest on IT and ICT tools, mostly considering their current business requirements or needs. Therefore, cost related to technology deployment is a major factor for SMEs. Considering that CC provides enhanced capacity or improved enterprise-level capabilities without additional expenditure that would traditionally need an investment in equipment, software, or employee training, it is therefore hypothesized that this technical platform offers multiple opportunities for SMEs (Aljabre, 2012). Moreover, payment flexibility based on resource utilization is offered by the cloud suppliers (Bask 2015). CC offers SMEs with benefits such as on-demand self-service, resource pooling, extensive network access, instant flexibility, and controlled service access (Layo I., 2013). It also facilitates dynamic employee collaboration in a highly competitive SME environment. SMEs can utilize web-based applications in order to ease their communication between suppliers, clients, and distributors and use it as a communication channel to assess the environmental changes. The SME owner is not entitled to own an entire IT infrastructure, and make a substantial upfront expenditure while using cloud computing system. Instead, SME owner simply can use a similar infrastructure that is controlled by a third party and only need to spend for computational resources they really use. Different entry points facilitate the SME clients to connect to available real or virtual environments through different types of IT devices such as desktop computers, laptops, tablets, and smartphones to access information online uninterruptedly (Bask 2015). With the cloud technology, the market entry barrier for SMEs and the risk associated with it will be significantly reduced. Moreover, Cloud provides additional flexibility for SMEs and offers unlimited storage capacity by virtual

means. Hence, data storage issues are minimized to a great extent for SMEs by using cloud storage, and they may operate the business in a way that downtime and productivity loss is reduced (King, Hicks, and Reeves 2014). Automatic updates of software and applications is possible by hiring cloud services, additionally, CC enhances the collaboration between SMEs and their employees being spread across various geographical regions. It improves staff and organizational efficiency by enabling dispersed teams of individuals to virtually connect and exchange information. However, in order to be unique from their rivals and to maintain a competitive edge, SME owners must learn how to utilize CC sensibly and exploit the computing resources in a unique way (Truong 2010).

5) Cloud-based ERP in SMEs

ERP systems, offer excellent benefits for corporate and business enterprises such as they enable integration with partners, external applications, and information systems. However, they also face several issues including high upgrade costs, integration between various components, equitable resource utilization, transparency, organizational changes, monitoring of financial conditions, bidding and pricing, etc. The ideal solution for resolving ERP system inconsistencies is adopting Cloud Computing. Many SME owners are determined to enhance their enterprise computational capabilities, but they are unable to do so because of the heavy cost of the solutions. Cloud-based ERP solutions provides excellent benefits with significant cost savings by lowering the requirement for an IT support team, technical IT labors, and other on-premises resources. With its pay-per-use, on-demand infrastructure, CC enables SME to take advantage of affordable solutions. Cloud-based ERP is yet another technology that SMEs can rely on, and that can be operated regardless of device or location. This technical platform enables customers, businesses, or individuals to access and utilize computer resources over the internet as needed irrespective of their location or which device they use (Schubert, 2011; Marston, 2011). Although traditional ERP model offers many benefits, a lot of SMEs still prefer Cloud-based ERP model, since the ERP software can be installed on the service provider or vendor's site, where users, clients and businesses can have access to the resources and services over the internet whenever they demand it (Saini, 2012). Moreover, SMEs are able to access all the features of traditional ERP via remote locations whereas they only pay for the services they use. It is a cost-effective (pay-per-use) IT solution for SMEs when compared to traditional ERP model that needs huge investments cost to

set up IT infrastructure. According to (Tuncay, E 2010), SMEs can minimize the expenditure needed for employees, infrastructure, maintenance, and management by implementing cloud-based services. Along with saving money and time, cloud technology offers better backup and disaster recovery services, automatic resource provisioning, and simple setup and maintenance (Armbrust et al., 2010). However, technical competence and availability of a basic ICT infrastructure are essential conditions for an enterprise to successfully adopt cloud computing (Low et al. 2011). The likelihood that technological advancements are adopted by enterprises is majorly depends up on the level of knowledge about those technologies (Ifinedo, 2011). Therefore, IT skilled and knowledgeable employees who have technical background or experience plays a vital role in the adoption of cloud-based ERP solution by SMEs.

3.2.3 E-commerce in SMEs

E-commerce has rapidly evolved into a sustainable method and strategy of conducting business online. E-commerce is a new interdisciplinary field that plays a significant role in international economic affairs due to IT application in activities connected to commercial and economic affairs (Feizollahi, et al., 2014). E-commerce can be used to facilitate sustainable trading via the internet (T. Oliveira, et. al, 2017). E-commerce has been defined differently by many researchers, for example, it is described by (Turban E., 2010) as "the process of purchasing, selling, transferring, or exchanging of goods, services, and/or information across computer networks, mainly through Internet and intranets." While (Iansiti, & Lakhani, 2014), defined 'e-commerce' as the practice of conducting business transactions electronically to purchase and sell products and services. E-commerce applications are used in the process of facilitating the customer-oriented activities such as marketing and trading. It is worth noting that e-commerce has triggered significant changes and developments in commercial activities and business practices. This implies that purchasing and selling of products and services became better and evolved, and the relationships between customers and providers have improved along with communication. It has resulted in fundamental transformation of business perspectives in terms of improved output and improved communication between customers and sellers (Yang, Pang, Liu, Yen, & Tarne, 2015). For instance, in order to improve efficiency and effectiveness, 'e-commerce logistics system' offers a solution which enables the clients to quickly and flexibly communicate order information, financial data, capacity status, and nearly any other relevant information that they may need (Wang

et al. 2014a, b), because e-commerce marketplaces became highly competitive across the supply chain from products to services, and a lot of e-commerce enterprises (e-businesses) are focused on their logistics infrastructure as well. The main benefits of e-commerce, include lower costs, greater sales, enhanced productivity, decreased processing times, high market penetration, and enhanced consumer loyalty (Turban 2010). These benefits are very crucial for SMEs since they mostly rely on the low budget IT deployment options.

1) Types of e-commerce in SMEs

E-commerce operations are typically divided into two major categories, which are "Business to Business" (B2B) when business enterprise interact with other business enterprise, and "Business to Consumer" (B2C) when business enterprise interact with consumers. While there are also other types of e-commerce such as Consumer to Consumer (C2C), Customer-to-Business (C2B) Mobile commerce (m-commerce) etc.

(i) Business to Business

A simple definition of B2B e-commerce is electronic trade between the enterprises or businesses that deals with interaction between and among businesses. The B2B e-commerce offers a lot of opportunities for SMEs specially by lowering transaction expenses and improve transaction speed and dependability between the enterprises via internet. The real-time communication and business-to-business interaction may also eliminate knowledge gaps between suppliers and customers and strengthen the coordination among trading partners. This can minimize inefficiencies driven by a lack of coordination between the SMEs across the value chain. One of the basic and key features of B2B e-commerce is 'E-markets' which are the websites where sellers and buyers communicate with each other and execute trading deals.

(ii) Business to Consumer

The B2C e-commerce involves customers buying material assets (such as books or daily usage consumer products) or information goods (such as software or e-books), and receiving of these products or information goods via an electronic network. The two parties involved in this transaction are on the selling end is the enterprise and at the receiving end is the consumer. B2C e-commerce lowers the transaction costs, especially the cost involved in searching of products by providing customers with more information and enabling them to find the best deal on a product

or service. While it also minimizes market entry constraints since it is significantly less expensive to set up and maintain a website. B2C e-commerce is even reliable for information commodities, since it spares enterprise from having to bear the additional expenses of a physical distribution network which is highly suited for SMEs.

(iii) Consumer to Consumer

In C2C e-commerce, the business transactions takes place between the two customers or individuals. This may include any electronic transaction in products or services between customers, and usually, a third party that provides an online transaction platform conducts such trade. C2C e-commerce can be characterized by the expanding electronic marketplaces and auction websites, where customers and individuals may compete for what the want from a wide range of suppliers. It may provide great opportunities to create new markets.

(iv) Consumer to Business

In C2B e-commerce, the transactions or trading goes in reverse order when compared to usual case of B2C ecommerce. Reverse auctions are implemented in these transactions, allowing the customer to have more control on cash flow. For the individuals who want to sell their services or products to businesses that aim specifically at particular types of services or items, C2B is the best option.

(v) Mobile commerce

M-commerce is the practice of trading products and services via wireless handheld devices (such as smartphones, and SMEs are becoming more aware of the value of adopting mobile commerce to increase their competitiveness (Chau &Deng, 2018). Many consider 'm-commerce' as the preferred means for conducting e-commerce transactions as the content distribution through wireless devices becomes quicker, more secure, and scalable. M-commerce offers enterprises with several benefits, such as high productivity, reduced operational expenses and improved customer satisfaction. Therefore, m-commerce is considered as one of the cost-effective methods for the promotion of products and services over the internet (Njenga, et al., 2016), and its special advantages allow businesses to provide their consumers with more value. M-commerce for instance enables SMEs to connect with their clients whenever they want irrespective of physical location. This gives SMEs a lot of opportunities to explore new m-commerce marketplaces.

Through e-commerce, businesses may enhance inter-industry collaboration across worldwide, and develop a business marketing system. Particularly for SMEs sectors, B2B e-commerce dismantles the barriers of scales, since it not only minimizes the cost and barriers to access new markets but also provide opportunities for partnerships and collaboration with other businesses around the world by providing access to information on market demands. Moreover, B2B e-commerce may assist SMEs in achieving enormous benefits by developing customer/supplier relationships, improving sales and profits, improving operational efficiency, as well as by strengthening their competitive aspects with large enterprises in the international markets (Mohtaramzadeh, Ramayah, & Jun-Hwa, 2018; Rahayu & Day, 2017). Not only has the growth of online shopping revolutionized the way that retailing is conducted throughout the globe, but it has also sparked a business to customer (B2C) e-commerce revolution that has never before been seen, particularly after 2010 according to the UNIDO report. The B2C e-commerce enterprises use commercial trade networks, auction websites, online product catalogs, websites, and other online resources to reach out to new clients, and offer better services for existing clients, and achieve effective purchasing and lower costs.

2) Factors associated to e-commerce adoption in SMEs

A wide variety of e-commerce activities conducted in SMEs results in new, diverse and expanded marketplaces, easy customization of product and services, productivity enhancements, knowledge sharing and management, while providing anytime business opportunity for customers. There are multiple factors that affect the e-commerce adoption in SMEs especially technical factors, such as network security issues, the cost of buying e-commerce-related software, hardware, and other expenses, the cost of system integration, the initial start-up costs, etc. Although earlier research (Wanyoike, Mukulu & Waititu, 2012; Saffu, Walker & Mazurek, 2012) show that there is a favorable association between technical factors and the e-commerce adoption and a few studies (S. K. Yeng, et al., 2015; B. Ramdani, et al., 2013) also suggest that technical factors significantly affect the rapid adoption of e-commerce in SMEs. However, SMEs are generally considered to have limited access to financial resources (Woschke et al., 2017) and technically skilled labor. Technological factors, are also closely associated to 'perceived behavioral control' including customer's cognitive abilities in utilizing the chosen technology (e-commerce) such as the technical expertise, support from the provider, as well as internet

infrastructure etc. (H. O. Awa, et al., 2015). If consumers feel that technological application of e-commerce to be difficult to use and comprehend, their lack of technical knowledge may limit their acceptance, nevertheless, if the e-commerce technology is simple to use, adoption of innovative tools will be more probable. Moreover, the ability of SMEs in deciding whether or not to adopt e-commerce is also greatly depends up on the employee's IT expertise. This is due to the fact that IT solutions is constantly evolving, hence the IT skills of employees must also grow and adapt in order to keep up with the updated technology (C. E. Ocloo, et al., 2018). Compatibility, according to prior studies, has a favorable and considerable impact on SMEs' adoption and use of e-commerce (F. Aziz and N. Jamali, 2013). The level of organizational leader's awareness of the importance of e-commerce is referred to as 'top management support' which also represents getting sufficient financial and technological assistance to implement information technology advancements (H. O. Awa, et al., 2015). While according to various studies, management support is positively connected with SME's adoption of e-commerce and extensive internet usage (Al-Alawi and Al-Ali, 2015). Environmental factors in adopting e-commerce by SMEs include two main aspects, 'competitive pressure' and 'trading partners pressure'. As the industry-level competition grows, the possibility of SMEs to adopt e-commerce becomes higher (H. O. Awa, et al., 2015). Whereas, IT adoption is positively impacted by the pressure of trade partners, which has demonstrated to be a significant indicator of SME's e-commerce adoption (J. H. Walker, et al., 2016). Numerous studies have also demonstrated that financial resources are positively and significantly linked to SME's adoption of ICT and e-commerce (Mishra & Agarwal, 2010; Ghobakhloo, Hong, & Standing, 2015).

3) Cloud-based e-commerce in SMEs

With the rapid advancement of Cloud Computing technology, it made possible for e-commerce enterprises to rent their infrastructure and software rather than purchase it, which has reduced the cost related to system development (Wang, D. 2013). E-commerce and cloud computing both are well-accepted technologies since both are cost effective (Wang, H., 2011). While Cloud computing reduces the cost of IT infrastructure, e-commerce allows enterprise to do business without having the need to rent or purchase an entire physical store (Qin, Z., 2009). Many top-tier global companies such as Google, IBM, Amazon, Microsoft, and Alibaba, have started to offer cloud computing services that are practically being used by all commercial enterprises

(Guoyin Jiang, 2013). These businesses are now able to virtually rent IT services and products based on their requirements, which also gives them a competitive advantage in market. E-commerce infrastructure consists of basic IT layer that is supported by computer hardware, software, networks, and other internet-related facilities and enabling technologies. SMEs that use e-commerce can access the needed infrastructure in the service mode and pay for this service, hence, data is remotely stored. SMEs perceive the adoption of cloud-based computing services as an opportunity to improve their operational performance. By using this platform, SMEs may adopt to customization in order to meet the needs and expectations of their customers. In addition, Cloud computing has proven to be crucial for enterprises (SMEs) as it allows them to operate their applications on a shared multi-tenant platform rather than on personal computers (Devasena, C. L. 2014). Additionally, this supports SMEs to control and perform their daily operations in accordance with specified plan based on strategic business priorities. Technically a single service provider can offer almost all the essential services through an e-commerce website, this ultimately positively affect the supply chain of an e-commerce enterprise (Wang, D. 2013). Cloud computing can affect the existing e-commerce architecture.

3.2.4 E- payment system in SMEs

A smooth e-commerce experience necessitates various components of the e-commerce ecosystem such as a secure payment system and efficient shipping and logistics to align and operate in a synchronized way. ICT and digital technologies have evolved significantly in the areas of finance, economics, and operational costs (Slozko & Pello, 2015). While the global payment system, with the advent of e-payment system eventually has aligned with current trends of cashless payment between individuals, corporate and business enterprises, and governments (Odi & Richard, 2013). Electronic payment system provides a virtual payment option for the services or items purchased over the internet and serves as a replacement to cash payment system (M A Kabir, et. al., 2015). Whereas, the diversity of payment options also stimulates competitiveness, with opponents that are seeking to provide the comprehensive set of payment alternatives (Rafique, Rizwan, Batool & Aslam, 2014). It is also inferred that due to global acceptance of e-commerce activities for online business transactions that resulted in the development of e-payment systems. The Federal Financial Institutions Examination Council (2010) describes the electronic payment as a latest payment method for retail in which a seller obtains payment information for products

and services and retrieves this information in the form of electronic template and generate it electronically for processing over a network. E-payments are also known as 'digital payments' which involves the sending of money from one to another account using technological medium such as mobile wallets or mobile payment applications which may include Bank transfers, Debit cards, Credit cards, and E-wallets, such as GoPay, ShopeePay etc. While (T D Hascaryani 2013) defines e-payments as a payment method that do not involve cash and instead utilizes electronic media. However, there are other types of e-payment systems that are accessible in markets, for example, electronic wallets (e-wallets), electronic cash (e-cash), wireless payment systems, value systems online stored, digitally collecting balance systems, digital check payment systems (S Junadi[a] 2015), and electronic payment cards (such as debit, credit, and charge cards); virtual credit cards; mobile payments; loyalty and smart cards etc. The customers who utilize the e-payment service have access to a web-based user interface that provides them a remote access to view and operate their bank account and transactions (Hidayanto A. N., et. al., 2015). SMEs are capable to explore and utilize these payment methods depending on the nature and conditions of trade they carry out. The key benefits of e-payment systems are, an effective and reliable e-payment system that guarantees quick payments, improved tracking, transaction transparency, reduced time consumption, cost reductions, and improved confidence between the provider and customers. Since e-payments provide a simple and easier transaction process during e-commerce activities between the buyer and seller (S Junadi[a] 2015), which is recommended method for SMEs that engage in e-commerce activities. Moreover, e-payment system is a cost-effective payment method when compared to paper-based payments (A Premchand & A Choudhry 2015) which provides significant cost savings for SMEs. Additionally, the use of electronic transactions is crucial for accountability, transparency, and for minimizing of cash-related corruption, which is basic requirement of economic development and progress (Mieseigha and Ogbodo 2013). Some of the prevalent modes of e-payment systems that are useful for SMEs can be further discussed.

1) Credit Cards

Before making a purchase, credit cards are used to authenticate customers and check with the bank to see whether there is enough money for the transaction. Credit card use has so far been the most popular method of online payment. Although initially credit cards were thought to be a less-suitable option for SMEs, since SME customers are involved in low-price transactions with small

payments. However, there has been a significant shift and dramatic increase of the credit card customers over the decade, that has established a vast network already in markets and presently ensuring a sizable user base for a variety of digital transactions. One of the main benefits of credit cards is that they are simple in operation, which allows users to perform online transactions quickly and from any location.

2) Debit Cards

In contrast to credit cards, debit card payments are deducted straight from the consumer's own account rather than a secondary account of provider. Customers are able to instantly transfer money from their accounts with the help of debit cards, given the condition that customers have enough funds in their account to easily make purchase. Because the debit cards incur lower charges on customers than credit cards, they are ideal for micropayments. The debit card usage is notably strong in most of the countries with a specific user base, however it also depends on the criteria and laws associated with credit card distribution. Due to their rapidly growing prevalence, debit cards are presently the most widely used non-cash payment method worldwide (Capgemini and RBS, 2013).

3) Mobile transactions in SMEs

By using mobile payment technology, customers, especially in the service marketing sector have a more affordable option to pay for their products, services, and information exchanges using wireless technology (Lai & Scheela, 2018). While (Hoofnagle, et al. 2012) assert that payments done using wireless devices, such as mobile phones and smartphones, are believed to be more convenient, minimizes transactional costs, and provides more security of electronic payments. Mobile money, as defined by the (WTO, 2013), refers to payment services made possible by mobile devices. 'Mobile money' and 'mobile payment' refers to the same. While the transaction is carried out on mobile devices, which can be stored as digital wallets. It is worth noting, that 'mobile money transfers' refers to the money being sent from one individual to another by utilizing a mobile device. Whereas the 'mobile payments' refers to the transactional money that is being paid from one party (usually customer) to other party (usually a retailer) as a remuneration for purchased products and services via the mobile phones (WTO, 2013). Since the 'mobile phones' and 'mobile banking services' are now quite affordable, therefore majority of SMEs use 'mobile payments' for their business transactions (Mbogo, 2010). Modern customers utilize mobile money

transfers to pay bills, top up data, and carry out other activities by using their mobile money accounts, without any restrictions (GSMA, 2017). Particularly, with the help of mobile money services, such as Business-to-Person (B2P), or bulk payment service, the SMEs are able to pay several clients at a single time, just by directly sending money (also known as pushing cash) into their mobile money business account, which in turn enhances the efficiency of SME's business operations. According to (Liu et al., 2019)'s conceptual study, customers in developing nations (e.g., India) where cash is still extensively used have a relatively favorable attitude toward using mobile payments despite the existence of relatively low broadband Internet penetration (Lai & Scheela, 2018; Mukerji & Roy, 2019). Potential reasons may include rapid spread of inexpensive smartphones and the growing awareness among tech-savvy customers to keep up with the constantly changing urban lifestyles (Poushter, Bishop, & Chew, 2018). Mobile payment is projected to be highly contributive to worldwide growth and is becoming increasingly popular in developing nations (Capgemini, 2019).

The phrase 'mobile banking' refers to using mobile devices to conduct banking operations or get account information. According to (Asia, Mbabazize, and Shukla 2015), it is the use of a mobile phone to process financial transactions. Mobile banking, as defined by (Guitterez and Singh 2013), is the practice of conducting both financial and banking transactions via a mobile device. The 'mobile banking' concept relies on the 'mobile money' technology to effectively execute transactions. Moreover, it supports person-to-person transfers which helps in immediate transfer of funds from the client to the enterprise. This concept is appealing for SME owners because the transaction will become flexible, reliable and faster between the seller and customer. The electronic transactions conducted by using specific electronics methods, systems or channels (e.g., credit cards, mobile devices, e-applications) can significantly enhance the SMEs financial control and the relationship between the vendor and customers. Earlier studies suggest that e-payment and mobile payment methods offer their users several benefits, such as location-free access, a wide range of purchasing options, an easy and effective replacement for cash payments, and instant access to financial resources, and SMEs can leverage these benefits by adopting e-commerce, e-payment and mobile payment systems in their business. However, there are many other factors that determines the adoption of e-payment and mobile payment systems in SMEs.

4) Factors effecting the e-payments and mobile payments

(i) Ease of use: Results of an information systems research underlined the significance of user acceptance and determined that 'perceived usefulness' and 'perceived ease of use' are among the most important determinants of adoption of mobile payment systems (Liu et al., 2019).

(ii) Compatibility: The flexibility of mobile payment systems, which enables easy integration into customer's daily usage, is a crucial factor of compatibility which encourages customers to accept mobile payment methods. Mobile payment methods are preferred for smaller payments.

(iii) Complexity: Complexity of use in different electronic payment methods such as smart cards or mobile payments, can lead to a decreased adoption of these services. Therefore, mobile payments offer relatively fewer complex services to its customer base.

(iv) Costs: The overall cost of a transaction is one of the main aspects that influence the customer in adopting to mobile payment systems. Several consumers have avoided using mobile payment systems in the past (Mallat 2007), because these services use to be expensive initially. However, they are very cost-effective in the modern business era.

(v) Security and trust: The main obstacle to the adoption of e-commerce transactions and e-payments is the lack of security and customer confidence in the service provider. One of the biggest issues mobile payment systems encounters, is the rising incidence of cybercrime, which leads to data theft and cyberattacks on financial data, according to (Karp 2015). For consumers to make secure online payments, they seek confidentiality, authentication, data integrity.

3.2.5 Electronic contracts in SMEs

With the advancement in e-commerce, the usage of electronic contracts has also grown with a rapid pace. E-contracts also known as (e-contracts) relies on ICT, and other intermediaries such as Internet Service Providers (ISPs). The entire process of e-contract is rather simple and can be finalized within few seconds by merely attaching digital signatures of both parties (buyer and seller) to an electronic copy of the contract. By this, delayed couriers and additional travelling costs can be completely avoided. However, the adaptation of e-contracts may present other challenges on multiple levels, including conceptual, logical, and implementation, since a lot of people are unfamiliar of legal consequences and complexities that are associated with e-contract's usage on a regular basis. Legislators were initially hesitant to acknowledge e-contracts technology,

but several nations have already established laws to recognize and validate e-contracts. Usually, a software system is used in order to design, specify, execute, and deploy an e-contract by using an electronic means. Hence an 'e-contract' can be characterized as a contract that is created through electronic interaction between two or more parties, such as by using email; a person and an electronic agent (such as a computer program or application); or at least two electronic agents that recognize the existence of such a contract. 'Originator' and 'Addressee' are two parties between whom the e-contract is usually conducted according to IT Act, 2008. An 'Originator', which excludes an intermediary, is a person who sends, creates, stores, or transmits any electronic communication to be sent, created, stored, or transmitted to any other person. Whereas, a person who is supposed to receive the electronic record which excludes any intermediaries is known as an 'Addressee', according to the provisions of the IT Act of 2000. These electronic methods may include 'e-mail', 'social media', or 'web-page'. E-mails are one of the easiest and simplest forms of concluding a contract. Social media is also used by many businesses to make e-contracts with their consumers. Social media use virtual community networks for creating and sharing of information. It is very interactive online technology which relies on social media websites such as Facebook, YouTube, Twitter, Snapchat, Viber etc. An e-contract can be sent through social media platform by writing a text massage, by making a voice call using a microphone or a recorded voice message. An e-contract can also be done by using customary signals on social media such as specific emoticon for acceptance or rejection. The e-contracts based on website or a web page are performed in three different methods (e.g., web-wrap, browse-wrap and shrink-wrap).

In a "web-wrap" contract also known as 'click-wrap', the seller provides the information of products and prices on a retail website, which can be viewed by the potential customers. More information is accessible to users or customers on selecting particular product on that webpage. And by clicking on each of these options, the customer is given a choice either to agree it or refuse it. If the customer agrees and proceeds with the payment through credit or a debit card, and if he is able to download the file or a program or able to successfully place an order for an item, then it is regarded as consumer's acceptance. This type of e-contract is referred as making of contracts by actions. In "browse-wrap" contracts customers are given access to use or download particular web content through a website. This is usually done through providing access to a website and then re directing the user to another website through a hyperlink which accounts to acceptance of new terms and conditions if the user wants to proceed with buying the products or services. Therefore,

'browse wrap' contracts are considered to be complex in nature as the terms and conditions are not clearly implicated. The "shrink wrap" contracts are usually applied to those products or software, on which the licensing conditions are based on particular software. The term 'shrink-wrap' is use in the context of plastic wrapping which usually coats the standard purchased products during delivery. When the consumer opens the box and reads the contract terms, he has already paid for the software and generally considered as acceptance of this contract. And the consumer in most cases have no return guarantee. Therefore, the limitations of e-contracts include, particularly with plastic wrapping contracts, there is no central body in charge of monitoring the entire process. Therefore, the risk factor is quite high since there is no guaranteed security. Whereas the benefits of e-contracts for SMEs include (i) Easier ways to enter into e-contracts are e-mail, world wide web (www), and cyber contracts, (ii) The contracting parties do not need to hold any type of formal meeting in person. (iii) In most cases, handwritten signature or handwritten agreements are not necessary. (iv) Physical products are purchased and paid online, but deliveries are made physically. (v) There are no limitations of geographical and physical boundaries.

3.2.6 Social media platforms in SMEs

Digital media and its numerous manifestations which includes social media, mobile applications, and web-based services, has provided a framework for new entrepreneurs, start-ups, and established enterprises to deliver value proposition for both current and potential clients (Horst and Murschetz, 2019). Social media platforms are the social networking sites (SNS) that are web-based technologies and allows users to create virtual representations of themselves (user profiles) to connect with other users to interact (Pai, P., Arnott, D., 2013). They mainly refer to a wide range of digital media platforms such as Facebook, Instagram, Telegram, WhatsApp, websites, and weblogs which allow the users, audiences, and potential or existing customers to interact with people and businesses. Social media-based CRM is an excellent way to maintain a direct relationship with customers which may provide lots of information (Chen et al., 2012). Not only it is helpful in collecting data about customers, but also it further promotes entrepreneurship and assists enterprises in maintaining more flexible relationship between inside and outside environments (Scuotto et al., 2017). Specially SMEs are now able to restructure their CRM activities to develop customer relationship (Cheng and Shiu, 2018). It is a strategic move for SMEs to use social media, and viewed as a proactive response towards environmental changes (Dutot

and Bergeron, 2016). They are useful in collecting data from various e-commerce websites to analyze the customers commercial activities such as whether they are involved in the purchasing of products or services or not (Ogunrinde, Jusoh, Pa, Rahman, & Abdullah, 2017). These sources of data collection can be quite beneficial for SMEs in terms of acquiring and evaluating data for commercial purposes. The customer information gained by these platforms helps SME owners to enhance service quality, and improve productivity, while facilitating effective micro-customer segmentation during marketing activities. SMEs can significantly increase their marketing effectiveness in the context of social media structures (Bulearca and Bulearca, 2010). For instance, utilizing modern technological tools such as the website or phone-marketing, which is a suitable approach to implement for SMEs (Harrigan and Miles, 2014). SMEs now have better opportunities to expand their marketing strategies and market vision due to online social media (Nakara et al., 2012). Moreover, it supports customer's engagement which enables the enterprise with a better knowledge about customer's needs (Stockdale et al., 2012). The information acquired is also helpful to improve supply chain efficiency while promoting the accurate demand planning (Singh & Singh, 2017). Developing operational practices with the customer's point of view in mind, may allow enterprises find and remove harmful misinformation and customer dissatisfaction as well as identify, absorb, and explore new knowledge (Wang et al., 2016). According to research by (Ferrer et al. 2013), social media has a favorable impact on enterprise's social capital, which in turn impacts its performance. While it may also assist with developing creative capabilities, resource acquisition, innovation, and strategic engagement through improving customer-supplier engagements (O'Dwyer et al., 2009). Utilizing social media, businesses may implement technical innovation in addition to improving their communication capabilities (Papa et al., 2018). Moreover, social media made it possible for a vital transformation in information accessibility and data structuring (Bulearca and Bulearca, 2010).

Previous research suggest that SMEs have been increasingly utilizing social media in CRM (Harrigan and Miles, 2014), market research (Kim et al., 2013), information sharing (Panahi et al., 2012), knowledge management and organizational learning (Hamburg, 2012). Moreover, SMEs utilize social media tools for business growth (Kumar & Aggarwal, 2018), sustainable development (Kumar & Pandey 2018), and as an integrated marketing tool. Most importantly, SMEs utilize social media platforms for identifying new opportunities and new market-specific product ideas so that they can develop and enhance their own products and services (Jussila et al.,

2014). Although the foundation of entrepreneurial activities has always been "opportunity" by making use of media (Emami and Khajeheian, 2019). Increasing usage of smartphones and social media sites have become common and has created opportunities for SMEs for marketing and sales of products and services. For instance, smartphones are one of the best options for advertising the products to the clients that are near or within a particular geographical area or location with the help of GPS (Global positioning system) technology. It creates several opportunities for SMEs to explore and gain new potential clients and provides possibilities to generate high revenues for service providers. By utilizing social media, an enterprise may identify market gaps, assess industry trends accurately, and offer a tool to adapt to the changing market conditions (Stockdale et al., 2012). According to a study, SMEs continuously prioritize markets, innovation, and analyses customer's attitude by developing and maintaining customer relationships (Papa et al., 2018). Researchers such as (Wong 2012) discovered that social media had a positive influence for SMEs.

3.2.7 Internet of Things (IoT) in SMEs

The development of collaborative processes by means of innovative and advanced technologies is a core feature of today's industrial manufacturing environments. Moreover, the new industrial philosophy emphasizes on each element in a product's value chain to be smart, with the ability to make decisions and communicate with other components to share crucial information (Kagermann et al. 2013). The term "Internet of Things" (IoT) is often used in the context of interconnected devices or equipment via the internet or a local network. The IoT connects a variety of sensors, devices, and nodes that have the capacity to interact with one another without human involvement (M. Ambrosin, 2016), where sensors and actuators are implanted in physical objects, that are linked by wired and wireless networks, typically utilizing the same Internet Protocol (IP) that bridges the Internet (Whysall Z., et al., 2019). Initially IoT was used to convert standalone things (i.e., gadgets) into networked smart objects using the existing Internet infrastructure by means of different tools such as sensors, RFID, and certain types of embedded computing. IoT devices may communicate information and deliver a variety of useful services by converting many objects (devices) to behave like smart things. The core of the IoTs is the development of mutual intelligent relationships among objects through sensing, information processing, and networking with the least amount of human involvement. Since these objects are loaded with smart capabilities they are known as smart objects. Sensors are crucial to every smart application, since they identify

any physical or chemical change, and after analyzing the data gathered, sensors automate the software or equipment to make it intelligent or smart. In terms of opportunities, IoTs made it possible for increased production efficiency, new data-driven services, and improved automation. The development in IoTs offers a wide range of services for different industries such as manufacturing, healthcare, and education. Depending on the field and context, IoT enabling technologies vary. For instance, flexible technologies are needed for smart transportation to guarantee the connectivity of a large number of mobile nodes. For all industrial fields that deals with physical items, where manufacturing is primary, IoTs are of concern to them, and the IoT used in industrial context are referred to as Industrial Internet of Things or simply (IIoT). Firms are able to deploy new types of services due to the collection, integration, and evaluation of such information (Lehrer C. et al, 2018). Some examples include, predictive maintenance services for machinery and equipment, fine-tuning and routines for process manufacturing (Wöstmann, R., 2020), energy management, production and logistics process analysis and monitoring, as well as novel package management etc.

IoT presents SMEs with an opportunity to pursue new partnerships (Chiang Y., Lee D., 2017), while (Moeuf et al., 2020) found that 90% of experts agreed that IoT is crucial for industrial performance of SMEs. According to (Hansen and Bøgh, 2021), IoT will have a significant impact on how SMEs manage their operations for their future directions and has the potential to guarantee their sustainability and competitiveness. Whereas (Shin 2017), who asserted that IoT is an essential facilitator for MSME innovation, provides more support for this. However, the IoT's implications are not yet fully understood by SMEs, and the literature only contains a few of examples of successful implementations. This implies that the requirements for deploying IoT are not clearly known, nor are the real benefits of IoT for SMEs (Moeuf et al., 2018). For the management of perishable inventory particularly in SMEs, contemporary literature has strongly advocated the adoption of advanced technology such as the Internet of Things (Colakovic et al., 2020; Kamble et al., 2018b; Moeuf et al., 2018). While (Kamble et al., 2019) claims that IoT significantly enhances the product workflow, communication between operations, and minimizes product spoiling. It is therefore expected that IoTs has a lot of potential to assist SMEs. Furthermore, customer relationship between an SME and clients can be significantly improved by using IoT solutions such as the automatic monitoring tools for tracking inventory, and automate consumer checkouts, while SMEs can witness the influence of IoTs in terms of the customer satisfaction.

However, the notion of high operational and installation costs is the primary reason why there don't seem to be many successful IoT efforts according to research by (Kamble et al., 2019). Lack of resources, knowledge, dedicated strategies, and practical research implications are few reasons that hinder the IoT implementation in SMEs (Hansen and Bøgh, 2021). While (Abazi 2016) outlined the steps that SMEs must undertake for decision-making of successful IoT adoption, emphasizing that the owners, managers, and workers need to gain awareness about IoTs and its influence on the enterprise. However, the capabilities required to implement the IoTs in enterprises, especially in SMEs needs further investigation.

3.2.8 Big Data in SMEs

The term "Big Data" refers to large volumes of data, that are too complex for traditional data processing systems to handle according to (Neetu Jain, 2018). The concept of big data is the primary force behind the transformational shift in how business enterprises compete in the ecosystem, how the processes undergo transformation, and facilitating innovation (Brown et al., 2011). It can also promote the value of business enterprises by unleashing their potential and addressing major business-related challenges (Wamba et al., 2015). Massive amounts of data are being produced or generated by a variety of heterogeneous sources on a daily basis, including Social Networking Sites (SNS), the health sector, the government, marketing firms, the financial sector, etc. Moreover, the exponential rise of data is greatly facilitated by internet-connected gadgets. For instance, due to increasing use of smartphones in our everyday lives, enormous amounts of data are created. Big data also includes sent emails, text, image, and video postings on social media, credit card transactions, phone conversations, and locations we have visited. Big data analytics has become a phenomenon because it develops a new model of decision support (Sivarajah et al., 2017) that enables enterprises to retrieve and store data from external data sources (Morabito, 2015) as well as from internal systems. These external sources include social media platform websites, online news sources, blogs, web contents, data produced by interconnected devices known as the internet of things (IoT), and other traditional and modern data sources (Joshi, 2017). These data sets can grow to vast quantities when machine data (data gathered by smart devices, sensors, etc.) are also included, which can also be linked to emerging technological developments, such as the Internet of Things (IoT) and the widespread use of Cloud Computing (Botta, A., 2016). 'Analytics' refers to systematic way of gathering, processing, and assessing data

sets utilizing statistical and other business analytical approaches, regardless of size and quantity, to improve strategic, tactical, and operational decision-making (Neetu Jain, 2018; Wamba et al., 2017). The concept of big data analytics (BDA) offers an opportunity for enhanced decision-making and performance results along with intelligent decision support systems (McAfee and Brynjolfsson, 2012). This is one of the most significant reasons that business enterprises make use of business intelligence and big data analytics (BDA), which helps in producing the customer-centric products which can satisfy customer's demands and requirements and increases the possibility of customers buying the product. The demand-side information from customers is essential for creating both new products, that have just introduced in the market, and successive products, which are updated iterations of existing products. Therefore, data analytics plays a crucial role in demand and procurement management as well (Inamdar et al., 2020).

By using big data technologies, whether in supply chain management, logistics, customer & business intelligence, etc., SMEs may deliver value out of the massive amounts of data generated and leverage it successfully to address critical business issues (Wamba, S.F. et al., 2015). To achieve a competitive edge, enterprises are expected to respond to market transformations by adjusting their strategies, including offering new services in the shortest period of time and at the highest value at the minimum cost (Shan, Song, and Ju 2016). Experts on big data and analytics, believe that SMEs need to adopt big data for business expansion and to gain a competitive edge. Since SMEs may get more precise and comprehensive performance data on anything from product inventories to sick days as they generate and store more transactional data in a digital form. This can be useful for analyzing their prior success parameters, and combining it with external data to predict market behavior and provide new customer insights (MacInnes, 2013; Preez, 2014). It will reduce data uncertainty and increase performance since it unlocks crucial data and makes information transparent. Moreover, through implementing data analytics, firms have been able to leverage benefits of data integration processes to take smarter decisions and with less risk. The identification of new resources and data patterns in strategic decision-making is enabling SMEs to seize new opportunities. Machine data, marketing data, consumer data, and financial data that has various dimensions are all collected and analyzed using advanced analytics to deliver 'informed' and 'smart' decisions (Witkowski 2017). Big data could be used by SMEs to create advanced and improvised products and services, since big data makes it possible for exact and detailed assessment of consumer performance, resulting in much more precisely targeted products or

services. The performance of SMEs is significantly affected through information exchange in supply chains (Ali et al., 2019), whereas, big data analytics (BDA) is considered crucial for supply chain and business operations (Lamba and Singh, 2018). The BDA capabilities are not only supportive in reduction of supply chain vulnerabilities (Ruel et al., 2019) and reduce the risks associated to supply chains (Sharma and Routroy, 2016), but also support human resource management (Liboni et al., 2019).

3.2.9 Artificial Intelligence in SMEs

To determine the consumer preferences in accepting or rejecting a product or service, it is crucial to precisely examine a large amount of customer's data (termed as Big Data). Studies show that by examining customer's data, it is feasible to evaluate their behavior, which may be utilized to improve processes or the enterprise ability to effectively engage with customers (Graca, et al., 2015). And if the enterprises analyze it through humans alone, it is quite challenging effort. Artificial intelligence (AI) on the other hand, is the capacity of a system to analyze and learn from data, simulating human intellect (Rahman, Hossain, & Fattah, 2021), and it is a new generation of technologies that bring unique techniques in the commercial environment (Dwivedi, Hughes, et al., 2021). AI analyzes how the individuals works, learn, and take decisions when solving a problem. It then utilizes intelligent software to imitate these results. The concept of AI encompasses advanced technical solutions that can deal with uncertain and unpredictable conditions in trading or in manufacturing environment. By enhancing the traditional solutions and analytics, AI-based solutions can support business decision making. The B2B SMEs with highly technical staff have a higher chance of effectively implementing AI techniques, which positively affects their enterprise-customer relations and operational performance (Agostini & Nosella, 2016; Ghobakhloo & Ching, 2019). Applications related to AI, such as process automation and optimization, analytics, dynamic pricing, and prediction, can be useful in multiple ways across the business areas, which enable enterprises to leverage many benefits, including higher revenue, greater effectiveness, productivity, reliability, and agility along with enhanced decision-making and customer interaction (Dwivedi, Hughes, et al., 2021; Syam & Sharma, 2018). By means of technological tools and devices such as cameras, video, light detection and ranging (LiDAR), motion tracing, and self-driving technology, AI technology has transformed the traditional work processes and is widely used in the fields of medicine, image recognition, robotic manufacturing,

intelligent assistance, supply chain management etc. (Benaich and Hogarth, 2020). To improve their opportunities for growth and expansion, SMEs have been expanding their operational activities throughout business marketplaces (Mogaji, Soetan, & Kieu, 2020). New and advanced technologies such as AI can provide the potential for SMEs to successfully overcome barriers, engage and connect with their customers, and enhance their business performance (Agnihotri et al., 2016). Whereas, business intelligence (BI) has been acknowledged for its rising contribution to enterprise growth and performance, by means of enhancing decision support (Singh and Singh, 2013), especially for SMEs to learn and to seize opportunities that arise from fluctuating conditions (Guarda et al., 2013). However, a key feature of intelligent (or smart) transformation process for SMEs includes the adoption of AI technology at enterprise level and not just get confined to developer mode. An intelligent transformation can be denoted by the use of AI technologies by enterprises, such as machine learning (ML), to switch from a traditional work model to self-learning (Yu et al., 2020), self-optimization, self-configuration, and for the self-diagnosis of processes (Ilmudeen et al., 2019), which increases flexibility and agility of the enterprise.

When IoT is used in manufacturing SMEs, consequently manufacturing data will emerge. By means of IoT-gateways or sensors, the product will be able to transmit real-time data for the purpose of analyzing it through AI tools. This manufacturing data can provide with benefits such as transparency and clarity in production process. Furthermore, the integration of the Internet of Things (IoT) with AI is favorable since IoT creates vast amounts of data from which the AI analyzes the user data and converts it into predictive solutions. AI tools have the unique ability to categorize and detect non-linear and complex patterns which even the production engineers sometimes are unable to uncover. Since machines can do self-optimization when a defect is found by using AI technologies, identifying or detecting faults in industrial processes can therefore be a good opportunity for SMEs to become more efficient and defect free. Predictive analytics is among the four analytical capabilities that has identified by Gartner Inc. (Hagerty J. 2017) which include, descriptive, diagnostic, predictive, and prescriptive analytics.

1) Descriptive analytics

Since most SMEs generally lack information from the system in the event of a malfunction, so they do not start at the 'descriptive analytics' level. Instead, they utilize their expertise to

comprehend and address the issue. In such situation, SMEs could explore the IoT for the manufacturing data and other subdomains.

2) Diagnostics analytics

At this stage, SMEs may need to take help from intelligent systems such as AI (or machine learning). The system may offer more information through 'diagnostics analytics' on why it has occurred rather than just what happened. As a result, it saves the time for employees to diagnose things from machinery or equipment.

3) Predictive analytics

Both AI and IoT needs to be used by SMEs, to get to 'predictive analytics' stage, for example, in maintenance. However, this needs the availability of the appropriate sensors to collect this information, as well as an AI-IoT model. The system will then be able to predict if a machine will fail or if a manufactured item will be defective. The advantage with predictive analytics solution is that SMEs can improve reliability and reduce downtime by integrating IoT and plant-floor data to predict and prevent equipment failure and also reduces the inspection costs.

4) Prescriptive analytics

In this stage, the system performs adjustments according to, how a particular item should be manufactured. This stage is desirable for SMEs and for most businesses, where Industry 4.0 systems will be able to operate almost independently to make adjustments in order to achieve the targeted part production. This type of setup works similar to the predictive analytics; however, considerably stronger models and sensors are required. There are not many examples for prescriptive analytics, especially for SMEs.

There are other areas where SMEs can benefit from AI and IoT, such as, for improving the quality of products, the manufacturers can be informed about initial minor problems that are responsible for quality losses, in a manner similar to predictive maintenance AI alerts are generated. AI can be used by enterprises to improve supply chain activities of manufacturing processes, allowing them to react more quickly and predict variations in the market.

4. Research

4.1 Research model and methodology

4.1.1 Research model

The research begins with choosing a research topic with a broader area of study and a research problem. An extensive semi systematic literature analysis is carried out on two major fields of the research topic i.e., 'agility' and 'Information Technology'. The aim is to observe how research within the selected field has progressed over time. The review aimed to identify and comprehend all possible concepts and recent scientific methods that have a relevance for the subject under study. This type of analysis is helpful to identify patterns, theoretical viewpoints, or common challenges within the chosen research area. However, it was required to narrow down the research area gradually so that the focus is moved to specific research questions that need be answered. The literature analysis is helpful in formulating the research hypotheses which require having an in-depth knowledge of the problem in question and to reframe it in terms of analytical point of view. A research question necessitates more creative data gathering in order to bring together different viewpoints and introduce new and creative theoretical models. For the purpose of searching research articles, scientific journals and international publications the study has mainly relied on renowned search engines and relevant websites that provides updated information on the chosen research area. The selection and prioritization of literature is based on specific time frame, which range from the year 2010 until the latest, with latest publications being the priority. In order to proceed in the direction of formulating research questions, the literature review area been gradually narrowed down and reached the point where it focused on agility and IT with specific inclusion criteria such as industry type, size of enterprise etc. The literature analysis has proceeded to further narrow the focus area to SMEs in India, while agility and IT being the subject of study. This has led to discover a research gap with respect to role of IT in improving agility of Indian SMEs. The focus area of research is shown in the developed research model in figure (4.1).
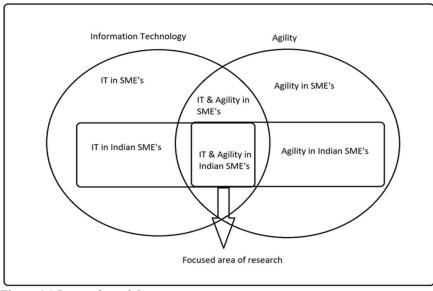
Figure 4.1 Research model
Source: Own work

To formulate the research hypothesis, it is necessary to the identify and clearly define the dependent and independent variables. Different types of IT tools or solutions that are popularly used by SMEs are identified and selected as independent variables. While, multiple indicators related to agility are identified and assigned as dependent variables. A few hypothetical statements are formulated which represents the research hypothesis of this study. A few research questions are proposed that are needed and helpful in verifying the validity of the research hypothesis in order to examine the problem.

4.1.2 Research methodology

The research method or approach is a strategy for evaluating the connection between the dependent variables (fact) and independent variables (factors) that are chosen for the research questions. It is the choice made to select an appropriate approach with respect to the relationships between the theory and empirical research (Bryman A., 2012) in order to answer the research questions. There are typically three important types of research approaches that are commonly applied, which include deduction, induction and abduction (Saunders et al. 2012). The 'deductive approach' is more appropriate and suitable for this study, since with this approach it is easier to examine the validity of theories, assumptions or hypotheses in hand. Both the 'qualitative' and

'quantitative' research approaches have been used for this research. Such as, for defining the research model, agility variables and to select different ICTs for the research, qualitative approach has been used. And for collecting the data and values of variables and to process them, quantitative approach is utilized.

1. Choosing the primary data collection instrument

Designing the research study necessitates determining what type of case or samples to use, as well as how to quantify significant variables and which research methods to be used. Researchers from both academic and commercial sectors use surveys and questionnaires to know the responses to key questions (Taherdoost, 2016a). A questionnaire is merely a collection of printed or mimeographed inquiries that is filled out by or for a respondent to express his opinion (WHO, 2nd ed). It is a necessary tool to gather quantitative information in an organized manner and that are internally consistent and clear for analysis (Dudwick, Kuehnast, Jones and Woolcock, 2006: 3). Moreover, questionnaire use minimum resources, and a less expensive method of designing and administering the data collection by distributing among individuals or groups. Therefore, for the purpose to collect primary data, a survey questionnaire is adopted as an instrument in this research.

2. Defining independent and dependent variables

Prior to designing a model for the questionnaire, it is highly necessary to identify the independent and dependent variables first. This facilitates to clearly and precisely formulate the questions in the questionnaire that can extract crucial information on particular area of research. The independent variables used in this research are related to Information Technology tools used in SMEs which is represented by special letters Iv with a corresponding number associated to it, such as (Iv1,2,3….). Whereas, the dependent variables are related to agility aspects of the enterprise, represented by special letter Dv with a corresponding number associated to it, such as (Dv1,2,3….). The questionnaire is designed based on the defined variables which are attached to the appendix as 'Attachment 01' and 'Attachment 02'.

A) Independent variables used in the questionnaire:

Iv1: Basic IT tools (e.g., Standalone computers, Internet explorer, websites, etc.)

Iv2: Office automation tools (e.g., Word, Spreadsheet, Basic Inventory etc.)

Iv3: Enterprise Resource Planning (ERP) for managing resources

Iv4: E-commerce for improving the sales

Iv5: E-commerce Online-Payment system for improving business efficiency

Iv6: Online/electronic-contracts (e-contracts) for improving performance

Iv7: Cloud services for managing business resources

Iv8: Social media platforms (e.g., Facebook, WhatsApp, YouTube etc.) for marketing

Iv9: Internet of Things (IoT) i2P (Things-to-People)

Iv10: Internet of Things (IoT) i2T (Things-to-Things)

Iv11: Big Data for the decision making and productivity

Iv12: Big Data for identifying market opportunities.

Iv13: Artificial Intelligence (AI) for coordination of machines, equipment, processes.

Iv14: Artificial Intelligence (AI) for problem solving and decision making.

B) Dependent variables used in the questionnaire:

DvB1: Scanning the macroenvironment changes (Political, Legal, Economic, Technological).

DvB2: Scanning changes in industry environment (Customers, Suppliers, Competitors).

DvF1: Operational technology enable to offer range of products.

DvF2: Employee competence and skills enable to offer range of products.

DvF3: Cooperation with business partners enable to offer range of products.

DvI1: Systematic employee trainings.

DvI2: Company innovations enable to introduce new products.

DvI3: Holding patents on products/technologies due to company innovations.

DvS1: Adapting the products/technologies in line with customer's needs, expectations.

DvS2: Adjusting the business partner's relationships when opportunities are detected.

DvS3: Entering in to new domestic markets.

DvS4: Entering in to new foreign markets.

DvRe: Receive feedback from customers on products customization.

DvPro1: Introducing new products for existing markets.

DvPro2: Introducing new products for new markets.

3. Choosing the questionnaire model and measurement scale

The designing process started by collecting relevant information on each question by keeping focus on research goals, the queries are specific, objective and easy to understand. As a next step, what type of respondent options need to be included in the questionnaire is an important issue that needs to be addressed, since there are different models of questionnaire with specific options such as matrix questions, open-ended, closed-ended and others. The 'open-ended' refers to those questions where there are no proposed options or predefined categories. Whereas, 'closed-ended' questions are the ones where the reactions of respondents are restricted to a fixed set of options, and the ones to which the respondent must select one option out of a limited number of possible responses (Taherdoost, 2016b). Most of the research scales are based on closed-ended questions which assist in collecting demographic data and other factual information. By analyzing various questionnaire models, closed-ended questionnaire is chosen as the suitable model for this research.

After choosing the questionnaire model, which measuring scale need to be used for the respondent's choices is an important issue. There exist many categories of measuring scales depending on the convenience or necessity of the research. In closed-ended questionnaire model respondents are usually offered with multiple choice options. However, there are many types of multiple-choice models. Among many measuring tools used in questionnaires the most prominent tools are the 'attitude scales' and 'the rating scales', which is used by researchers in a diverse discipline including sociology, psychology, information technology, politics, and economics. The 'rating scales' are most commonly used since they help the researcher to assign a position or a point along the wide range of spectrum to an individual, an object, or another event. And later, this point or position is given a numerical value. Whereas, the 'attitude scales' are slightly different from 'rating scales' because attitude measuring scale is used as a tool to evaluate an individual's

inclination towards a certain topic or a point of view. The Likert scale comes under the same category and it is one of the widely used scaling techniques in social science researches. After considering various models, the closed-ended questionnaire model along with Licker scale as a measurement tool is chosen for this research study. This choice is made because of the its benefits such as, the Liker scale is simple to develop and is expected to generate a highly consistent scale. Moreover, it is less complicated to read or understand from the participants point of view. To address the issue of number of points for responses on the Likert scale, a five points Licker scale is chosen, which implies that the survey participants are asked to provide their answers to how firmly they agree or disagree in a range of 1 to 5 points, with 1 being 'strongly disagree' and 5 being 'strongly agree' with the statements that have been presented. The five-point Likert response scale is used as presented by (Simms, et al., 2019) in the figure (4.2).

Options	1	2	3	4	5	6	7	8	9	10	11
2-points	Disagree	Agree									
3-points	Disagree	Neither Agree nor Disagree	Agree								
4-points	Strongly Disagree	Disagree	Agree	Strongly Agree							
5-points	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree						
6-points	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree					
7-points	Strongly Disagree	Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Agree	Strongly Agree				
8-points	Very Strongly Disagree	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	Very Strongly Agree			
9-points	Very Strongly Disagree	Strongly Disagree	Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Agree	Strongly Agree	Very Strongly Agree		
10-points	Very Strongly Disagree	Strongly Disagree	Disagree	Mostly Disagree	Slightly Disagree	Slightly Agree	Mostly Agree	Agree	Strongly Agree	Very Strongly Agree	
11-points	Very Strongly Disagree	Strongly Disagree	Disagree	Mostly Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Mostly Agree	Agree	Strongly Agree	Very Strongly Agree

Figure 4.2 The Likert Response scale
Source: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3588604

4. Determining the sample size for data collection

The demographic segment from which one can derive generalizations about the entire population is referred to as a 'sample size.' It is also the number of observations drawn from the total population, chosen for a survey. The collection of a sample size is necessary if the population size is too big to perform the research on the whole population. Determining the optimal sample size for data collection scientifically is possible through standard formulas. The components of these formulas are population size, margin of error, confidence level, and expected variance. The 'population size' refers to total number of distinct entities in the population you are interested to research. 'Margin of error', also known as confidence interval, determines the level of confidence

or ambiguity in a sampling procedure. It is a percentage that indicates the level of certainty that the total population would choose a response from a particular range of random samples. The 'standard deviation' helps to predict how much the results received will differ from one another and from the mean number when computing the sample size. When the values for population size, margin of error, confidence level, and standard deviation are already known then necessary sample size can be calculated through standard formula as shown in figure (4.3).

Necessary Sample Size $= \dfrac{(Z\text{-score})2 \times StdDev \times (1\text{-}StdDev)}{(margin\ of\ error)2}$

Figure 4.3 Formula for calculating the sample size
Source: Google

To compute the sample size using a web-based sample-size calculator is used as a strategy especially perform multiple iterations. A constant value of 19,954 for 'population size' is chosen, since this value represents the total number of registered MSMEs in the region of Telangana state in India. The 'Margin of error' was kept constant at 5%, since this value is considered to be standard value used by many researchers. Whereas, the required value for 'population proportion' which represent the percentage value of the SMEs to the total registered MSMEs in Telangana region. Since the registered SMEs in Telangana constitutes 6408 in number as shown in table (4.1), so it makes 32% of the total MSMEs. And 80 % confidence level is chosen for the final iteration.

Category	Number of Enterprises
Micro	13,546
Small	5,830
Medium	578
Total	19,954

Figure 4.4 Sample size calculator
Source https://www.calculator.net/sample-size-calculator.html

Table 4.1 Number of registered SMEs in Telangana
Source: https://invest.telangana.gov.in/msme-full/

The sample-size calculator generates the results as shown in the figure (4.4), in which it is clear that with 80% confidence level, 5% margin of error, 32% of population proportion and with population size of 19954, we get the sample size result as 142. Considering the above-mentioned

values to be the ideal in our case, the result we get is 146 which is closer to 150. Therefore, the sample size we choose is 150 SMEs for the research.

5. Method adopted to collect responses, checking reliability and statistical validity of data

In order to collect the primary data a longitudinal time frame is chosen. The data collection time period lasted for approximately three months in the early 2022. A survey was conducted during which a mixed-method choice is adopted i.e., for collecting the responses. The first method adopted was sending questionnaire to SME owners/managers though e-mails. Due to the fact that the response received through e-mails were rather slow and a lot of SME respondents either ignore the questionnaire attached in the e-mail, or may have faced troubles in accessing their e-mails in a timely manner. To avoid longer duration of the process, a second method of data collection has been adopted, which is based on a professional team approaching the SME respondents that is the owners or managers of SMEs to collect the empirical data. This method was more efficient because the SME owners/managers who had trouble with answering the questionnaire in a non-native language (English), were managed by translating the questions in the native language before collecting the responses. The data collecting team has collected the responses on time and were also able to register precise responses from the respondents.

The statistical techniques are normally applied for testing the data. Since a lot of standard data processing software are available that can extract precise and reliable information out of raw data. By using standard data processing software 'Statistica' the empirical results were analyzed, because it is simpler, reliable and accurate. The results gathered in this empirical research are tested for reliability using Cronbach's alpha test. It is a known method to provide a measure of the internal consistency of a test, and used in quantifying the reliability of a score to summarize the information of several items in questionnaires. To compare the results between multiple variables a post hoc multiple comparison test is applied using Kruskal-Wallis ANOVA by Ranks. It is reliable due to the suitable approach adopted for collection, properly processed, and critically analyzed (ACAPS, 2012). The Spearman's Rank correlations are used in establishing and checking the correlations between the independent variables and dependent variables and to interpret the results.

4.2 Research results

4.2.1 Results for the independent variables

The research results that have received by means of a questionnaire response on a sample of 150 SMEs in the region of Telangana in India has generated the statistical data as shown in the table (4.2). The number of responses received for each independent variable (Iv) can be seen in 5 different rows which represents the corresponding Likert scale from 1 to 5.

Likert scale (Ls)	Frequency of respondents for independent variables (Iv)													
	Iv1	Iv2	Iv3	Iv4	Iv5	Iv6	Iv7	Iv8	Iv9	Iv10	Iv11	Iv12	Iv13	Iv14
Ls 1					1	2	21	1	33	112	47	48	66	66
Ls 2	72	60	54	38	37	44	18	35	75	11	52	53	29	30
Ls 3	60	67	67	80	78	63	56	80	20	11	29	27	35	34
Ls 4	9	15	23	21	28	32	21	28	16	12	17	16	13	15
Ls 5	5	4	1	6	1	4	2	1	1		1	1	2	1

Table 4.2 Independent variable's (Iv) statistical results
Source: Own work

The frequency of responses received for each independent variable (Iv) on Likert scale 1 to 5 can be viewed in a graphical presentation in figure (4.5).

Figure 4.5 Frequency of responses for independent variables (Iv)
Source: Own work

1) Considering the responses received on the Likert scale 01 for the independent variables, it can be inferred that the least implemented technology in Indian SMEs is Internet of Things (i2T Things-to-Things) which have the highest response rate followed by Artificial intelligence (AI). Moreover, a few of the independent variables such as Iv1, Iv2, Iv3 and Iv4 (Basic IT, Office automation tools, ERP and e-commerce) have received zero responses which can be interpreted as they are commonly used technologies in Indian SMEs, hence no respondent has chosen rate the question on Likert scale 01. Whereas Iv5, Iv6, and Iv8 (Online-Payment system, electronic contracts and social media platforms) received very minimum and negligible responses which can be considered as positive indication as well. Since zero or low response rate on Likert scale 01 can be considered a positive sign, indicating that these technologies are important and relevant for Indian SMEs so the respondents did not want to choose this scale.

2) The Likert scale 02 response rate shows that Internet of Things (i2P Things-to-People) proved to be not so influential technology for Indian SMEs but still implemented followed by Big Data implementation.

3) By analyzing Likert scale 03 responses it is possible to interpret that 'e-commerce', 'online-payment systems' and 'social media platforms' delivers a moderate level of improvement and beneficial effects to a considerable number of Indian SMEs, as they have received maximum responses from the SME respondents. This has been followed by the basic IT and office automation tools, ERP, online e-contracts and Cloud services which also showed similar effectiveness but comparatively in a smaller number of SMEs.

4) The Likert scale 04 results demonstrates that the online/electronic-contracts, online-payment system, and social media platforms have equally shown satisfactory level of effectiveness but on a limited number of Indian SMEs followed by ERP, e-commerce and Cloud services that have also shown beneficial effects on a very limited number for SMEs.

5) Although the intensity of responses on Likert scale 05 are quite limited, however these results confirm the above interpretations about the basic IT and office automation tools and e-commerce which are significantly important technologies for Indian SMEs. Moreover, these results also indicates that Internet of Things (i2T) is not used in most of the Indian SMEs.

4.2.2 Results for the dependent variables

The research results that have generated the statistical data is shown in the table (4.3). The number of responses received for each dependent variable (Iv) can be seen in 5 different rows which represents the corresponding Likert scale from 1 to 5.
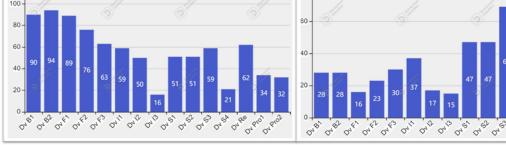
Likert scale (Ls)	Frequency of respondents for dependent variables (Dv)														
	Dv B1	Dv B2	Dv F1	Dv F2	Dv F3	Dv I1	Dv I2	Dv I3	Dv S1	Dv S2	Dv S3	Dv S4	Dv Re	Dv Pro1	Dv Pro2
Ls 1								37			1	79	2	28	14
Ls 2	27	24	39	46	49	51	77	77	46	49	17	22	46	54	80

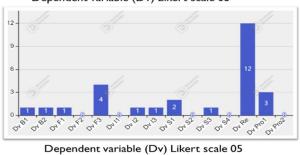|															
Ls 3	90	94	89	76	63	59	50	16	51	51	59	21	62	34	32
Ls 4	28	28	16	23	30	37	17	15	47	47	69	24	23	26	20
Ls 5	1	1	1		4		1	1	2		1		12	3	

Table 4.3 Dependent variable's (Dv) statistical results
Source: Own work

The frequency of responses received for each dependent variable (Dv) on Likert scale 1 to 5 can be viewed in a graphical presentation in figure (4.6).

Figure 4.6 Frequency of responses for dependent variables (Dv)
Source: Own work

1) The Likert scale 01 results for the dependent variables reveal that entering new foreign markets is not common among majority of Indian SMEs and hence most of them are not present on the foreign markets. Whereas, holding patents on products/technologies is also very rare. There

are at least nine dependent variables (DvB1, DvB2, DvF1, DvF2, DvF3, DvI1, DvI2, DvS1, DvS2) for which the respondents choose not to respond, which can be interpreted as these dependent variables are relevant and important for Indian SMEs. Therefore, if the respondents have not answered or dogged these questions, it can be considered as a positive indication. Moreover, the dependent variables DvS3 and DvRe has received minimum and negligible response which can also be understood in a positive way that these variables are significantly important for Indian SMEs.

2) The Likert scale 02 results show that Indian SMEs very rarely develop new products for new markets and also for existing markets. The company innovations in SMEs very rarely leads to introduce new products, while most of Indian SMEs have their own solutions but without holding patents on it.

3) By analyzing Likert scale 03 results, it can be interpreted that Indian SMEs often enters in to new domestic markets. However, Indian SMEs monitors and scans the changes in the industry environment (e.g., customers, suppliers, competitors), and macroenvironment (e.g., political, legal, economic, technological) in a moderately systematic manner. The operational technology and the employee skills and competency in Indian SMEs enables them to offer a narrow range of products to their customers.

4) The Likert scale 04 results show that Indian SMEs very frequently enters into new domestic markets. While they also quickly adapt their products and technologies according to the needs and expectations of their customers. They often adjust their connections and relationship according to their supplier and subcontractor when new market opportunities are detected.

5) Up on analyzing the responses from Likert scales 03, 04 and 05 it appears that Indian SMEs receive feedback from their customers to change or upgrade their products in a mixed manner. In which most of the SMEs receive feedback occasionally, while many SMEs receive it often, and few of the SMEs receive it very often.

The results obtained from the questionnaire in the form of statistical data has offered useful information for this research. However, this data gathered from SMEs is in a segregated state which include two major information groups, i.e., 'Information Technology' and 'Agility' separately. The raw data collected from SMEs in the form of responses to questionnaire needs to

be processed and interpreted correctly with respect to mutual interdependence between IT and agility. In this regard, the data processing techniques need to be applied to the statistical data in order to find the answers to the research questions. Moreover, data processing is also a necessary condition for the testing of hypothesis in this research study. The interpretation of data processing results is discussed in detail in the next chapter.

4.2.3 The influence of ICT on agility dimensions

The results obtained after processing the statistical data from the questionnaire by using 'Statistica' software and through applying 'Kruskal-Wallis ANOVA by Ranks' and 'Multiple Comparisons' methods has revealed essential details with respect to Information Technology implementation in Indian SMEs and its impact on four key dimensions of the chosen enterprise agility framework including 'brightness', 'flexibility', 'intelligence' and 'shrewdness'. Each of these four dimensions of enterprise agility need to be discussed in detail with respect to the results obtained after processing the statistical data. This provides a better perspective on the role of IT and its impact on each dimension of agility framework of the enterprise in Indian SMEs.

4.2.3.1 Brightness

Brightness refers to an enterprise's ability to recognize threats and commercial opportunities. Brightness is one of the four dimensions of agility framework chosen for this research. In order to create or shape brightness of an enterprise, it necessitates a systematic and structured observation of the environment. The results obtained after processing the statistical data by applying 'Kruskal-Wallis ANOVA by Ranks' and 'Multiple Comparisons' methods has generated correlations between dependent variables representing 'Brightness' in relation to independent variables representing various IT tools. By analyzing the spearman's rank correlations, the following correlations have been identified as significantly positively associated between the dependent variables (DvB1, DvB2) with various independent variables as shown in table (4.4) and fig (4.7).

Brightness variables	Independent variables
DvB1	Iv5, Iv4, Iv3, Iv2, Iv1
DvB2	Iv2, Iv5, Iv3, Iv4, Iv6, Iv7

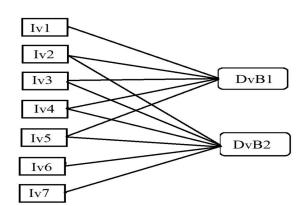Table 4.4 Brightness correlations
Source: Own work

Figure 4.7 Brightness correlations
Source: Own work

The dependent variables (DvB1) and (DvB2) representing the Brightness component of agility framework fulfil the following criteria.

DvB1: The enterprise scans and monitors changes in macroenvironment such as political, legal, economic and technological.

DvB2: The enterprise scans and monitors changes in the industry environment such as customers, suppliers and competitors.

The results generated by spearman's rank correlations shows that among all the independent variables 'e-commerce online-payment system' (Iv5) is the most significantly positively correlated with (DvB1) and (DvB2). Whereas, 'e-commerce' (Iv4) implementation also shows to be significantly positively corelated with (DvB1) and (DvB2). This implies that using 'e-commerce' and 'online-payment system' in Indian SMEs not only improves business efficiency and performance but also proves to be effective in scanning macroenvironmental changes and industry-level environmental changes.

Macro environment refers to external factors on which the enterprise does not have influence or control, whereas macroenvironmental factors may influence the decision-making process of the enterprise. The economic environment is a part of macroenvironment which includes elements that may have an impact on consumer's purchasing power and spending behavior. E-payment or online-payment in general, refers to the electronic payment method in the context of e-commerce transactions over the Internet which has gained wide-spread acceptance in commercial activities. The online payments systems are more convenient, quick, effective, and economical than the

traditional payment methods and facilitates the customers with lower payment value and reduced technology price spendings. Customers that utilize the e-payment service have access to a web-based user interface that lets them remotely view and control their bank accounts and transactions (A N Hidayanto, et al., 2015). This allows purchasers to manage their expenses because they can view their payment history by regularly checking their virtual account on a personal computer or a mobile phone over the Internet. Which in turn can influence a wide range of customers to change or update their spending patterns and improve their purchasing power. The improved purchasing power of customers is particularly essential for SMEs, since this factor leads to discover new opportunities for SMEs by observing the new and changing behavior patterns from its existing clients. Therefore, it can be considered that online e-payments are effective and have positive influence on opportunity discovery in Indian SMEs which answers the research question **(RQ1)** and satisfies one of the features of the brightness component of agility framework which is to identify market opportunities in the environment. Moreover, effective sensing of customer's behavior patterns especially caused by improved purchasing power of customers can encourage SMEs to exploit the customer's spending pattern information to gain new market opportunities, such as SMEs can provide customers with products and services within the range of customers affordability. This in turn will attract more customers since they can purchase SME products or services that are cost effective. This indicates that web-based or online 'e-payment system' is effective in sensing and exploitation of new opportunities in Indian SMEs, hence this satisfies the research hypothesis **(H1)**.

The 'industry environment' refers to an environment that has a significant impact on daily business activities and which is directly involved with the enterprise such as consumers, suppliers and market intermediaries. The online/e-payment systems support the processing of transactions in a simple way during e-commerce activities between consumers and sellers (Junadi 2015) and support the customers to finish their entire payment process in a short period of time. Therefore, instant payouts with less time consumption, better tracking system, transparent transactions, cost savings, and improved confidence between the sellers and consumers are all benefits that an efficient and reliable e-payment system offers. These benefits create significantly positive effect on customer responsiveness and attracts a greater number of customers to use online e-payment systems during their e-commerce activities. Hence it can be considered that e-commerce online/e-payment systems have a positive influence on customer responsiveness in Indian SMEs, which

satisfies the conditions of research hypothesis **(H2)**. The market intermediaries are also an essential part of industry environment that helps the enterprise to improve its overall performance and value delivery. It may include individuals or organizations that support the enterprise in promotion activities, selling and distribution of products to their final customers. The online e-payment transfers are carried out electronically between the banks through a third-party payment interface. For instance, this payment can be directly made through a credit or even a debit card. The third-party payment option refers to a network-based payment method which offers a transaction platform between bank and online payment platform. Such third-party payment option may include PayPal, Net Bank, Amazon Payment, Google Wallet etc. which acts as credit intermediary that supervise and support both the online business and the bank. These third-party companies offer different types of online payment services for their customers. This particularly for SME customers not only gives an opportunity to perform quick payment after online purchases, but also significantly reduces the threat associated with money transfers. Hence the third-party payment services by using e-payment system provides SMEs an opportunity for flexible and quick payments while reducing threats associated to payments. This can be linked to the theme of brightness component of agility which refers to recognizing opportunities and threats in the environment. It also indicates that online e-payment services by using third-party payment methods proves to be effective for Indian SME's in introducing new and innovative services in the Indian markets which answers the research question **(RQ3)**. By using third-party payment services through online e-payments, SMEs have the opportunity to attract not only domestic but foreign customers and expand the range of their business in international markets. This answers the research questions **(RQ4)**.

In order to gain new customers and to retain existing ones, it necessitates SMEs to maintain efficiency and quickness in their approach and strategies. E-commerce provides a platform for SMEs that allows to acquire or search for new potential customers through the internet. This is possible at any time and from anywhere because it is easier to reach customers online, which is also encouraging for retail chains such as suppliers, providers and business partners to perform online business with SMEs via e-commerce platforms. E-commerce proves to be an effective IT tool in scanning market environmental changes such as customer's behavior patterns and competitor's market strategies. This leads to identify new market opportunities for Indian SMEs in terms of attracting new customers and business partners instantaneously, which answers the

research question **(RQ1)**. Moreover, by successfully identifying potential customers and business partners, SMEs are able to exploit this opportunity by adopting suitable measures and strategies and gain new customers and business partners. Hence the e-commerce enables Indian SMEs to have positive influence on sensing and exploitation the opportunities in Indian market which satisfies the hypothesis **(H1)**. There is always a threat of competition in SMEs posed by the market revelries due to the introduction of new or better products and services in the marketplace. E-commerce implementation provides SMEs an advantage of providing its customers a wider range of products choice at an affordable price than its market competitors. This significantly and effectively reduces the threats from its competitors, because it facilitates the SMEs to make a strategy or upgrade the current strategy based on market information about its competitors at any given time. While it also provides benefits to customers of accessing products or services at a lower price with more variety of product choice. Hence it can be inferred that e-commerce is an effective tool for SMEs in identifying as well as manage threats in the market. And hence one of the conditions of 'brightness' component is easily relatable which is the ability of the enterprise to recognize opportunities and threats in the environment.

The spearman's correlation indicates that Office automation tools (Iv2) is significantly positively corelated with DvB2, suggesting that Indian SMEs use Office automation tools for scanning industry-level environmental changes. Indian SMEs tend to communicate with their customers on a regular basis mostly in an open and informal way which have its own social dimensions. However, Office automation tools such as e-mails and websites are used by SMEs to facilitate these interactions, enhance efficiency, support personalization and to save time. In order to maintain a sustainable communication with customers, SMEs must also be able to collect, analyze and manage customer information such as personal details, unique requirements, order histories etc. Office automation tools such as word, spreadsheet, basic inventory software are useful tools for SMEs to record such information which help them to personalize product and service offerings to specific customers groups, while treating their most valuable customers with high priority. Office automation tools are also effective in scanning changes in market environment by using customer's profile information, customer's behavior changes based on purchase history, order history, type of communication etc. These tools also help Indian SMEs to segment their market, predict customer demands, and to make appropriate marketing related decisions. While they also enable to detect the threats related to bad customer entries or unpaid or overdue payment

records, untimely or delayed supply chain from suppliers and providers. Therefore, Office automation tools are effective for Indian SMEs to successfully sense market opportunities as well as threats which satisfies the conditions of 'brightness' element of agility framework and also answers the research question **(RQ1)**.

4.2.3.2 Flexibility

Flexibility refers to the quality or feature of the enterprise's resources. By being flexible, it becomes easier to increase the variety of manufactured products and services offered and to take leverage of different market opportunities. The results obtained after processing the statistical data reveals some of the important aspects of flexibility dimension of enterprise agility and the role of Information Technology in Indian SMEs. By analyzing the spearman's rank correlations, following connections have been identified as significantly positively associated between the dependent variables representing Flexibility dimension (DvF1, DvF2 and DvF3) and other independent variables representing various IT tools as shown in and table (4.5) and fig (4.8).

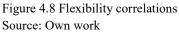| Flexibility variables	Independent variables
DvF1	Iv4, Iv5, Iv3, Iv2, Iv8, Iv7
DvF2	Iv5, Iv4, Iv2, Iv8, Iv3, Iv7
DvF3	Iv2, Iv5, Iv4, Iv6, Iv7, Iv3

Table 4.5 Flexibility correlations
Source: Own work

Figure 4.8 Flexibility correlations
Source: Own work

To examine the flexibility dimension of agility the dependent variables DvF1, DvF2 and DvF3 were used as part of the standard questionnaire. They fulfil the following criteria.

DvF1: The operational technology enables the enterprise to offer a range of products.

DvF2: The competence and skills of employees enable the enterprise to offer range of products.

DvF3: The cooperation with suppliers and subcontractors allows to offer a range of products.

The results obtained from spearman's rank correlations indicates that the independent variable (Iv8) is significantly positively correlated with dependent variable (DvF1). This implies that social media platforms are not only beneficial for marketing in Indian SMEs but also effective in supporting the operational technologies to provide wide variety of products to their customers. The use of operational technologies may vary in SMEs ranging from basic tools to integrated tools such as Cloud technology, ERP to highly advanced technologies such as IoT and AI depending on their business requirements and capacity. In order to fully leverage the benefits of operational technologies, SMEs need to effectively communicate with external players such as customers, suppliers, business partners through online and digital media. Building marketing relationships with consumers necessitates the use of social networking websites and platforms in SMEs. Social media platforms such as Facebook, Twitter, and YouTube are crucial means for SMEs to promote and market their brands at a very low cost (Narkiniemi, J. 2013). Furthermore, building business brand value by using social media and utilizing social media websites to increase sales are both part of sales strategy (Nobre, H., & Silva, D. 2014). The retail websites that promote the interactivity among its users or customers have relatively bigger advantage to effectively respond to the customer's specific needs and requirements. Interactivity is a two-way communication between the site's visitor and the SME's retail website. Therefore, the intensity of response from SME's retail website to its visitors and customers is the crucial factor in the promotion of products and services and in building customer relationship. Whereas, the concept of service quality is also applicable to electronic services (Jiang et al., 2014). The 'e-service quality' is the effectiveness with which the website satisfies the customer's needs, requirements and expectations which leads to customer satisfaction. The customer satisfaction can be indicated by the website's stickiness or loyalty towards website from user's perspective, which is the frequency of revisits by a user or customer to the retail website for online purchasing. The SMEs that maintain a high quality of retail websites gain greater level of customer satisfaction. Hence the 'social media platforms' and 'retail websites' plays an important role in being flexible and to create new opportunities for Indian SMEs such as attracting and gaining new customers through online marketing, improving and promoting their brand value, scanning the market requirements and responding appropriately with better product and services. Hence it satisfies the research hypothesis **(H3)**. While 'social media platforms' and 'websites' also exploit the customer loyalty and customer satisfaction to their

advantage for customer retention. This makes social media platforms and websites an effective IT tool for Indian SMEs in being flexible to market needs and demands through customer responsiveness. And also allows them to take full advantage of market opportunities (exploit market opportunities) and results in delivering new, innovative and improved products and services. This not only satisfies the conditions of 'flexibility' dimension of agility and but also the conditions of research hypothesis **(H1)** and **(H2)** by having positive influence on opportunity discovery, opportunity exploitation and customer responsiveness. Moreover, it also answers the research questions **(RQ1)** and **(RQ3)** since social media platforms and websites help Indian SMEs to discover new opportunities and to effectively respond to market opportunities by introducing new innovative products and services which positively affects the agility of Indian SMEs.

The spearman's rank correlations results suggests that the independent variable (Iv3) is significantly positively correlated with dependent variable (DvF2). This implies that Enterprise Resource Planning implementation in Indians SMEs is helpful in improving the competence and skills of its employees to offer a variety of products. ERP is based on various modules for managing resources of the enterprise and each module is related to specific department and purpose. For instance, CRM is not just an information tool, that contributes to increase in financial worth of the enterprise by enhancing customer service (Marolt et al., 2018). But CRM has also been linked to strategic response towards customer needs and behavior through customer data management to create an effective enterprise-customer relationship aiming for customer loyalty. CRM is helpful in fostering enterprise-customers relationship which is facilitated by skilled SME employees. For example, employees are trained and directed to deliver high-quality products and services that foster positive customer relationships (Tseng, 2016). The technology-oriented CRM systems gather, evaluate, store and share information of both existing and potential customers, in a manner that it enhances the ability of SME employees to effectively respond to individual requests and needs. This is accomplished through evaluating the quality of customer's data, structuring and classifying the types of customers data and its sources. This in turn enables SMEs to deliver a wide variety of high-quality products and services to its customers. Moreover, CRM enhances the customer experience and responsiveness due to effective information sharing between customers and the SME employees and to take leverage of market opportunities such as it enables SMEs to attract new customers and retain existing ones. Moreover, the role of CRM in interlinking the internal resources of the enterprise such as employee skills and customer's data to

identify new potential customers and to maintain current customers is significant. Hence by implementing CRM as part of the ERP system proves to be effective for Indian SMEs to enhance the skills of their employees and increase the variety of their products and services and benefit from market opportunities which satisfies the conditions of 'flexibility' dimension of agility. This answers the research question **(RQ2)** as well, since CRM implementation is effective in improving SME employee IT skills in dealing with customer responsiveness.

The results obtained from spearman's rank correlations shows that the independent variable (Iv4) is significantly positively corelated with (DvF3). This implies that adopting 'e-commerce' in Indian SMEs not only improves business performance but also proves to be effective in cooperating with suppliers and subcontractors. E-commerce role in Indian economy is significant and the government's support in this regard have positive association with e-commerce adoption which is in favor of SMEs. SMEs adopt networking approach in order to deliver high-quality and customized products and services and to grow and expand their business in a competitive market environment. Because new methods of collaboration between enterprises results in creating new services and products as well as new ways for enterprise interaction with customers and employees (Rachinger et. al, 2018). While according to (Chanana & Goele 2012), e-commerce is the practice of conducting business through the use of electronic communication and digital information processing technologies in order to establish, transform, and redefine network connections that add value to both parties involved in the transaction. E-commerce enable Indian SMEs to restructure their business processes by maintaining strong online network connections with customers, suppliers and business partners. By conducting e-commerce activities SMEs are able to exchange business information with their customers, suppliers and partners as well as they are able to collect useful data and market information that leads to create, modify and deliver new, innovative and improved quality of products and services via online networks. This makes e-commerce an effective IT tool for Indian SMEs to introduce new and innovative products and services in Indian markets, which answers the research question **(RQ3)**. While e-commerce also enables Indian SMEs to improve the productivity and expand their range of products and services in Indian markets as well as foreign markets which in turn enable them to take advantage or exploit various market opportunities through online networks at local and global markets. This answers the research question **(RQ4)**. E-commerce implementation enables Indian SMEs to become flexible through better interaction, exchange of information and cooperation with their suppliers,

customers and business partners, while allowing the consumers to make transactions from various locations such as from home, office, internet cafe or work places at any given time. It results in an increase in variety of SME products and services offered, and to leverage different market opportunities. This feature of e-commerce enables Indian SMEs to improve the quality of their IT services and satisfies the condition of 'flexibility' dimension of agility. Moreover, it proves that e-commerce in Indian SMEs have a positive influence on sensing and exploitation of market opportunities by means of maintaining strong network connections with customers, suppliers and business partners which satisfies the conditions of research hypothesis **(H1)**. While e-commerce effectively sense and exploit market oppertunities have a significant and positive influence on the agility of Indian SMEs.

4.2.3.3 Intelligence

Intelligence refers to the ability of an enterprise to analyze and predict or foresee the upcoming market environmental changes that can be converted in to opportunities. Furthermore, the quality of intelligence enables the enterprise to prepare for a targeted response towards future opportunities by using enterprise's resources. The results obtained after processing the statistical data and by analyzing the results of spearman's rank correlations, following connections have been identified as significantly positively associated between the dependent variables representing Intelligence dimension (DvI1, DvI2 and DvI3) and all other independent variables representing various IT tools as shown in table (4.6) and figure (4.9).

Intelligence variables	Independent variables
DvI1	Iv2, Iv4, Iv3, Iv7
DvI2	Iv7, Iv4, Iv5, Iv10
DvI3	Iv7, Iv9

Table 4.6 Intelligence correlations
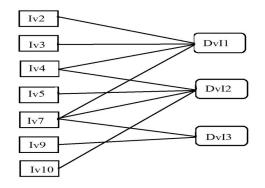Source: Own work

Figure 4.9 Intelligence correlations
Source: Own work

The Intelligence component of agility framework represents the dependent variables DvI1, DvI2 and DvI3 which fulfils the following criteria in the questionnaire.

DvI1: The frequency at which employees are given systematic training.

DvI2: The company innovations lead to introduce new products in the market.

DvI3: The company innovations lead to holding patents on products/technologies.

The analysis of spearman's rank correlations reveals that the independent variable (Iv3) is significantly positively corelated with the dependent variable (DvI1). This implies that the systematic trainings given to Indian SME employees supports the effective implementation of ERP in managing enterprise resources. ERP is based on set of business modules, that interconnects the functional areas such as finance, accounts, production, purchasing and customer service into a single integrated system which provides a common platform for the information dissemination across the enterprise. The SME employees ERP training includes the training provided on ERP's core business functions, such as finance, accounting, logistics, SCM and CRM etc. The purpose of such trainings is to make SME employee's tacit knowledge transparent and available; to convert the tacit knowledge into explicit knowledge; and to improve the capacity of enterprise knowledge and competitiveness (Zhao et al. 2014). In this regard applying team-based training methods provides SME employees an opportunity to gain knowledge beyond the boundaries of a particular department. Since learning collectively enable the employees to access both tacit and explicit knowledge from other individuals outside of their own functional units. Furthermore, team-based training affects the employee's knowledge integration and task effectiveness in a positive way. Enterprise training is regarded as an ongoing process rather than a one-time event where knowledge is demonstrated throughout the entire process and also during the on-boarding phase (Zhao et al. 2014). The main goal of on-boarding process is to promote ERP transactional expertise in a particular functional domain. This facilitates the employee to gain capabilities to operate independently with their own functional interests. In the second phase of employee training the development of tacit knowledge begins, and by the repetition of tasks, activities, and ideas over the time the problem solving and decision-making skills are developed. According to (Zhao et al., 2014) the final stage of training is "off the job training," which includes professional development or self-growth during which the employees gain the systemic knowledge through collaboration and socialization. For instance, an ERP simulation is a sort of collaborative event that enterprises

can utilize to promote the inter-departmental exchange of knowledge and expertise. This inter-departmental and cross-functional engagement is the basis for creating knowledgeable employees. Because the active involvement of employees in collaborative activities and discussions fosters the exchange of tacit knowledge and develops a shared knowledge on how each employee can influence the entire system, and create a collective resource for the enterprise. Such knowledge employees are valuable asset or resources for SMEs which helps to discover new opportunities and to foresee or predict upcoming opportunities by utilizing their ERP expertise to manage the SMEs resources in a planned and targeted manner. This quality of SME to utilize its employees ERP knowledge and skills as a resource to prepare for forthcoming opportunities represents the 'intelligence' dimension of agility framework. Moreover, the coordination of internal resources is necessary for the SMEs to systematically scan the market environment and take necessary actions in response to market opportunities. And the role of trained SME employees is significantly vital and effective in interlinking of internal resources through ERP implementation, which facilitates opportunity sensing and responding capabilities of Indian SMEs. This answers the **(RQ1)** and **(H1)**, since the systematic training of SME employees on ERP leads to effectively sense and discover market opportunities and respond accordingly by managing the enterprise resources to exploit market opportunities, which in turn improves the agility of Indian SMEs. Moreover, this also answers the research question **(RQ2)** and hypothesis **(H3)**, because the systematic trainings offered to Indian SME employees lead to create knowledgeable and IT skilled employees that supports customer responsiveness by utilizing their CRM expertise which positively influence opportunity creation. Because the effective management of enterprise resources by trained employees through CRM module can attracts new customers and creates a new customer base for Indian SMEs, since knowledgeable employees can offer better and targeted services to particular customer groups in the interest of the company.

The results from spearman's rank correlations shows that the independent variable (Iv7), (Iv9) and (Iv10) are favorably positively corelated with dependent variables (DvI2) and (DvI3). This makes a logical connection between implementation of Cloud Computing (CC) technology and Internet of Things (IoT) with innovativeness of Indian SMEs in managing resources, to introduce new products/technologies, and hold patents on them. In manufacturing SMEs context, both CC and IoT are critical and enabling technologies that interconnects manufacturing resources such as machines, workers, tools to share and communicate real-time data. Integrating CC with IoT can

resolve a few issues of each technology (Perera et al. 2014) and offers enhanced service delivery and make use of resources in an efficient way (Botta et al. 2016). This integration has also been referred to as Cloud of Things (CoT) which provides an essential means to utilize and share manufacturing resources, control the operational activities, encourage product design, enhance manufacturing potential, and improve the overall capabilities of SMEs. In Cloud of Things environment, the sensor-based data is collected from various IoT machines which is then stored, analyzed and communicated by using a cloud computing platform (Mai and Khalil 2017). The CoT solutions use cloud computing technology since it offers limitless data storage, data administration, and computation capacity in a scalable and energy-efficient manner (Heidari and Navimipour 2022). The CoT platform supports the integration of physical manufacturing resources which results in an innovative production design (Narwane et al., 2020). Several technical researches have offered comprehensive frameworks and methods for integrating IoT and cloud computing in order to digitize various industrial sectors. Though technology is emphasized in those studies, but business-centric approach is rarely applied, making it difficult for SMEs to use them as a model. However, SMEs can use the flexibility offered by both Cloud Computing and IoT technologies to produce innovative products. In manufacturing SMEs for instance, Cloud provides access to variety of manufacturing resources, such as physical resources (e.g., manufacturing cells and IT hardware infrastructure) and software resources (e.g., software, databases and simulation tools), which offers SME clients the flexibility to choose a short-term or a long-term production chain based on their customer's demands. Furthermore, Cloud allows to have manufacturing services on pay-as-per-use and on-demand basis (Xu, Chen, and Zheng 2016). This makes CC an optimal choice for SMEs to boost their innovative capacity. While IoT makes it possible to intelligently sense and interconnect both physical and software manufacturing resources to other networks through various smart devices (Han et al. 2018). As indicated by (Pflaum, and Gölzer, 2018), the key to use Internet of Things is to build smart products and data-driven services. With IoT, it is possible to have real-time communication between physical objects which can be used to monitor various products and processes in real time and to support decentralized decision-making. Since agile manufacturing is about developing more innovative products in faster ways than its competitors, the capabilities of enterprise are particularly crucial for product innovation, production flexibility and to attain agility (Zhang, 2011). And to achieve this, inter-enterprise collaborations and employee flexibility are two necessary conditions. When it comes to

discovering, disseminating, and integrating useful knowledge both internal and external, the enterprises with high level of external collaboration can provide superior organizational processes and promote innovation (Clausen, 2014). Since the information exchange and communication become easier and flexible with Cloud technology through simple means of on-demand network connectivity. While the inter-enterprise knowledge sharing generates new ideas leading to introduce new and innovative products, methods, and enhanced processes, which also improves the innovation capabilities of SMEs. Moreover, SMEs with a greater inclination towards innovation could exploit the "external knowledge sourcing" (Brunswicker and Vanhaverbeke, 2015). On the other hand, empowering the employees and self-regulated workforce with autonomy, can accelerate the innovation process and deliver more innovative and economical products which provides real value to its consumers and in turn enhances consumer satisfaction (Dubey and Gunasekaran, 2015). Adopting Cloud technology in Indian SMEs brings incremental changes by adding new features to existing technologies such as the extension of computer resources (e.g., CPU, RAM etc.), extension of applications through Cloud APIs, adding virtual machines and infrastructure etc. These incremental changes are regarded as least risky to create and deliver innovation-based products for Indian SMEs. Therefore, Cloud Computing is an effective tool for Indian SMEs to introduce new and innovative products and services in Indian markets which answers the research question **(RQ3)**. While Cloud Computing also improves the customer responsiveness in Indian SMEs effects positively, hence it satisfies the research hypothesis **(H2)**. While IoT contributes to effective management of enterprise resources and provides greater flexibility to adapt to market changes (Mohammadian, 2020). Moreover, IoT solutions have become more and more affordable and firms implement IoT devices to efficiently and rapidly respond to market changes, and to enhance consumer experiences (Lo, F.-Y.; Campos, N. 2018). Not only that IoT have the potential to provide business opportunities, IoT technologies are also effective in dealing with "altering the nature of entry threats, supplier's power, buyer's power, threats from partners, and competition amongst existing firms" (Prieger, J.E.; Heil, D. 2014). Therefore, IoT is considered as a technological wave and an opportunity for SMEs to modify and enhance their business structure through digital innovation (I. Lee, 2019) and to improve productivity. Hence the flexibility offered by both Cloud Computing and IoT in Indian SMEs not only supports to create and introduce new innovative products but also useful in managing resources and scanning and predicting market opportunities and to adjust accordingly

to seize or exploit such opportunities. This satisfies the conditions of 'Intelligence' dimension of agility framework, and the research hypothesis **(H1)**. It also answers research question **(RQ1)** and **(RQ3)**, since the integration of IoT and Cloud technologies in Indian SMEs is an effective means of discovering market opportunities and responding to them appropriately by introducing new innovative products in markets which significantly and positively affect the agility of Indian SMEs and create a transformation path towards building the industry 4.0 business environment.

4.2.3.4 Shrewdness

In order to benefit from the short-lived events in the form of opportunities, an enterprise need to be very quick in reacting to it, so that the accessible range of opportunities can be turned in to already exploited opportunities. Shrewdness refers to agile quality of enterprise that encourage to react to market changes in a very quick and efficient manner prior to its competitors and convert the potential opportunity in to used opportunities. Moreover, it also refers to the ability of enterprise to use its reactive as well as proactive responsiveness or capabilities in a radical way to seize the potential market opportunities. Therefore, shrewdness includes both reactive and proactive responsiveness of the enterprise. After investigating the results through spearman's rank correlations and after processing the statistical research data, it is found that the dependent variables (DvS1, DvS2 and DvS4) are significantly positively associated with many independent variables representing various IT tools as shown in table (4.7) and figure (4.10).

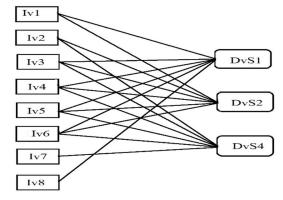| Shrewdness variables	Independent variables
DvS1	Iv1, Iv5, Iv3, Iv6, Iv4, Iv8
DvS2	Iv2, Iv1, Iv5, Iv3, Iv4, Iv6
DvS4	Iv2, Iv7, Iv5, Iv6, Iv3, Iv4

Table 4.7 Shrewdness correlations
Source: Own work

Figure 4.10 Shrewdness correlations
Source: Own work

To examine the Shrewdness dimension of agility framework, the dependent variables DvS1, DvS2, DvS3 and DvS4 were used as part of the standard questionnaire. They fulfil the following criteria

DvS1: We adapt our products and technologies to the needs and expectations of our customers

DvS2: If new market opportunities arise, we adjust supplier/subcontractor relationships

DvS3: We enter new domestic markets

DvS4: We enter new foreign markets

The results of spearman's rank correlations shows that independent variables such as (Iv1), and (Iv8) are significantly positively corelated with the dependent variable (DvS1). This implies that implementing basic IT tools, and e-commerce supports SMEs in adapting to products and technologies according to the needs and expectations of customers. In order to exhibit the characteristics of shrewdness, SMEs need to be able to react very rapidly to potential market opportunities and turn them in to used opportunities. In order to be shrewd, SMEs need to adapt, change or modify their products/technologies according to customer's expectations in a very rapid manner. However, SME's coordination with supply chain members such as suppliers, business partners and customers are highly necessary in order to adapt to new products/technologies. Achieving coordination among supply chain members is not possible unless there exists an effective communication between them. Since communication is highly essential to quickly adjust or reconfigure the resources in order to respond to market changes in an agile manner (Li et al. 2009). Moreover, the data or information is considered to be a vital resource for enterprises, since it helps in creating product development strategies (Forbes, 2014). As discussed earlier, SMEs that implement e-commerce uses various electronic communication channels such as emails, corporate websites, social media platforms etc., which support active communication with customers, suppliers, and business partners to share critical information on product/service enhancement. The highly precise information received from sales and data analytics (e.g., customer's preferences, taste, and inclination towards particular product) can be significantly useful in improving the enterprise's demand responsiveness (Innovation Enterprise, 2016; Shen et al., 2021a). For instance, an SME's product quality/service can be determined by the information provided on its SME's retail website, based on which customers build their perception towards particular product/service. Previous studies have revealed that a retail website's content/information quality is also one of the crucial determinants in evaluating the customer satisfaction levels on a particular product/service quality, as it directly influences the customer satisfaction. The service quality of an SME's retail website has two main aspects. The 'technical

aspect' refers to the speed and effectiveness with which the business websites respond, and offer new updates. Whereas, 'functional aspect' deals with the interactive communication between SME retailer and the customer, new methods used for customer engagements, and the improvements made to their communication methods. Both technical and functional aspects of SME's retail website are important in designing an effective product development strategy for SMEs. Since both these factors contribute to information generation and information extraction on product development to meet customer demands. Hence, the more the customer interacts with SME's retail website, the more the information on product quality, products improvement, customers choices, customer expectation, demand patterns etc. is generated. This helps Indian SMEs to successfully adapt to products according to needs and expectations of their customers.

SMEs that implement e-commerce also uses digital information processing technologies such as EDI (electronic data interchange) to automate the paper-based transactions such as purchase orders or invoices in to standard electronic format. EDI transactions enable quick dissemination of information from host SME to destination SME via IT applications. Moreover, data sharing is rapid and less time consuming compared to paper-based manual methods, which helps SMEs to develop, transform, and redefine their business relations with other SMEs. EDI eliminates some serious errors caused by manual transaction processing, since it ensures that data is formatted in a right way prior to the transmission. The 'message flow' of EDI-based transactions shows the how the EDI messages (e.g., digital images, sounds, text) are moved to various inbound and outbound addresses and departments. EDI's electronic documents can be easily integrated with various IT applications including e-commerce and supports the process of data collection, and analysis. EDI is also important for the formation of e-contracts, and to exchange computer-based business information in a standard electronic format. Hence, the automation provided by EDI can lead to positive customer experiences for SMEs. Because EDI not only support flexible and transparent transactions but also supports in quickly delivering products and services in a reliable manner. Hence the Indian SMEs can determine which of these electronics channels and digital technologies (e.g., email, websites, social media platforms, EDI) are effective and reliable to communicate with their customers during their e-commerce activities. This helps Indian SMEs to adapt to most relevant technologies that are suitable to their customer's interest.

From above discussion, it is clear that implementing e-commerce and using basic IT tools such as company's retail websites helps Indian SMEs to successfully adapt to products and technologies according to customer's needs and expectations. Shrewdness refers to quickly seize market opportunities and convert them in to used opportunities. Moreover, 'shrewdness' enable Indian SMEs to quickly discover new and short-lived market opportunities and exploit them to their advantage prior to their competitors. However, in order to be shrewd, Indian SMEs need to be able to utilize both reactive and proactive approach in adapting to products and technologies. For example, by using the reactive approach, Indian SMEs are able to quickly seize temporary or short-lived market opportunities such as sudden variation on customer demands for a particular product/technology due to changes in market trends. Whereas, by using their proactive approach, Indian SMEs are able to prepare themselves in advance to avail future opportunities. For instance, by designing a strategy in advance on how to deal with future product/technology changes, in order to attract the future customers, so that they can be successfully converted in to actual customers. Hence this satisfies the conditions of 'shrewdness' dimension of agility framework. Moreover, by proactively designing new strategies for future products/technologies, SMEs are able to create new market opportunities, since it becomes easier by using e-commerce and websites to sense customer's needs and expectations based on customer's behavior patterns and gain new customers, which satisfies the research hypothesis **(H3)**. While responding to customer's behavior patterns, Indian SMEs can effectively adapt to suitable products and technologies to satisfy the customer's needs and expectations, which improves customer satisfaction. This implies that using e-commerce and websites, positively influence the customer responsiveness of Indian SMEs which satisfies the research hypothesis **(H2)**. Moreover, it enables Indian SMEs to effectively sense and respond to market changes such as customer demand variations, new technologies in markets, new market strategies from competitors etc. which positively influence opportunity sensing and opportunity exploitation capabilities of Indian SMEs, and hence satisfies the conditions of hypothesis **(H1)** and research question **(RQ1).**

The results of spearman's rank correlations shows that the independent variable (Iv6) is significantly positively corelated with dependent variable (DvS2). This implies that using online/e-contracts is helpful in adjusting supplier/subcontractor relationships when new market opportunities are identified. The information acquired by SMEs during supply chain activities is a crucial factor, that can change or influence the SME's relationship with its business partners or

suppliers. As pointed out by (Choi et al., 2017), information exchange among competitors can boost supply chain efficiency and accomplish supply chain coordination. The latest and accurate information received during supply chain activities can lead to better decision making and minimum errors, while it also improves product quality and cost effectiveness. However, (Liu et al., 2021) examines the motivation for retail platforms to share the demand information, especially when there are multiple vendors. For example, SME retailer decides what to order, or how much to order, only after receiving a demand update, or the SME retailer can confirm the order and sale price only after having an information update on the supply output. SMEs sometimes make decisions or agreements prior to accurate information is known. For instance, an SME has already involved in an e-contract with its supplier when both supply and demand information is not yet clear. In such situation e-contracts are beneficial for both retailers and supplier because e-contracts provides possibility to modify the contract based on mutual information update. Several researches have investigated the challenges related to 'information sharing' and 'supply chain contracts' such as asymmetric information, demand information updates, supply information updates etc. (Shen and Chan 2017; Shen et al. 2018). While the challenges related to asymmetric cost information, and 'after-sales service contract' have also been examined by (Lan et al., 2017). An online/e-contract allows both parties to use certain electronic medium to express their intent or consent and make an agreement on a particular business deal. An e-contract typically follows three stages. At 'first stage' an electronic contract is prepared by specifying the contractual roles, conditions and outline of business interactions. The 'second stage' is negotiation phase which is the crucial stage, during which both the contracting parties communicate with each other to reach out for a mutual agreement on the specifications of the contract. Mutual agreements are made related to payments, quality/quantity of products to be delivered, and the time period of product's delivery etc. Negotiation phase is meant for benefitting both the parties and hence it can be redrafted or restructured. However, the methods used for negotiations may differ depending on the type of e-contract, such as business-to-business (B2B) e-contracts, business-to-customer (B2C) e-contracts, and retailer-supplier e-contracts. These negotiations can be norm-oriented, goal-oriented, document-oriented etc. At the 'final stage' an e-contract is enforced by executing particular actions. This phase generally involves purchase and exchange of resources (such as raw items) and making of payments. Updating or modifying an existing e-contract with SME's supplier/subcontractor is highly necessary, especially when there is new or updated information

available, based on which SMEs can seize potential market opportunities. For example, if the SME retailer notices some changes in market environment such as a sudden rise in customer's demands, product modification feedbacks, information on supply outputs, new technology changes etc. which provides an unexpected and short-lived opportunity for SMEs. In such situation, SMEs need to be quick to react dynamically and seize such opportunities.

An e-contract provides the opportunity for SMEs to act on the latest information and make necessary changes or amendments to an existing e-contract. Although e-contract agreements are already agreed up on by both parties, an e-contract can still be re-drafted, as and when needed by negotiating with suppliers/subcontractor. This allows the Indian SMEs to efficiently respond to new transient/short-lived market opportunities, which otherwise could have been missed if the supplier/subcontractor have not been notified and updated through e-contract negotiation. Such mutual interaction of information exchange on market dynamics, and the mutual consent and for contractual changes helps Indian SMEs to effectively sense and exploit new market opportunities when they occur, which satisfies the hypothesis **(H1)**, because by effectively sensing and exploiting the market opportunities, Indian SMEs can improve their agility. Moreover, Online/e-contracts are helpful for Indian SMEs to quickly react to market opportunities that are transient or short-lived events, by taking suitable actions through effective e-contract negotiations with business partners and suppliers, and convert the potential opportunities in to already seized opportunities, which satisfies the conditions of 'shrewdness' of agility framework. The online/e-contracts are effective for Indian SMEs in adapting and adjusting their relationship with supplier/subcontractors when new market opportunities arise. And by making contract negotiations based on the latest information updates, leads to improved competitiveness among Indian SMEs and encourage Indian SMEs to expand their business at both local and international markets. Since the online/e-contracts are helpful to explore new markets, customer bases, and to engage with new business partners at local and global markets by engaging them with effective e-contract negotiations answers the research question **(RQ4)**. While online/e-contracts negotiations based on mutual information updates between SME retailer and supplier/subcontractor creates new opportunities for Indian SMEs to gain new customers, business partners and business deals which satisfies the research hypothesis **(H3)**.

The spearman's rank correlations results shows that independent variables (Iv4) and (Iv7) are significantly positively corelated with dependent variable (DvS4). This implies implementing E-commerce and Cloud Computing technology helps the Indian SMEs to enter new foreign markets more frequently. Several studies have examined the use of Cloud Computing and e-commerce, demonstrating how these innovative technologies have facilitated the transformation process of developing nations into the digital economy, resulting in national economic growth and international market penetration (Busalim and Hussin 2015; Nawaz et al. 2016). Implementing e-commerce, can enable SMEs to extend their relationship with customers, and business partners/suppliers through online networks and does not require heavy equipment to operationalize e-commerce activities. Although, e-commerce infrastructure relies on basic IT layer that consists of computer hardware, software and Internet enabled applications, networks, and other supportive technologies. E-commerce also eliminates the location dependency due to online connectivity channels such as integrated e-commerce platforms, business websites, mobile devices, social media platforms etc. This facilitates SMEs to expand their business transactions to various geographical regions all around the world, which also allows SMEs to connect with customers from domestic and foreign markets. However, the traditional e-commerce requires sufficient financial investment, high quality physical resources, and significant time. To save time, effort and cost of e-commerce implementation, most SMEs subscribe a third-party professional e-commerce service providers to outsource their non-core e-commerce technology and business processes. The e-commerce "business service providers" for instance, provide business process outsourcing (BPO) services related to e-commerce activities such as manufacturing, financial management, human resources etc. While the e-commerce "technology service providers" offer Information Technology Outsourcing (ITO) services that are needed to implement for data hosting, renting equipment, technology consultations etc. Implementing Cloud Computing has an effect on all the e-commerce services, particularly on traditional ITO (Hongfeng Hou, et al., 2012). Because Cloud Computing offers standardization of services when compared to traditional ITO which leads to cost benefits. Due to which, many of the traditional e-commerce service providers have migrated towards Cloud environment for their e-commerce transactions. Cloud Computing enable business enterprises to execute their operations without being need to develop or retain IT infrastructure, since it supports the enterprises to store and use their computing resources and data on a Cloud platform. This helps SMEs to store and extract data related to customer's needs and requirements,

customer's purchase patterns, data on supply chain activities and other related information. This in turn enable SMEs to quickly and efficiently respond to day-to-day customer needs or business requirements, and for effective decision making or even to re-strategies their business plans.

Migrating e-commerce operations to Cloud Computing offers huge commercial benefits for SME retailers. Cloud Computing significantly reduces the cost of IT infrastructure and resources, since Cloud does not rely on heavy IT equipment which is one of the motivating factors for SMEs to migrate to cloud-based e-commerce. Moreover, both of these technologies rely on internet connectivity for their operations. An SME retailer may hire an on-demand ''Infrastructure-as-a-Service' model in order to avoid buying the physical infrastructure such as storage, networks, servers and operating systems for conducting the e-commerce. Unlike traditional architecture, the IaaS service model is based on Cloud's Virtualization technology which include network, storage and server virtualizations which helps in enhancing the efficiency of hardware resources and improves the reliability (Li, Qiong, and Ruiying Li., 2016). The virtualization methods offered by Cloud not only saves investment on hardware procurement but also the space for storing it, which improves the operational efficiency of SMEs. It also reduces the expenses related to security, privacy, energy, and maintenance (Babar, M.A. and Chauhan 2011). Furthermore, the Cloud Computing services are disaster tolerant and its built-in redundancy feature can save the business data from being lost, because Cloud's 'redundancy' feature is a built-in replication of systems, data, equipment, and other useful components. Therefore, Cloud services can effectively manage security threats or disasters and resume the business in to its previous state (Wang D., 2013). Hence, the information stored on remote server of a Cloud platform is usually safe even if physical storage fails. Cloud technology supports interoperability between multiple platforms and for various e-commerce components (Jiang 2016; Kiruthika et al. 2012). The interoperability feature acts as an enabler for cloud-based e-commerce activities in SMEs, especially when performing foreign e-commerce transactions. Implementing e-commerce, allow enterprises to gain access to international marketplaces and global platforms, which can help developing nations to improve their economic growth, since it helps in expanding the geographical reach of their business beyond local regions (Guo et al. 2017). Whereas, the emergence of Cloud Computing has facilitated it furthermore and reduced the challenges to enter a particular market or a segment of markets specially for SMEs, because cloud-based e-commerce uses shared network resources that are utilized to its full extent. While using Cloud technology can also benefits in improved asset

utilization, while moving from asset ownership to service management (Turban et al., 2013). This enables SMEs to easily downscale or upscale their IT needs and requirements as and when necessary, without modifying their core IT infrastructure. Cloud Computing platforms support in managing various e-commerce businesses in many different countries related to their specific customer base. Several Cloud service providers such as Google, Amazon, IBM, and Microsoft have built their data centers worldwide in order to ensure reliable access to Cloud applications, which has also reduced the access time. Furthermore, cloud-based e-commerce offers the flexibility to access the products and services from any part of the world at any time. For instance, cloud-based e-commerce platforms through smart phones or mobile devices provides direct opportunity for customers to buy products and services from any geographical region in the world and at any time, since the Cloud centers operates all over the globe (Z. H. Wu., 2011). Moreover, Cloud minimizes the barriers for entering in to new e-commerce markets (Liu and He 2017). All the mentioned conditions and features of cloud-based e-commerce are beneficial and feasible for Indian SMEs to expand their business reach and explore new markets. By implementing cloud-based e-commerce, Indian SMEs are able to effectively establish their network connections with customers, suppliers and business partners from various markets including domestic and foreign markets. Hence the integration of e-commerce with Cloud technology helps Indian SMEs to expand their business reach and is highly effective to explore new markets at both local and international levels which answers the research question **(RQ4)**. This in turn supports Indian SMEs to maintain effective business relationship and interaction with its domestic and foreign customers, suppliers, business partners, and facilitates to sense their needs and expectations for products and services. This enables Indian SMEs to appropriately respond to each segment in the market such as by analyzing their behavior patterns and leads to discover new market opportunities which answers the research question **(RQ1)**. Whereas the effective sensing of market opportunities and responding to the needs of customers, suppliers and partners have a positive influence on the agility of Indian SMEs and also satisfies the conditions of research hypothesis **(H1)**.

4.2.3.5 Reactive and Proactive approach to opportunity recognition

In general, the reactive model of responsiveness is considered as a defensive strategy which is used in response to deal with a threat (Gligor et al., 2013). The reactive approach shows the business resilience of an enterprise after the event occurs through its reactive capabilities. Whereas,

proactive model of responsiveness has been linked to opportunity-seeking behavior as well as the qualities such as alertness, readiness, preparedness (Fayezi et al., 2015). It shows the proactive resilience of the enterprise before an event occurs. After investigating the results through spearman's rank correlations and processing the statistical research data, it shows that the dependent variables (DvRe, DvPro1 and DvPro2) are significantly positively correlated with many independent variables representing various IT tools as shown in table (4.8) and figure (4.11).

Reactive and Proactive variables	Independent variables
DvRe	Iv1, Iv8, Iv4, Iv7, Iv3, Iv5
DvPro1	Iv6, Iv2, Iv7, Iv3, Iv4, Iv8
DvPro2	Iv6, Iv2, Iv3, Iv5, Iv7, Iv4

Table 4.8 Reactive & Proactive approach correlations
Source: Own work

Figure 4.11 Reactive & Proactive approach correlations
Source: Own work

To examine the Reactive and Proactive dimensions of agility, the dependent variables DvRe, DvPro1, DvPro2 were used as part of the standard questionnaire. They fulfil the following criteria

DvRe: We get feedback from customers on the need to change/modify our products

DvPro1: We develop new products for existing markets

DvPro2: We develop new products for new markets

The results of spearman's rank correlations shows that independent variables such as (Iv1), (Iv4) and (Iv8) are significantly positively corelated with dependent variable (DvRe). This implies that implementing Basic IT tools, Social Media Platforms, and E-commerce help SMEs to receive feedback from customers on the need to change or update their products. To achieve digital transformation, enterprises usually rely on knowledge and information exchange with other enterprises within the supply chain (Kong et al. 2020; Shu et al. 2012). Prior to exchanging information, SMEs must first establish their relationships with business partners/suppliers and customers. E-commerce platforms allow SMEs to collect customer information and provides a

platform to share information about their products and services by using IT tools such as E-mail, Websites, Internet, Electronic Data Interchange, Electronic Fund Transfer (Kurnia et al. 2015) etc. Specially, the digital channels such as the websites and e-mails are used for promoting products and services and to directly interact with large number of customers (Almaazmi et al., 2020). E-mail is one of the most effective marketing tools, which provide methods for achieving marketing goals (Vidhya, 2021) by simply using basic IT tools such as an internet explorer, computer device, mobile device etc. For example, by targeting a particular group of customers, emails are capable to send a set of commercial messages to many people in one time via internet. SMEs that use company's email facilities in promoting and marketing their products usually results in gaining more potential customers, since it helps to motivate customer's intentions or decisions on buying those products (Tran & Strutton, 2020). By using digital strategies and tools such as emails, the marketing firms (SMEs) can describe in detail their selling procedure, prices, payment options, and delivery options (Alghizzawi, 2019). This can help SMEs to establish better relationship with customers, suppliers, and business partners which also allows them to receive feedback or opinions on product expectations, need for product enhancements or modifications from their customers. Since SMEs seek customer satisfaction, emails provide a great facilitation for SMEs on how to develop, change or upgrade their future products by frequently receiving customer feedbacks. Whereas, the commercial information offered by company's retail websites are helpful in promoting and encouraging the potential consumers to buy their products (Tran & Strutton, 2020). This is done through retail website's attractive search engines which offers useful commercial information to consumers and give free exposure of the enterprise's brands, so that the customers can evaluate it against the products offered by another competitor (Altarifi S., et. al, 2015). Customers can also provide their valuable suggestions or opinions on product or service enhancements by using online web blogs. This concept has gained notable prominence recently, due to its flexible method and ease of access to any user by using a website. SMEs can use these commercial websites for multiple purposes such as to attract new customers, improving productivity, customizing their product and services, continuous and uninterrupted trading and for information exchange etc. Most importantly, the feedbacks received from SMEs retail websites, help SMEs to meet customer expectations in terms of product and service enhancement. Moreover, the enterprise retail websites offer significant and helpful feedback about firm's products or services, which makes it easier to evaluate their quality level (Varadarajan, et. al, 2021).

The concept of electronic word-of-mouth (eWOM), also commonly known as online feedbacks, reviews, online recommendation or opinions, has recently gained significant attention due to the emergence of social media platforms. Social media is one of the effective informal communication tools between a perceived communicator and receiver with respect to a product, service or a brand (Woo, Ahn, Lee, & Koo, 2015). Using social media does not put a high investment cost on SMEs. Whereas, social media provides a distinct marketing and communication tool (Eagleman, 2013) specially for SMEs. The perceived usefulness of social media usage and its influence to online buying intention has been found to be positive (Pookulangara and Koesler 2011). Therefore, the commercial information shared by SME's social media platforms, as well the reviews and recommendations from previous customers can influence and encourage the potential consumers to buy the recommended products (Tran & Strutton, 2020), since it triggers and influence the consumer's decision-making process. Hence the user generated data or content on social media platforms can be manipulated by SMEs in order to easily predict the customer behavior and their purchasing patterns in future. Social media platforms also support SMEs in enhancing their product's brand image, develop brand awareness, gain customer loyalty while attracting new customers. Hence the marketing activities carried out on social media, online websites can generate a collaborative user information. SMEs can leverage this user information through different mediums such as mobile and web-based technologies and create an interactive environment, where customers, suppliers, business partners and SME employees can share, analyze, discuss, this customer information for product enhancement activities. Implementing e-commerce and electronic communication channels such as emails, websites, and social media platforms, is highly crucial for Indian SMEs in order to effectively communicate with customers, and receive relevant feedback on the need to change or improve their products. Moreover, the web-based IT (e-commerce, websites, e-mail, social media platforms) is helpful in collecting and analyzing the customer data on product demands and expectations which also leads to increased competitiveness among rivals SMEs to produce new innovative products. This in turn enable Indian SMEs to introduce new and innovative products and services in Indian markets, which answers the research question **(RQ3)**. Based on the customer feedbacks and opinion, SMEs are able to respond by making effective market strategy to counter the threats as well as exploit market opportunities. Since the implementation of e-commerce, websites, social media platforms in Indian SMEs enable them to successfully identify and exploit market opportunities, it satisfies the

research hypothesis **(H1)** and also answers the research question **(RQ1)**. Whereas, the sensing and responding capability of Indian SMEs is improved with the use e-commerce, websites, e-mail, social media which have a significant and positive influence on agility of Indian SMEs.

The spearman's rank correlations results shows that the independent variables (Iv4) and (Iv7) are significantly positively corelated with the dependent variables (DvPro1) and (DvPro2), This implies that implementing E-commerce and Cloud Computing technology is helpful for Indian SMEs to develop new products for existing as well as new markets more frequently. SMEs are generally considered to have technological constraints, cost constraints, and lack of expertise to invest in technological solutions in order to analyze customer's data and purchasing patterns (Jiang 2016; Rao et al. 2013). While the Cloud-based e-commerce adoption, particularly in SMEs enable to overcome these constraints and provides the capacity to improve the customer service. Due to the flexible nature of Cloud Computing technology, it enables interoperability between multiple platforms and for various e-ecommerce components (Jiang 2016; Kiruthika et al. 2012). For instance, the Cloud's 'Software as a Service' architecture supports the integrated e-commerce services such as office automation (OA), business web sites, enterprise resource planning (ERP). Cloud also supports external service applications such as electronic payments, electronic authentication, supply chain management (SCM), customer resource management (CRM), e-commerce logistics, which provides a direct connection with customers. Whereas, the 'Platform-as-a-Service' model of Cloud can provide SMEs with pre-built applications that can be used by SMEs as and when needed. With PaaS it is possible for SMEs to instantly launch an e-commerce website without being worried about servers or software updates. Unlike the traditional e-commerce, migrating to cloud-based e-commerce necessitates to hire a single cloud service provider, that is responsible for providing all the necessary services to e-commerce website, through which all the other entities of e-commerce are connected. This facilitates in smooth exchange of data and information between the e-commerce website and customers (Muntjir and Siddiqui, 2016). The cloud-based e-commerce implementation, therefore provides an effective means of interaction between the SME and its customers. This not only leads to seamless services for customers but also provides an opportunity for SMEs to collect essential customer data and information. Hence this positively influence the customer responsiveness of Indian SMEs, which satisfies the research hypothesis **(H2)**. Enterprises, typically have four development stages including e-commerce information display, online interaction, online trading, information

integration (Ying Feng, Qiang Mei, 2012). The first stage 'information display' is for information sharing with customers for marketing reasons. The 'online interaction' deals with exchange of business information with customers, suppliers, and distributors. The 'online trading' deals with currency transactions between the trading parties, which results in e-commerce work flow processes, and logistics activities. However, the final 'information integration' stage is crucial for the product development process, because during this stage the enterprise have full integration of all business transactions that are carried out on e-commerce integrated systems such as ERP, CRM and SCM etc. Since customer data and information is significantly important in improving product's quality as well as to introduce new products. During the 'information integration' phase, SMEs are able to collect and analyze relevant and crucial data on various aspects of product development. Moreover, the interoperability feature of cloud-based e-commerce enable SMEs to interconnects various e-commerce integrated components such as, Office Automation (OA), business web sites, Enterprise Resource Management, Customer Resource Management to effectively extract information on customer's needs and requirements, customer's purchase patterns, supply chain activities, electronic payments etc., which helps SMEs in developing new and improved products. The product development process is also significantly affected by Cloud Computing's demand-based scaling of IT resources, since Cloud services enable enterprises to quickly add or remove the resources that are more adaptable and useful for workload (Venters and Whitley, 2012). It also enables SMEs to efficiently manage their resources in an intelligent way, so that the expenses spent on resources can be saved which can be later redirected towards operational activities (Akter & Wamba, 2016). When there is a shift in products demand in the market, due to various factors such as the competition among rivals to deliver new or improved products. In such conditions, Cloud Computing enable enterprises to quickly (re)configure their internal IT resources and enable the enterprise to effectively react to such market changes (Battleson et. al., 2015). Moreover, communication and data collection challenges are significantly reduced during the cloud-enabled product development process and facilitates SMEs in interacting with customers and suppliers, data collection, and data analysis processes. In this way, Cloud-based e-commerce is helpful for Indian SMEs to appropriately respond to new product demands in the markets and develop and introduce new products for both existing markets and the new markets. This answers the research questions **(RQ3)** and **(RQ4)**, since cloud-based e-commerce is highly effective for Indian SMEs to introduce new and innovative products in the Indian markets,

while it also enables Indian SMEs to expand their products range for local markets as well as for new foreign markets.
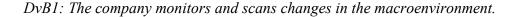
Implementing Cloud and e-commerce enable Indian SMEs to introduce new products in the markets which attract new customers from both existing and new markets. Moreover, due to their global presence and extended market reach, Indian SMEs can also explore new customers from foreign markets. This results in discovering new market opportunities for Indian SMEs. Hence it answers the research question **(RQ1)**. The cloud-based e-commerce supports interoperability between multiple platforms and various e-commerce components, which results in effective interlinking of internal resources in Indian SMEs. Moreover, the Cloud's demand-based scaling of IT resources enable Indian SMEs to quickly add or remove the resources that are more adaptable. This in turn leads to successfully sense, and respond to market opportunities in Indian SMEs, since the effective co-ordination of internal resources is helpful in gathering useful information and customer data and analyze it, so that when new market opportunities arise, SMEs can respond appropriately by developing suitable products to satisfy customer needs. Hence it answers the research question **(RQ1)** and hypothesis **(H1).** The improved IT skills and competencies of Indian SME employees plays an important part in effectively dealing with customer responsiveness. Since Cloud Computing and e-commerce services enable Indian SMEs to be more flexible in managing their IT resources to develop new products. This encourages Indian SMEs to improve and boost their employees IT skills and competencies accordingly. While the instant services offered by Cloud and e-commerce allows SMEs to share online feedbacks and opinions on product updates facilitates and encourage the customers to purchase newly introduced products, which also improves the customer responsiveness because the SME employees and customers both engage in effective information sharing on products and demands. Hence it answers the research question **(RQ2)**. Cloud and e-commerce enable Indian SMEs to quickly react to customer needs and expectations on product development prior to its competitors and help in introducing new innovative products. Since the cloud-based e-commerce is effective in delivering improved products and services based on the analysis of customer data on product demands and expectations, received from diverse markets from various geographical locations across the globe. This helps Indians SMEs not only to introduce new and innovative products and services in Indian markets, but also to expand and explore new foreign markets. This answers the research questions **(RQ3)** and **(RQ4)**. This in turn leads to increased competitiveness among Indian SMEs, and hence

encourage Indian SMEs to identify new potential customers from various markets including local and international, and to quickly exploit market opportunities such as by engaging with new foreign customers, suppliers or partners. Hence, it satisfies the conditions of 'shrewdness' dimension of agility framework and the research hypothesis **(H1)**.

4.2.4 Needed changes in the use of ICT

The research results and findings of this study have some practical and managerial implications particularly in the direction of improving the IT capabilities of Indian SMEs in order to meet the agility goals or to improve the overall enterprise agility of Indian SMEs. In order to systematically analyze the managerial and practical implications of this research, the study first focus on each agility dimension of the defined agility framework, and then the implications on research hypothesis and goals are discussed.

4.2.4.1 Improvement of Brightness

DvB1: The company monitors and scans changes in the macroenvironment.

DvB2: The company monitors and scans changes in the industry environment.

Figure 4.12 Kruskal-Wallis graph representations on Brightness variables
Source: Statistica software

The Kruskal-Wallis graph represented by figure (4.12) shows that if Indian SMEs use Office automation tools in not so beneficial or moderately beneficial way then they monitor and scan the macroenvironmental changes in a moderate way. And if Office automation tools are used in a satisfactory or highly beneficial way then Indian SMEs scans and monitors macroenvironment changes systematically. This implies that, there is a need to improve Office automation tools in Indian SMEs in order to perform systematic scanning and monitoring of macroenvironmental

changes. Macroenvironment refers to external factors such as political, legal, economic and technological. In this context, social, political and legal environments are managed by the state authorities while financial performance of the enterprise can be simulated by a positive perception about the enterprise by their environment (Belás et al., 2015). The macroenvironment also includes the stakeholder groups that SMEs maintain their relationship with and they affect the costs, quality and performance of the enterprise. Though SMEs may not have direct and total control on macroenvironmental factors but these factors influence the decision-making power of SMEs. Moreover, the macro-economic factors play a significant role in shaping business environment (Sinicakova & Gavurova, 2017), and they are important determinants of business environment for the country, therefore have a significant influence on profitability of enterprise (Bekeris, 2012). An increase in macro-economic instability characterized by policy deficits and uncertainty may have harmful effects on enterprises especially for SMEs that are particularly vulnerable given their size limitations and resources to overcome these instabilities. In this context, systematic scanning and monitoring of the macro-environmental changes in Indian SMEs is highly essential, and Office automation tools are highly useful and beneficial. Whereas, the 'industry environment' refers to an environment that has a significant impact on daily business activities and which is directly involved with the enterprise such as consumers, suppliers, business partners and other market intermediaries. The Kruskal-Wallis graph represented in figure (2.12) shows that if basic IT tools are used by minority to half of the staff, then Indian SMEs monitors and scans changes in the industry environment in a moderate way. And if majority of the staff uses basic IT tools, then Indian SMEs monitors and scan changes in the industry environment in a systematic way. This can be interpreted as the more the number of SME employees use basic IT tools, the more it contributes to systematic scanning of the industry environment. It also evident that basic IT tools need to be improved so that they are useful for majority or even all of the Indian SME employees. However, it can be achieved through implementing key initiatives such as deploying more sophisticated Office automation tools, improving the capacity of basic IT tools, or upgrade the basic IT tools to the latest versions of Office automation software.

Office automation tools are basically the business automation software that can be either in the form of a complete package or a platform that supports the automation of various business activities, or it can be an independent automation tool that support the sole purpose of automating a specific business operation. In either case they are essential tools for Indian SMEs to automate

their day-to-day repetitive business operations. There are multiple types of Office automation tools that are helpful for SMEs depending on their specific business requirement. For example, marketing automation software is helpful to automate many of the basic marketing tasks in SMEs, which also include e-mail automation tools that support marketing activities. These solutions range from sophisticated demand and lead creation tools, to email marketing systems, or a market research tool that is required when designing and developing a product. 'Sabhae' is one such communication and collaboration tool that combines various functions in one platform including chat, meeting, discussion, files, calendar, notes and whiteboard. With automation tools such as 'Calendly' it is simple to set availability preferences for the next meeting and associate a link to an email invitation. While other automation tools such as 'ActiveCampaign' combines advanced email marketing features with an enterprise standard CRM. Marketing automation tools are also crucial for digital and social media marketing, while platforms such as 'Hootsuite' and 'Buffer' makes it possible to automate the social media marketing and facilitate in managing campaigns across multiple platforms. Office automation tools also include accounting software that automates the operations such as invoice updates, payments processing, validation, and create reports in real-time. One such example is AP Automation platform which reduces the load of processing paper receipts, limits invoice errors, and saves excessive costs. Hence the Office automation tools which include marketing, email, social media, accounting and other automation tools are very useful for Indian SMEs in order to scale their business operations, raise employee productivity, and to deliver better services to customers. These tools make it easier for Indian SMEs to systematically scan the environmental changes in industry since they help to collect and analyze information on customer's needs and requirements, and also helpful to successfully sense and identify potential market opportunities. Moreover, Indian SMEs need to upgrade their basic IT tools either in the form of physical capacity or move towards the latest versions of software. For example, improving the storage capacity of a computer hard drive, upgrading the operating system of a computer machine, installing new Office automation software or updating it, increasing the number of physical devices, increasing the number of physical connections of each computer device etc.

Since 'brightness' refers to the quality of an enterprise to recognize the threats and potential opportunities. It requires a systematic and planned observation of the environment. Therefore, to improve the brightness of Indian SMEs, scanning the macroenvironmental changes and industry-level changes is essential. By analyzing Kruskal-Wallis multiple comparisons graphs as shown in

figure (2.12), it is found that 'basic IT tools' and 'Office automation tools' are useful in improving the 'brightness' of Indian SMEs. However, they need to be upgraded as suggested in the discussion. By adopting such measures, Indian SMEs can improve their opportunity sensing capability which helps to find new opportunities in Indian markets and ultimately exploit them for the benefit of the enterprise. This can also support the research hypothesis **(H1)** since it deals with IT capabilities have positive influence on the sensing and exploiting of opportunities. Hence by implementing the suggested measures on the basic IT and Office automation tools in Indian SMEs the 'brightness' dimension of agility can be improved while supporting the hypothesis **(H1)**.

4.2.4.2 Improvement of Flexibility

DvF1: The operational technology enables the enterprise to offer a range of products.

DvF2: The competence and skills of employees enable the enterprise to offer range of products.

Figure 4.13 Kruskal-Wallis graph representations on Flexibility
Source: Statistica software

From the Kruskal-Wallis graph as shown in figure (4.13) it can be interpreted that if ERP is not so beneficial or moderate level helpful, then the operational technology enables Indian SMEs to offer narrow range of products. And if ERP is very highly useful in managing resources, then the operational technology enables to offer with wide range of products in Indian SMEs. This implies that, there is still scope to enable the operational technologies to offer with a very wide range of products for Indian SMEs, however, they need to improve the ERP implementation in a more effective way. Whereas, the Kruskal-Wallis graph in figure (4.13) shows that if ERP is moderate to satisfactory level helpful then the competence and skills of Indian SME employees

enables to offer narrow range of products. And even if ERP is implemented in a very highly useful level, still the competence and skills of Indian SME employees only enable to offer narrow range of products with slight improvement. This explains that, there is a need to improve the effectiveness of ERP implementation in Indian SMEs in order to increase the range of products from narrow to very wide range, while the competence level and skillset of Indian SME employees needed to be further improved specially in the areas of ERP implementation. From managerial perspective, it can be suggested that Indian SMEs need to adopt certain measures in the direction of improving the effectiveness of ERP implementation and also need to train and improve the skillset of their employees or staff for the effective management of enterprise resources. However, these measures must be undertaken in specific and crucial areas of ERP implementation in Indian SMEs. Some of them include ERP customization, employee resistance, commitment from top level management, employee training etc.

1) ERP customization and configuration

One of the crucial success factors of ERP implementation is its customization and configuration. Although ERP customization and configuration are two different terms but they are interrelated and works in combination. Where customization is more related to optimization of software settings to fulfill certain business needs, which also include finding a suitable match between an ERP system and the enterprise business activities. With ERP customization the top-management of Indian SMEs is expected to bridge or fill the gap between organizational needs and the capability of standard ERP system. Whereas, ERP configuration is related to changing and modifying the components of ERP system in synchronization to business environment to function efficiently. The ERP configuration enable the enterprise to select options for certain basic or standard applications depending on the business needs, such as, email programs or business productivity tools. While ERP customization enhances the functionality of current ERP system and adds more features to it. ERP customization in Indian SMEs mainly depends on their organizational needs, and accordingly Indian SMEs need to restructure or align their business processes with industry's best practices. The incompatibility between the software packages and business processes is a major issue in SMEs that need to be addressed by managers. Moreover, when there are heavy processes and no optimal package in ERP, then customization becomes absolutely necessary. ERP customization allows SMEs to include specific task management

processes according to business needs which can help Indian SMEs to exploit different ERP software modules. However, prior to ERP customization, the manger/owner of Indian SMEs need to select appropriate ERP package that meets their organizational needs as well as suits the enterprise operations. If the best suitable ERP package is not selected, then this may lead to several issues related to implementation and customization and eventually in failure. Since there are many ERP packages available from different vendors, therefore during the ERP selection phase, the SME manager needs to consult an external expert that can assist the process in an efficient manner by providing relevant knowledge to SME managers which improves the likeliness of success. One of the factors that Indian SMEs need to be concerned about is the lack of product knowledge or its relevance from the consultant side for ERP customization. Although ERP system customization may be partly justified due to the functional inadequacy. This can be linked to insufficient development work in the ERP package from the provider, or the inability of the employees and internal management that are responsible to handle and safeguard the ERP system and its implementation. Therefore, Indian SMEs need to be careful while deploying an ERP system and make sure that the vendor/provider delivers the ERP package that is actually useful and fulfil the basic needs of the enterprise and which also is a best match between enterprise operations and the ERP package. Moreover, employees or staff need to have sufficient knowledge and training opportunities to familiarize themselves with ERP adoption and implementation. Because lack of knowledge, experience and training may lead to unnecessary customization of standard features available in ERP which need to be avoided. Large scale customizations in Indian SMEs are undesirable since they may result in failure when upgrades are made in future. While it can happen due to choosing wrong package that require high level of customization and may result in unsuccessful ERP implementation in Indian SMEs. While over-customization can be expensive for Indian SMEs adding excessive cost and time that needs to be avoided by managers. Other risks associated with ERP customization is 'business continuity risk' which is related to an extensively customized ERP system that makes Indian SMEs to be more dependent on the developer, and hence it forces SMEs to build a quality relationship with software suppliers, developer or IT consultant. Whereas, 'long-term ownership risk' is the risk associated to highly customized ERP solution which needs constant updates to continue or work smoothly. These updates can be related to hardware, operating systems and software applications.

2) Top management support

ERP implementation supports the enterprises to achieve administrative clarity to perform agile business by utilizing the hidden information, and effectively transforming the business data into meaningful and useful information in various functional departments (Al-Khasawneh, Malkawi, AlGarni. 2018). The managerial expertise of top managers along with vision and cooperation is among key factors that significantly and positively affect ERP implementation in SMEs (Philip, 2011). Top management support is the level of support, commitment, and active engagement from top management which is highly essential when it comes to planning and adoption of ERP system in SMEs and to ensure its appropriate usage by SME staff. In other words, top management support is crucial for successful adoption of ERP (Al-Alawi, A.I.; Al-Ali, F.M., 2015). Therefore, it is essential to make sure that top management are dedicated and focused towards providing necessary resources for successful implementation of ERP, while also minimizing the adoption resistance (Almaiah, M.A, 2018). Businesses are subjected to change and enterprises are forced to re-align their business goals, processes according to the changes in market environment. For example, it has been noticed that many ERP modules are not flexible or adaptive to the changing business needs and evolving business processes. This necessitates SMEs to focus on three main categories of management, which is strategic planning, management control and controlling operations. Lack of strategic planning from managerial side could influence the level of ERP customization to be made in SMEs, while better planning could improve the use of ERP system's functionality. When change management is not controlled or executed without following standard procedures, it may lead to confusion among employees and acts against the ERP implementation. Therefore, the manager/owner in Indian SMEs must be well equipped with essential technical knowledge, experience and expertise on ERP system's implementation, since they are responsible for making crucial decisions in SMEs.

3) Systematic employee training

Apart from top management support, another crucial factor that comes under organizational fitness of ERP is 'systematic training' of employees. It is the level at which an enterprise provides qualitative and quantitative instructions to its staff members related to application of particular technical tool. Along with supporting in knowledge growth for efficient and effective system deployment, training also minimizes challenges and confusion (Althunibat; Almaiah; Altarawneh; 2021). Since ERP is a complex IT tool and its implementation is quite challenging task for Indian

SMEs. Moreover, it requires Indian SMEs to deal with prior and post ERP implementation consequences. And if SME employees are not fully familiar with deployed ERP system, they may be reluctant to use it or they may not use it efficiently. While employee resistance is an important factor that may affect ERP implementation if employees are not educated about perceived benefits of ERP. Therefore, systematic training of employees is essential along with effective communication to deal with change management at each and every level. However, this must be done through educating and training Indian SME employees prior to actual adoption of ERP system in order to reduce the stress and confusion on ERP implementation and to have clarity on its advantages. Moreover, different groups of SME employees need different level of training, and hence SME managers need to arrange special training sessions targeting particular group of employees and ensure that relevant knowledge is transferred. Because one size does not fit for all as people have different culture, background, experience and skillset particularly in technical areas. Whereas, inadequate training and knowledge on ERP causes issues related to its implementation particularly for the employees that deals with day-to-day ERP activities in Indian SMEs. However, another factor that effects ERP training and implementation is inadequate requirements definition. The most suitable modules in ERP are implemented only if proper knowledge and training is provided to employees on requirements. Because when requirements are very clearly defined and mentioned, it becomes easier for employees to implement ERP accordingly. Therefore, the manager/owner of Indian SMEs need to be transparent and communicative on this issue and provide employees clarity on requirements and train them accordingly for the efficient use of ERP.

4) Financial stability

ERP implementation is a time-consuming process which puts more cost on the enterprise. If sufficient budget is not allocated for ERP adoption as well as its maintenance it may cause disaster or major loss to the enterprise. Indian SMEs need to allocate sufficient financial resources for ERP to be executed smoothly apart from the manpower and infrastructure. It is expected that often the estimated budgets are not be enough and there might be hidden and unexpected costs during ERP implementation. Therefore, top-management in Indian SMEs need to be particularly careful to avoid unexpected situations by having sufficient funds, while also having contingency plans for emergency situations and unexpected events to ensure a successful ERP implementation. In the context of the adopted agility framework, 'flexibility' refers to the quality or characteristic of the

enterprise resources. Being flexible implies that making use of the quality resources of the enterprise to take advantage and seize various market opportunities and improve the variety of products and services that can be delivered by the enterprise. In order to improve the 'flexibility' of Indian SMEs, the aforementioned and suggested measures are highly valuable, such as the ERP customization and configuration which improves the settings and parameters of ERP system in Indian SME, so that the operational technologies become more flexible and efficient in delivering a wide variety of products to the customers. Moreover, the systematic training offered to Indian SME employees on effective use of ERP can lead to improved skillset and competence levels of Indian SME employees, which is also helpful in improving the range of products from narrow to very wide range. Apart from that, top-management's support and cooperation, along with enough financial resources can help Indian SMEs to improve the quality of enterprise resources. Hence by adopting the suggested measures Indian SMEs are not only able to improve the 'flexibility' dimension of agility, but it also contributes to opportunity creation. Because flexibility allows quality resources to be used by Indian SMEs, which also improves variety of products and services delivered by Indian SMEs. This can create new potential customers that might be influenced or attracted towards the newly introduced products or services that are of high quality and in more variety. Therefore, the suggested measures enable Indian SMEs to create new customers or customer groups for their new products or services and hence lead to opportunity creation. Hence, research hypothesis **(H3)** can be supported by implementing suggested measures.

4.2.4.3 Improvement of Intelligence

DvI1: The frequency at which employees are given systematic training.

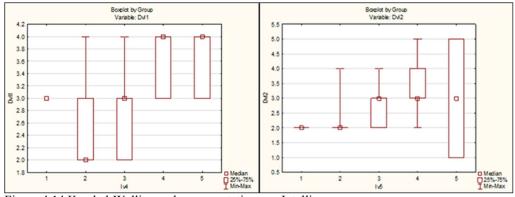*DvI2: The innovative technologies lead to introduce new products in the market.*

Figure 4.14 Kruskal-Wallis graph representations on Intelligence

Source: Statistica software

The Kruskal-Wallis graph in figure (4.14) represents the intensity of training given to Indian SME employees on e-commerce and its effect on sales. According to which, using e-commerce shows moderate improvement on sales if training is given occasionally. Whereas, using e-commerce shows satisfactory to very high level of improvement on sales, if training is provided systematically. By analyzing these results, it suggests that majority of Indian SME employees are occasionally trained for e-commerce and they are in need for more systematic trainings to implement e-commerce. Whereas, the Kruskal-Wallis graph in figure (4.14) shows that using innovative technologies such as e-commerce Online-payment system shows no improvement on business efficiency, if new products are rarely introduced. And using e-commerce Online-Payment system have moderate or high level of improvement on business efficiency, if new products are occasionally introduced. However, by analyzing the results, it is clear that majority of Indian SMEs introduce new products rarely or occasionally due to less intensity usage of innovative technologies. This implies that in order to introduce new products more often in the markets, Indian SMEs need to use innovative technologies such as e-commerce Online-payment system more intensively which in turn facilitates e-commerce operations and can improve the business efficiency to very high-levels. Moreover, it is not only crucial to improve the intensity of usage of innovative technologies such as 'Online payment system' in Indian SMEs but also the employees need to be trained and educated on how to use the newly adopted technologies by offering them training opportunities in a more systematic manner, so that high levels of productivity and business efficiency can be obtained. However, in order to achieve this, Indian SMEs need to adopt certain measures and follow improvement policies, specially by providing their employees with training opportunities on effective involvement and use of innovative technologies specially in e-

commerce. The most influencing factors that have been identified by many researchers in adopting e-commerce include relative advantage, compatibility, organizational readiness, and managerial support. Technology readiness is another important factor in successful adoption of e-commerce in Indian SMEs which refers to both technology infrastructure and IT human resources. It is also represented as 'technical capabilities' of SMEs which include technology infrastructure, relevant systems (e.g., e-commerce platforms) and technical skills (both managerial skills and employee skills) that can support a smooth e-commerce adoption. However, managerial understanding and expertise is necessary condition to exploit the real advantages of e-commerce activities in SMEs.

1) Improving managerial skills for implementing e-commerce

With greater managerial skills, technological resources can be used in a more efficient and beneficial way. This is particularly true for Indian SMEs, since they are adapted to rely on a centralized administration system, therefore the SME owner/manager plays a crucial role in making strategic and business-related decisions. Specially the owner/manager's IT experience and IT ability is crucial determinant factor in Indian SMEs that is essential in several areas such as choosing the right e-commerce platform, deploying it correctly and timely, effective implementation and to promptly deal with e-commerce customers etc. Therefore, Indian SME owner/manager need to ensure that right managerial skills are acquired and executed to gain potential benefits of e-commerce adoption. Apart from IT skills and experience, the manager/owner's innovativeness is also an influential factor in adopting ecommerce in Indian SMEs. Innovativeness not only refers to the degree to which a person finds creative solutions to technical issues, but it also includes the quickness of reacting to the issue and finding solutions faster than others in the same social settings. An innovative manager usually prefers to find a solution that has not been tried or conceived earlier and which is also linked with risk factor. Since, e-commerce adoption is a risk job, especially in the context of SMEs, and when implementing e-commerce in developing nations like India it becomes even more risky. Therefore, innovativeness of Indian SMEs owner/manager is highly essential in deploying different technical tools (both software and hardware tools) while conducting e-commerce activities. Because an innovative manager is the one who tends to find a solution by altering the structure where the problem is located. Moreover, it is a challenging task to choose appropriate IT tools according to the SMEs business settings and needs. Therefore, the role of SME manager becomes even more crucial in

adopting and implementing innovative technologies such as 'Online-payment system' in Indian SMEs while conducting e-commerce activities. SMEs in India operate and acts as heterogeneous groups or clusters, that consist of different types of enterprises such as grocery stores, small restaurants, computer peripheral shops, automotive parts shops, software enterprises, shops related to electric items and electronics etc. While implementing e-commerce in such diverse types of Indian SMEs leads to generate a lot of variety of information related to products, prices, designs, and other utilities. This information can be related to online services, agriculture productivity rates, computer tutorials, certificates related to hereditary social groups, managing public complaints, documents related to land issues and rights, online services, e-mail, rural e-bids, marriage services, information of public plans, children-specific documents, online job exchange, employment demand availability etc. This information if not utilized in an efficient and useful manner, it is a great loss for both the enterprise and the consumers. With low-levels of computer literacy and English proficiency and lack of availability of local language websites, the employees may not be able use or apply this information appropriately. Therefore, the manager needs to creatively manage this information needs of customers and ensure that SME employees have right skills and abilities that are relevant and needed for e-commerce activities. Moreover, employees must be provided with sufficient technological resources with access to right information on existing technologies. Especially managerial intervention and assistance becomes more crucial when new innovative technologies related to e-commerce are deployed in Indian SMEs. Because innovativeness is not only about deployment and use technology and services but also connected with methods or ways in which they are managed to achieve the intended results. Indian SMEs need to utilize the technical potential and innovativeness of the manager/owner, so that innovative technologies are effectively used in e-commerce activities to increase the frequency of delivering products and services to customers. This can be applied to areas of e-commerce such as payment systems, vendor management, logistics, brand management, e-market development, e-product development, e-customer support etc.

2) Providing training opportunities to develop e-commerce skills

The Kruskal-Wallis graph in figure (4.14) suggest that the Online-payment system's effectiveness in improving business efficiency of Indian SMEs is still moderate and there a need and scope for improvement. In this context, the managerial skills combined with effective

employee training is necessary. Since one of the responsibilities of manager also includes to engage its employees in proper training activities and disseminate required knowledge on e-commerce implementation. The manager needs to ensure that all the employees from various departments that are involved in e-commerce operations with customers need to be well acquainted and familiar with the process of 'Online-payment system' and its functionality. As pointed out by the research of (Poorja Sharma 2014), the employee readiness to access and use new system is the most challenging factor of e-commerce adoption in Indian SMEs that has major implications on business. Therefore, the managers/owners of Indian SMEs must ensure that sufficient training opportunities are provided to SME employees in order to develop required technological skills to efficiently manage 'Online-payment systems' in e-commerce activities which can lead to improved business efficiency of Indian SMEs. However, lack of knowledge or inadequate information about the benefits of e-commerce is a potential barrier that prevents the implementation of e-commerce and related technologies in Indian SMEs. Therefore, it is essential that knowledge oriented and technically skillful employees are hired or provided with training sessions to manage the e-commerce tools, since e-commerce deals with information intensive high-tech devices, software, and applications tools that are extensively used in production and commercial business. Moreover, the staff and management of Indian SMEs must always be ready to quickly learn and educate themself about new innovative technologies and business models that are continuously evolving in market environment. Specially with the rapid growth of business-to-customer (B2C) and business-to-business (B2B) business models, SME employees are required to have the technical skills and knowledge that was only expected with the top-managers or experts previously. This knowledge includes changing customer needs, preferences and patterns of consuming products, familiarization of domestic and foreign market's trading rules that are applicable, and the latest innovative technologies trending in the e-markets such as e-billing or e-invoicing, e-payments also known as online payment system etc. Since Indian SMEs are frequently in need of talented and skilled workforce, they can utilize that online job portals which provide a platform to match the enterprise requirements to candidate's profile and makes the hiring process easier. Talent management use to be a difficult process for Indian SMEs in the past, but now with accessibility to job portals and e-learning platforms, it became much simpler, efficient and less time-consuming process to hire technically sound labor. Although Indian SMEs need to spend on e-hiring facilities and portals, but it is a useful and beneficial deal for them in the long-run. Since

hiring right talent adds to the strength of the enterprise, especially for the Indian SMEs that seek to exploit market opportunities.
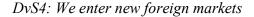
3) Improving coordination between SME management and employees

The cooperation and coordination between SME manager/owner with its employees make a big difference on how effectively the e-commerce is executed. While a strong employee-manager relationship is highly beneficial for Indian SMEs because it facilitates in organizational flexibility and communication between the employees and top-management, which is an important factor in implementing innovative technologies such as the Online payment systems. Moreover, innovations are easily accepted and implemented by employees if those innovations are compatible with organizational culture and practices. While according to (Lin and McDonough, 2011), a knowledge sharing culture promotes information sharing and creativity among the employees, which leads to organizational compatibility with innovations and hence makes it easier for Indian SMEs to adopt innovative technologies such as the Online payment systems in e-commerce. A strategic and innovative manager is capable of creating a knowledge sharing culture which also support the enterprise to improve its innovation ambidexterity (Lin and McDonough, 2011). Whereas, the limited flow of resources, rigid rules and regulations makes it difficult for employees to simultaneously engage in both explorative and exploitative activities, which also hinders the achievement of organizational goals (Su et al., 2011). Therefore, for an effective knowledge sharing and innovation adaptability in Indian SMEs, it is very important that there exists cooperation and coordination among SME manager/owner and the employees and that needs to be strengthened to engage in both explorative and exploitative activities by Indian SMEs. Explorative opportunities are the new potential opportunities while exploitative are the ones which the SME can currently exploit. This can be achieved if employees are encouraged by SME managers/owners and provided with an atmosphere of being creative and innovative while using the organizational resources. This also leads to active employee engagement, increased knowledge flow within the enterprise while achieving performance benefits and agility.

Intelligence in the context of agility framework refers to the ability of the enterprise to predict or foresee the upcoming market opportunities by analyzing the environment changes. This enables the enterprise to use its resources in a way that a targeted response is prepared for the forthcoming opportunities that can be converted into the real opportunities. By adopting suggested measures in

the areas such as improving managerial skills and innovativeness enables Indian SMEs to use its managerial resources to predict or foresee the upcoming market opportunities. While the training provided for SME employees on e-commerce and innovative technologies can help the Indian SMEs to prepare for a targeted response to convert the forthcoming opportunities into actual opportunities. Because with proper training, Indian SME employees are able to react to the market opportunities in a better way. Hence by implementing the suggested measures Indian SMEs can improve the 'intelligence' dimension of agility. Whereas, by improving the coordination between Indian SME managers and the SME employees enables the enterprise to exploit the opportunity in a well-planned and strategic manner leading to improved business efficiency and productivity, which supports the research hypothesis **(H1).** Because **(H1)** deals with effective sensing and exploitation of market opportunities for the benefit of the enterprise. This also improves the reactive responsiveness of Indian SMEs and hence supports the reactive model or dimension of enterprise agility.

4.2.4.4 Improvement of Shrewdness

DvS1: We adapt our products and technologies to the needs and expectations of our customers

DvS4: We enter new foreign markets

Figure 4.15 Kruskal-Wallis graph representations on Shrewdness
Source: Statistica software

According to the Kruskal-Wallis graph shown in figure (4.15) if using e-commerce shows moderate improvement in sales then Indian SMEs enter very rarely in the foreign markets. While if e-commerce usage has satisfactory level of improvement on sales in Indian SMEs, then they enter new foreign markets occasionally. This can be interpreted as, the more the Indian SMEs

implement e-commerce efficiently, the more they show improvement in sales and enter in new foreign markets. However, by analyzing the results it shows that majority of Indian SMEs does implement e-commerce efficiently and hence do not enter in to new foreign markets frequently. Hence there is a need to improve the ability of Indian SMEs to effectively use e-commerce in order to enter into the foreign markets more frequently and improve their sales. E-commerce can assist Indian SMEs not only to participate in international trading and marketing activities while minimizing costs and boosting efficiency but also to contribute to global economy. While according to (UNIDO, 2018), SME's reputation of conducting efficient and effective online transactions creates an image of SMEs in the international markets and enable them to grow stronger. Specially in the context of SMEs, e-commerce eliminates the challenges and issues related size limitations during their market access and provides the opportunity to collaborate with businesses from all over the world and strengthen their cross-sectoral cooperation among global markets by knowing more about their needs resulting in to enhanced global competitiveness. Therefore, Indian SMEs must put high emphasis and preference on international trading activities specially by adopting e-commerce. Recently there has been a significant increase in the use of cross-border e-commerce platforms and a lot of consumers are opting for new foreign products of high quality (Qi, X.; Chan, J.H.; Hu, J.; Li, Y., 2020), which has also resulted in the demand for internet services which facilitates direct overseas shopping. Although the growth of cross-border e-commerce activities in SMEs is affected and promoted by customer's attitude towards buying those products. However, there are other important factors that affect the SME's entry in foreign markets by adopting e-commerce. These factors majorly include technology, economic, social, and legal issues.

1) Improving economic factors to enter e-commerce foreign markets

It is related to cost justification and concerns about infrastructure upgrades and the skill shortage issues (Yadav, Gahlot, Kaswan, Rathi, 2021) and the growing expenses related to global e-commerce capabilities to operate from anywhere in the world (Xiao, Guo, Yu, Liu, 2019). It is crucial for Indian SMEs to consider these issues and ensure right funding for e-commerce activities. Moreover, Indian SMEs need to effectively 'market' their services by using marketing tools such as website marketing, advertising tools during cross-border e-commerce activities. Hence, they need to control and minimize the promotion costs, appropriately reduce the investment

in advertising and store activities. The 'pricing' factor is important because it is connected with the profits of intermediaries such as platform suppliers, sellers, suppliers, and consumer purchases. Indian SMEs must ensure right pricing options and optimize their internal operations and in-store activities for cost reduction process. Apart from that they can also adjust the costs and investment related to human resources and realign their sales strategy. Costs related to utilizing broadband infrastructure, and applications are likely to affect Indian SME's cross-border e-commerce, since the development of ICT-related infrastructure in Asian economies is uneven. Moreover, the region-wide ICT infrastructure development gaps may also incur additional cost. Indian SME managers/owners can strategize their investments related to hardware and software procurement that is needed when implementing e-commerce in foreign markets. For example, they can deploy flexible third-party e-commerce software tools for foreign transactions that are affordable and easily manageable. Moreover, they can increasingly shift towards wireless broadband services from fixed wired broadband service, since it can minimize the cost needed on ICT infrastructure and improve the efficiency at the same time.

2) Improving technology factors to enter e-commerce foreign markets

Technological factors include issue related to security, stability, reliability, communication protocols, bandwidth, and integration etc. For example, the most important factor related to the security is the online payment security systems. When cross-border ecommerce is performed there are three modes of payment which is a third-party payment, credit card payment, and overseas remittance. However, this involves potential security threats, such as hacking of transactional data or the misuse of financial and personal information. Therefore, Indian SMEs perceives it as a major threat and risky affair, especially when conducting business with overseas partners or customers. While the customer relationship depends majorly on 'trust' factor, where customers expect that the online retailer will use customer information appropriately. It is the responsibility of Indian SMEs owner/manage to maintain the trust with clients by providing secure payment options. While online/e-payment system serves as an important bridge between the virtual and physical dimensions of e-commerce transactions. There are multiple solutions that exists in today's market for e-commerce payments including the cash on delivery method, prepaid, credit cards, debit cards, e-banking, mobile payment, smartcard, e-wallets, etc. Indian SMEs need to choose the right payment method which is convenient and safer from the data security perspective. The availability

of various payment mode options is in fact a positive sign for Indian SMEs to promote themselves in cross-border e-commerce activities, while the diversity of payment methods also provides the consumers an option to select their preferred ways of payment during the online business. Instead of serving just as a simple network of payment, Indian SMEs need to utilize the Online payment system as a service platform that can accommodate various other forms of e-payment methods (e.g., e-banking, mobile payment, smartcard, credit cards, debit cards, e-wallets, etc.) in order to ensure transaction security, consumer protection and tracing of credit records. Although deploying and maintaining e-payment system in Indian SMEs may demand resources as it is a resource-intensive system in term of cost, technology, and human capital. But it can deliver huge benefits in the long run for Indian SMEs specially by creating opportunities to frequently enter in new foreign markets and in gaining customer trust. Moreover, Indian SMEs while choosing online shopping platforms, must give high preference to the websites that have high levels of customer privacy and security settings, and that offer strong protection to customer's data and payments. This ultimately results in easing and facilitating the Indian SMEs for cross-border e-commerce and entering in to new foreign markets. With the advancement in mobile technology such as 3G, 4G, and 5G implementing on smart-end mobile phones affected the commercial activities globally. SMEs in India can utilize this as an opportunity to instantly connect their business to new foreign markets. Because it is both innovative as well as convenient for SMEs to adopt e-commerce through mobile devices, especially when a large number of smartphone users are interested in trading activities through smartphones from different locations across the globe. Such online shoppers are able to instantly access e-commerce websites through a smartphone device conveniently and effectively. However, it requires that there exists good technology infrastructure in the country such as highly efficient telecommunication networks, high rate of internet accessibility with low interruptions, having an integrated e-commerce system, reliable e-payment infrastructure, and logistics. These are all factors that support and encourage Indian SMEs in performing cross-border e-commerce, since such infrastructure provides a good environment and opportunity for Indian SMEs to enter in new foreign markets through e-commerce platforms and also to expand the business reach. However, the government need to ensure that such infrastructure is accessible in all parts of India and take necessary steps.

3) Mitigating the legal factors to enter e-commerce foreign markets

One of the prerequisites for conducting cross-border e-commerce in SMEs is that they must be able to freely and efficiently transfer and share the business information across the borders without being constrained by technical limitations or competitive barriers. Since different countries have different data management rules and customer protection acts, this may limit the cross-border trading activities and create barriers specially for Indian SMEs to enter or to find new opportunities in foreign markets. The customer and the SME sellers both are in need for security assurance by their respective governments for their international electronic transactions to avoid any issues related to services, resources, and communication. Rules and regulations are essential for both systematizing the process as well as safeguarding the rights of all parties engaged in online transactions (Kartiwi & MacGregor, 2007). Moreover, the cost incurred during setting up of e-commerce is a big challenge for majority of SMEs, as they need to spend on installing computer networks and train their employees prior to its application (AlSomali, Gholami, & Clegg, 2015). The government plays an important role in this context, because the government support in reducing taxes is a big relief for Indian SMEs in setting up their online business, since it reduces the cost burden at the initial stages which is crucial and thereby encouraging the e-commerce adoption and implementation in Indian SMEs. Almost all the ASEAN region countries including India have initiated the e-commerce regulation process by enacting certain acts. For example, in February 2019 India has enacted 'Draft National E-commerce Policy', and in August 2019 India has introduced 'Consumer Protection Act, 2019' with the purpose of enhancing customer rights and e-commerce activities to support digital economy. However, under the act of 'Consumer Protection (E-commerce) Rules, 2019', conditions were established related to legal issues, setting up of e-commerce, and e-commerce operations, their liability for non-compliance etc. Whereas, the international and regional agreements, such as between the ASEAN member countries through various bilateral and multilateral agreements has facilitated the digital connectivity and e-commerce activities in India. In addition, steps were taken to attract foreign direct investments (FDI) and allowed 100% of FDI to invest in online retail. This is a major initiative in the direction of promoting the e-commerce industry level growth and development as well as attracting more foreign investments in the country. Indian SMEs need to leverage such government initiatives specially by venturing in foreign markets though e-commerce platforms. However, Indian SMEs must also be aware of the benefits and potential opportunities they have by performing cross-border e-commerce activities. For this they must visit the government's official websites and

portals that are usually helpful for receiving relevant information on the subject. Moreover, Indian government has setup technology centers for transferring technology to Indian SMEs and arranged training programs for promoting e-commerce awareness and knowledge. Other initiatives include financial assistance programs, reduction of transaction costs on e-commerce platforms, help and support SMEs in building their brand image, cooperation with research institutes to support skill development in SMEs. Indian SMEs can take advantage of such government policies and facilities to strengthen and improve their technological, financial, organizational capacity which facilitates to not only in local markets but also to enter and grow in new foreign markets through e-commerce.

4) Adopting the social factors to enter e-commerce foreign markets

These are the issues and challenges that Indian SMEs face related to diverse cultures, the customers concerns and resistance due to insufficient trust etc. It is very important for Indian SMEs to know and understand the cultural diversity and its business aspects on cross-border e-commerce, because it can significantly affect the revenues and profit of Indian SMEs due to the sales and business with customers from different geographical regions. Moreover, SMEs are required to build and gain confidence and trust with foreign counterparts during cross-border e-commerce operations. In order to achieve this, Indian SMEs need to analyze the social dimensions of the target market of foreign country and design and offer the products/services accordingly. This will increase the possibility of selling the product/service more successfully in foreign markets on Indian SME e-commerce platforms. Another social aspect is the customer service during issues related to product. Indian SMEs need to make sure that a reliable communication exists between the seller and the foreign customer to sort the issues related to the sold product, such as improvements to be made or processing the product return formalities. An external communication medium which is both efficient and flexible is needed in such situations. While the rising popularity of social media platforms has further helped the development of e-commerce market according to (UNIDO, 2017) report. Indian SMEs can and must use social media platforms to reduce the buyer-seller barriers to perform effective sales operations and offer customer services for building customer trust and company's brand image specially in the foreign markets by using e-commerce platforms. Social media platforms are highly useful in this process since they are used everywhere around the globe, especially foreign customers may rely on useful and communicative information from social media to know more about product and service offerings from Indian

SMEs. Therefore, the presence of Indian SMEs on social media platforms can be highly beneficial during cross-border ecommerce activities. Moreover, the language barrier can also affect the cross-border e-commerce in Indian SMEs since there exist language difference between nation to nation and specially India has region specific language barriers. Therefore, Indian SMEs need to work on minimizing this challenge by giving proper training opportunities to employees to gain language proficiency according to international trading rules.

5) Improving Cloud services efficiency

The Kruskal-Wallis graph in figure (4.15) shows that if Cloud services are not very effective in handling business resources then the products and technologies are adapted slowly to the needs and expectations of customers. And if the Cloud services handle business resources in a moderate to satisfactory level effectiveness, then the products and technologies are adapted quickly to the needs and expectations of customers. By analyzing the results, it appears that Indian SMEs need to improve the efficiency of Cloud services to very high level in order to rapidly adapt products and technologies according to the needs and expectations of customers. Contrary to large enterprises, SMEs in India generally do not tend to hire enough staff members in their IT unit and even may not have a formal IT department, in order to avoid remuneration needed for employees. This can lead to an unorganized IT resource management team. The manager of Indian SMEs needs to analyze the IT competencies of their employees to ensure they have Cloud related technical knowledge and skills to handle Cloud services effectively. Moreover, they need to employ the human resources consisting of full-time dedicated IT staff that are able to handle IT departments. Even though if SME employees have an IT background, however, it is likely that they may not have specific IT technical expertise related to Cloud technology implementation. Therefore, Indian SME's owner/manager need to provide enough training opportunities to employees to operationalize Cloud services effectively. On the other hand, Cloud computing offers benefits in utilizing various computing resources such as computers, storage devices, services, and software etc. over the internet (Laudon and Traver, 2016). And serves as a potential opportunity for SMEs to leverage the advantages of sophisticated technology. While the costs pertaining to employees, infrastructure, maintenance and management can be minimized in SMEs by adopting Cloud services (Cruz, X., 2013). However, when used as a utility service, Cloud services raise certain uncertainties among SMEs such as the transactions are not purely market-based, rather they

are more dependent on relationship with service provider which can also affects SME's investment decisions on computing assets. Although many countries including India are shifting towards Cloud centric management to ensure robust operations, yet the shift is rather slow in Indian SMEs. This can be linked to the inefficiency of 'Cloud service provider' that is not capable enough in assessing SME requirements. In this context, Indian SME manager/owner need to assess the ability and expertise of a Cloud service provider before hiring the Cloud service or architecture to ensure that the services offered by the Cloud provider are consistent and reliable for future.

Another significant issue in SMEs is that they have an outdated software and/or hardware that is still being used, which acts like a hurdle when deploying Cloud services. Cloud requires special IT skills to develop and deploy applications on Cloud architecture, and to exploit the flexibility and remote accessibility of data and applications. It is possible, only when organizational structures and business models are rearranged and realigned to take full advantage of the potential of Cloud computing. Therefore, the manager or owner of Indian SMEs need to be well acquainted with the skills and knowledge of Cloud deployment. Whereas, insufficient information and awareness on Cloud services by Indian SMEs mangers/owners can hinders its adoption. This is one of the important issues that need to be resolved by the government by means of offering various trainings and awareness programs on the benefits and usage of Cloud technology specially by offering initiatives, schemes and policies related to Cloud deployment in Indian SMEs. Specially the legal issues related to the Cloud contracts and data-related regulations on remote locations are special matters that can only be controlled by government authorities and legal departments. Moreover, internet connection plays a vital role in Cloud deployment in SMEs and a major concern for Indian SMEs. Hence, the government should focus in their policies to assure reliable and continuous Internet connection for Indian SMEs, so that they can access Cloud-based services. Although it is considered that Cloud services the pay-per-use pricing model offered by most of the Cloud service providers is beneficial for most SMEs as they drastically minimize the operational costs (Buyya, R., Broberg, J & Goscinski, A, 2011). And data in Cloud environment can be accessed from anywhere at any time by using mobile technology, which facilitates in rapid decision-making (Alali, F.A. and C.-L. Yeh, 2012). However, with all the mentioned benefits that Cloud Computing offers for Indian SMEs, the Cloud solution may not be suitable for enterprises that deals with highly sensitive data or if they have data security concerns. Although the adoption of Cloud is purely driven by its technological benefits, however it as a cost and risk-based decision (Martens

and Teuteberg, 2012). Therefore, a risk/benefit analysis is crucial factor that need to be considered before an enterprise adopts the Cloud Computing solutions, to ensure that the business is safe in all aspects (Sandu, R., et al., 2017). The risk related to Cloud computing technology needs to be well assessed by Indian SMEs owners before its adoption. Especially due to the fact that issues related to data privacy in Cloud are often overlooked by Indian SMEs due to lack of information or security concerns. Hence technological knowledge and awareness of manager/owner is crucial factor. Because Cloud technology needs careful assessment of benefits and risk prior to its adoption, especially the need for investment related decisions on physical, technical and computing resources. Hence SME manager/owner need to have or develop essential skills and knowledge to perform risk/benefit analysis before deploying Cloud Computing in Indian SMEs.

The above discussed measures are useful in improving the efficiency of Indian SMEs to enter in to new foreign markets by using e-commerce. Specially the measures suggested to improve the economical, technological, social and legal aspects of e-commerce implementation enables Indian SMEs not only to improve the level of their sales but also helps the enterprise to seize market opportunities very rapidly and exploit them to its advantage. For instance, by using third-party e-commerce software tools that minimizes the operational cost and easily managed while performing e-commerce foreign transactions and activities. By using the Online payment system that offers various forms of e-payment options and methods such as e-banking, mobile payment, smartcard, credit cards, debit cards, e-wallets, etc. ensuring transaction security and consumer protection. And by relying on wireless broadband internet services to save cost needed on physical infrastructure, Indian SMEs can achieve competitive benefits as well as leverage new market opportunities in foreign markets prior to its competitors in a dynamic way. Hence by implementing such measures or actions, Indian SMEs are able to convert the band of opportunities that are accessible into a band of opportunities that are already being exploited. In this way the suggested measures help to improve the 'shrewdness' of Indian SMEs. While this also supports the research hypothesis **(H2)**, because by implementing the Online payment system in various forms such as e-banking, mobile payment, smartcard, credit cards, debit cards, e-wallets, etc. not only ensures secure transactions but also customer responsiveness due to the fact that more and more customers will tend to rely and opt for secure transaction modes and methods of their payments. Hence it improves the customer responsiveness of Indian SMEs and supports the conditions of research hypothesis **(H2).** Moreover, Indian SMEs can use Social Media platforms to strengthen their brand image thereby

improving their business value by establishing trust factor with customers from both domestic and foreign markets. This facilitates Indian SMEs in building and maintaining strong relationship with domestic and foreign customers and minimize the buyer-seller barriers specially when performing e-commerce activities in foreign markets which might also lead to effective sales operations and customer services in the foreign markets. 'Proactiveness' deals with preparing for the opportunity prior to the real event occurs. It has been linked to opportunity-seeking behavior and the characteristics such as alertness, readiness, preparedness (Fayezi et al., 2015). Whereas, by means of Social Media platforms Indian SMEs can build a strong brand image that can be useful for getting prepared to exploit the future opportunities specially in foreign markets. Because the brand image is unique selling point or a point of differentiation that an enterprise can utilize for seizing upcoming opportunities. For example, the potential customers who might get influenced by the SME's brand image in foreign markets and subscribe or buy the product/service. In this way, Indian SMEs can utilize social media platforms to improve their quality or ability of 'proactiveness' specially to enter in to new foreign markets and to get prepared to seizing forthcoming market opportunities.

The efficiency of Cloud services in Indian SMEs can be improved by applying the suggested measures such as, the SME managers/owners need to develop necessary expertise on Cloud services adoption. They must also assess the expertise and efficiency of 'Cloud service provider' and perform risk/benefit analysis before hiring Cloud services. The manager must also provide training opportunities for SME employees to effectively operationalize the Cloud services. By following such actions or measures, the Cloud services efficiency in Indian SMEs can be improved to higher levels, resulting in adaptation of products and technologies according to needs and expectations of customers in a rapid manner. Such rapid adaptation of products and technologies prior to the competitors enable Indian SMEs to convert the band of opportunities that are accessible into a band of opportunities that are already being exploited. Hence this enables Indian SMEs to seize the market opportunities very rapidly and improves the 'shrewdness' dimension of agility. Moreover, it also supports research hypothesis **(H1)**, since **(H1)** deals with effective sensing and exploitation of market opportunities by using IT. Therefore, the suggested measures for improving Cloud services in Indian SMEs also supports the research hypothesis **(H1)**.

Conclusions

Theoretical contribution

Given the strategic importance of Indian SME industry that operates in various sectors and regions and its major contribution to national economic growth, the results of this research have both theoretical and practical value. The theoretical significance contributes to fulfill the research gap that exist in the Indian SME literature on the role and influence of information technology (IT) in improving the agility of Indian SMEs. The research results have shown that the IT capabilities of Indian SMEs which include the operational IT infrastructure along with the IT competencies of Indian SME managers and employees are crucial when it comes to scanning the environmental changes for detecting new opportunities and to successfully exploit them. The IT infrastructure related to basic IT tools is vital for Indian SMEs in order to engage the existing and new customers on a daily basis and to maintain their portfolio for future services. The basic IT tools have shown to be highly significant for opportunity identification for a larger section of Indian SMEs. Whereas, the IT infrastructure pertaining to online shopping and virtual transactions have gained much prominence among Indian SMEs and have shown to be beneficial in terms of improving sales efficiency, productivity and diversity of products and services that are offered to customers. This type of IT has shown to contribute immensely for Indian SME sector to expand the business in both domestic and foreign markets which creates new opportunities for Indian SMEs. The advanced IT tools that are responsible for managing enterprise resources of Indian SMEs have shown to be more effective when interlinked and used with other IT tools. Since the interlinking of IT tools, improves the overall efficiency of the conventional IT tools and can be implemented in an upgraded and latest method. This leads to a higher responsiveness of IT system in Indian SMEs, and helps to identify and exploit market opportunities in a more effective way. This type of inter-collaboration of IT tools is highly recommended for Indian SMEs to improve their responsiveness on opportunity detection, exploitation as well as opportunity creation and to improve the overall enterprise agility. Such integrated IT tools are also helpful for improving customer responsiveness because customers are able to interact with SMEs with high speed due to the reduced physical involvement as well as with less effort and time. Moreover, such integrated IT tools provide high security for transactions which is a positive sign to attract new customers

because customers prefer efficient and less risky mode of business. In this way integrated IT tools can create new opportunities by attracting potential customers for Indian SMEs. Whereas the IT skilled employees prove to be valuable assets for Indian SMEs since they play a major part in being quick and reactive towards new market changes. The swift response of Indian SME employees towards customer needs and demands for products and services is due to their IT knowledge and skills and the use of appropriate IT tools and techniques. In this context, social media platforms have shown to be popular among Indian SMEs, since they provide instant connectivity with customers to gain feedbacks and opinion on the offered products and services. This helps Indian SMEs in improve their products and services in the future according to the popular customer demands and preferences. Such IT tools are convenient and easy to access for both SME employees as well as for the customers and provides an excellent medium of communication. This in turn facilitates to improve enterprise agility of Indian SMEs by identifying new opportunities and exploit them quickly and efficiently. While the IT competencies of Indian SME employees shown to have greater impact on customer responsiveness and helps to identify, exploit and create new opportunities for Indian SMEs. By this it is proved that IT capabilities of Indian SMEs have positive influence on sensing and exploitation of market opportunities, customer responsiveness and on opportunity creation. And hence all the three-research hypothesis H1, H2 and H3 are successfully proved to be positive.

This research is based on the agility framework that has been used for the first time in the context of Indian SMEs. Theoretically, the adopted agility framework for this study blends or mixes three most important and well accepted agility frameworks including i) resource-based view (RBV), ii) enabler-capability view, and iii) sense-response framework. Each of these earlier frameworks mentioned have presented agility which is rather restrictive to a particular viewpoint and excludes other viewpoints. However, the adopted agility framework of this research conceptualizes the agility of an enterprise in four key perspectives known as agility dimensions or attributes, which include 'brightness', 'flexibility', 'intelligence' and 'shrewdness'. These agility dimensions emphasize on three crucial aspects of business that are vital conditions for achieving agility, which include opportunity identification, opportunity creation, and opportunity exploitation in market environment. The research provides important insights on the four agility dimensions of the adopted agility framework in the context of IT implementation in Indian SMEs. These four key agility dimensions are investigated with respect to multiple independent variables

of IT used in Indian SMEs. The research findings show that 'brightness' dimension of agility can be improved by implementing and upgrading certain basic IT tools, while the 'flexibility' dimension can be improved by improving the efficiency of resource management IT in Indian SMEs, which can be achieved by adopting the prescribed measures in this research. The 'intelligence' dimension can be improved by providing systematic training to SMEs employees on the efficient usage of online commerce IT tools and related innovative technologies, and also by improving coordination among Indian SME managers and its employees. Whereas, 'shrewdness' can be improved by improving online commercial activities conditions such as economic, technology, legal and social factors to enter foreign markets. The research has also examined the four agility dimensions to determine the effects on enterprise agility in terms of opportunity identification, creation and exploitation in Indian markets and found that all the four agility dimensions are useful and successfully contribute to determine the opportunity identification, opportunity creation and opportunity exploitation of Indian SMEs. The results generated not only provides practical and managerial implications in improving agility of SMEs, but also contributes to theoretical understanding and knowledge of SME researchers and managers in general and for Indian SME researchers and managers in particular. Such theoretical understanding enhances the agility awareness with respect to IT implementation among SME managers, and also enable them to reflect/share this knowledge with SME employees for improving business efficiency and agility particularly in the Indian SMEs context. Hence the conceptual and theoretical knowledge gained by this research is useful for both SME managers and SME employees to effectively operationalize the IT solutions in order to improve the agility of Indian SMEs.

The research findings indicate that the IT infrastructure used in Indian SMEs along with the IT skills of employees are highly crucial and significant in sensing market opportunities and to achieve customer responsiveness. Indian SMEs shows improvement in this direction since they shift from old IT architecture and traditional practices of technology implementation to new and advanced IT tools and adopt to new practices of IT implementation specially by upgrading the technical skills of their employees to create high levels of responsiveness in the system to achieve enterprise agility. Whereas highly responsive IT capabilities are also necessary when it comes to introduce new innovative products in local and foreign markets. Indian SMEs are improving their market reach by penetrating in to international markets by deploying suitable IT tools that are both effective as well as affordable. However Indian SMEs need to improve their technical
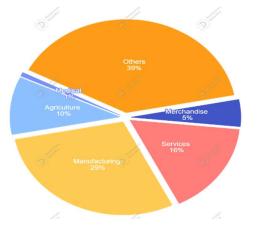
competencies furthermore in the areas of highly efficient technology infrastructure such as high-speed internet connections along with latest IT solution that are needed, and the relevant IT skills of their employees to operate such technology efficiently. This makes it easier for Indian SMEs to introduce innovative products for foreign customers since they must meet the standards and requirements of global markets and customers. This has also led to prove that all the research questions are answered related to sensing market opportunities (RQ1), customer responsiveness (RQ2), introducing innovative products (RQ3) and exploring new markets (RQ4). This research study also complements and extends earlier researches that have been conducted in the direction of agile enterprises, agility practices, agile methods. The insights of this research hold high value for Indian SME researchers and might help them to carry out further research in this direction. While the research is successful in explaining and interpreting agility in a precise way, and has provided insights on different agility aspects related to business operations in Indian SMEs, particularly the aspects that deals with market opportunities in Indian SMEs. It emphasizes the importance of agility and aspects of agility such as opportunity identification, opportunity creation and opportunity exploitation in the business environment specially in the context of Indian SMEs. Hence this contributes to reduce the theoretical research gap that exists in Indian SME's literature regarding opportunities and agile business in SMEs. And successfully attempt to partially reduce the research gap in general with respect to the relation between IT capabilities and enterprise agility of SMEs. It has also a successfully attempted to reduce this research gap particularly with respect to Indian SMEs to a considerable extent. While the research at the same time provides a research direction and a way to continue forward for future researches on agility in SMEs, and particularly for SME researchers that wish to study agility in the context of IT in Indian SMEs.

Managerial implications

There are practical and managerial implications for this research that are related to improvement to IT implementation in Indian SMEs in certain areas so that the enterprise agility of Indian SMEs is enhanced. The research has identified the key IT technologies and the area where it can be improved or modified. The basic IT and automations tools are identified as one of the key IT technologies of Indian SMEs where there is a scope of improvements. The areas of improvement have been discussed in detail which include upgrading to latest office automation software, improving the capacity of basic IT tools such as improving the storage capacity, upgrading the

operating system, computers, increasing the number of physical devices etc. This will enhance the efficiency of daily business activities of Indian SMEs such as interactions with customers and suppliers resulting in improved responsiveness and agility. Another key technology that needs to be improved is the enterprise resource planning (ERP), where SME managers need to ensure right package is selected for their enterprise business needs. Moreover, they need to perform customizations as and when needed to ensure right parameters of ERP are selected to activate the desired functionality of ERP, this in turn enable to effectively manage the enterprise resources and the operational technologies become more flexible and efficient in delivering variety of products and services. The right selection and implementation of ERP modules is highly crucial benefit the functionalities of connected departments that are present in the chosen ERP package. Moreover, systematic training needed to be offered to Indian SME employees to effectively use the ERP system. This enables Indian SMEs to properly utilize enterprise resources since the employees are directly involved in handling the enterprise resources. Apart from that the mangers of Indian SMEs need to have sufficient knowledge on ERP management specially while choosing the right package for the enterprise. This can all effect the efficient use of resources and improves the enterprise agility of Indian SMEs. The e-commerce is another key technology that have lot of prominence and scope to develop the Indian SME sector's business. Since e-commerce is effective in conducting commercial activities in both local as well as foreign markets, while it also ensures quick and efficient business transaction at any time and from anywhere. Therefore, the importance of e-commerce activities for Indian SMEs is highly crucial, and SME managers need to adopt necessary actions or measures to improve the e-commerce implementation in their business. In this context, Indian SME managers need to improve or develop managerial skills that are needed to implement e-commerce. Specially the IT skills and innovativeness is critical determinants in adopting ecommerce activities in Indian SMEs. Since these skills and qualities of Indian SME managers help in deploying innovative IT technologies during e-commerce activities such as the electronic payment systems. Moreover, providing necessary training to SME employees on e-commerce implementation can boost customer responsiveness and improves agility. While the cooperation and coordination between SME manager and SME employees is effective in conducting e-commerce transactions, since it facilitates organizational flexibility and interaction between the SME employees and managers, and helps to introduce new innovative technologies such as the Online payment systems to improve business efficiency and agility. The online/e-

payment system is an important factor for virtual and physical dimensions of e-commerce transactions. The various options and methods that are currently available in market for e-commerce payments such as the cash on delivery method, prepaid, credit cards, debit cards, mobile payment etc. enable Indian SMEs to choose convenient payment method which offers safety and data security. This encourages Indian SME managers to perform cross-border e-commerce activities. The SME managers need to develop suitable IT infrastructure to utilize the diverse payment methods that are available to enter in to foreign markets. They can specially improve the technological factors that contributes to foreign trading activities on e-commerce platforms. Moreover, innovative technologies can also support foreign transaction in a better way, such as making use of smartphones to connect with foreign customers more effectively and easily. Therefore, Indian SME managers need to focus on developing necessary IT infrastructure that support e-commerce activities, as well as provide training opportunities from employees to make use of e-commerce platforms and use innovative technologies to improve customer responsiveness in local and global markets. This will facilitate Indian SMEs to achieve high levels of enterprise agility.

Limitation of the research

This research has few limitations that provides a way for future researches to be conducted in this direction. The first limitation of this research is that it is carried out in a country-specific environment, and therefore the results cannot be generalized with SMEs from other countries. SMEs in India operate in diverse markets and in different sectors across the country. They mainly produce, sell and deliver products and services according to the regional customer's needs and demands. Moreover, India is rich in its cultural diversity but have many regional barriers as well, such as the language, traditions and culture may differ from region to region and hence the customer's taste and preferences for products also changes in different parts of the country. Although it can be viewed as an advantage from SMEs perspective as they can produce and sell variety of products according to customers taste and demands from particular region. However, from the perspective of comparing the SME empirical research results with the researches made in other countries can provide different insights due to country-specific environment and factors. Moreover, the majority of the researched SMEs are mainly based in urban part of the Telangana province which is comparatively more developed in resources and commercially active region.

Hence, the empirical research results may have been varied if majority of rural SMEs of Telangana were to be taken into consideration. Another limitation of this research is that it is conducted in a mixed SME sectors environment. Which means Indian SMEs operate in the markets where SMEs from different sectors coexists and perform their daily business activities including the SME sectors such as manufacturing, services, merchandise, agricultural, food, textile, automotives, electricals, home appliances and others. Therefore, the results and implications of this research cannot be compared to the SME researches that have been conducted on a specific SME industry or a sector. The response rate received by the empirical research in Indian SMEs from different sectors is shown in figure (3.5) and table (3.1).

SME sector	Respondents
Merchandise	7
Services	24
Manufacturing	44
Agriculture	15
Medical	1
Others	59

Figure 5.1 Response rate in percentage
Source: Statistica software

Table 5.1 Responses in numbers
Source: Statistica software

This research work is performed mainly by using a single source of information, that is the primary data collection source is the manager or the owner of the company. Although the source of information is a single person who is the top-level authority of the enterprise, which is a reliable source, but still, it poses some disadvantages such as the manager may overlook some of the issues while providing an unbiased and authentic information. For example, the concerns of employees on critical issues such as technology implementation, limited training opportunities on technical skill development of employees, and other general issues faced by the workforce. Moreover, having a lack of training opportunities to employees in order to improve and update technical knowledge or skills of employees related to newly adopted technology in the enterprise, which the managers are usually uncomfortable to disclose. And since the information source of both the dependent and independent variables mostly rely on a single person's knowledge, expertise, experience and opinion, which is the SME managers in our case, therefore it can be considered as

a risky task. Therefore, from this viewpoint it can be considered as a limitation to this research. Apart from that, the agility variables and the IT variables that are chosen for this research study were mainly considered in order to focus on the enterprise level agility or organizational agility of Indian SMEs. So, the research has followed a specific plan and confined the execution of the research to a limited scope, area and direction, which has limited or reduced the focus on other agility dimensions such as strategic agility, supply chain agility or network relation agility etc. This limitation can provide opportunity for future researchers to focus on the agility areas which are ignored in this research.

Another significant limitation of this research is the time during which the empirical research was conducted. Since the data collection process for the research started after the post pandemic era, it can be understood that a lot of SMEs all over the world were in a recovery phase including India. The transition of recovering from a badly hit economy was still under progress for a majority of businesses in India, but specifically the Indian SME industry was severely affected due to the shutdown of business activities for an uncertain time period. It is a general consensus that although the SMEs in India started to operate normally after pandemic, but they were still facing challenges due to the badly effected economic conditions of middle-class economy customers who are the main potential clients for Indian SMEs. This can be considered as a limitation to this research because the results could have been varied if the research was conducted before the pandemic. Another limitation of the research is lack of using key performance indicators (KPI) and dashboards. KPIs which are quantifiable measurements usually highlights the essential elements or critical success factors for an enterprise. Although KPIs may vary from one company to another depending on the type of industry they operate. However, they are useful in measuring the progress towards the organizational goals of an enterprise. In the context of Indian SMEs, KPI's can be useful to indicate many different factors such as the percentage of revenues generated annually, number of customers engaged in fiscal year, or the rate of response towards customers enquiries, the number of orders received, order fulfillment percentage, or the average time needed to deliver products or services etc. Although this limitation may not significantly affect the research area, however in the case of SMEs the use of KPI's can be beneficial in analyzing certain areas and key parameters of the enterprise. Moreover, dashboards became common tools for many businesses to display data in a clear and comprehensive manner that enable to make quick decisions. By using the dashboards in the research study, the researcher can present the key and essential data on

certain business indicators in a more understandable and clear manner. And hence lack of using enough dashboards in this research can also be considered as one of the limitations to this research.

Prospective research

Though this research has contributed to reduce the theoretical research gap that exist in the literature related to IT and agility studies in SMEs. However, it has also opened new possibilities and ways for researches to be conducted in future. Specially for the researchers that are interested to explore new possibilities and methods of conducting agile business in Indian SMEs in the Indian markets. Since there is a lot of scope in this research area when selected the key areas such as Indian markets, Indian SMEs, agility and information technology. However, since India has diversified markets with respect SMEs which operates in different sectors across many regions. And since the current research is carried out in SMEs from a mixed sectors in India, the prospective researches can focus on specific SME industry or sector in India such as manufacturing, services, agriculture, textile, merchandise etc. So that the agility of Indian SMEs can be examined in the context of a particular SME sector and specific corrective actions can be suggested or proposed in order to improve the agility and uplift that particular sector of Indian SME. Moreover, the future researchers intending to conduct their research studies in the field of Indian SMEs and agility can take useful inspiration and knowledge from the current research and further proceed in this direction. Since this research has adopted the agility framework that consist of four agility dimensions in order to determine the enterprise agility of Indian SMEs, other researchers can apply or adopt other frameworks that are consistent and reliable and which are helpful to measure or estimate the agility of Indian SMEs. Such future researches might provide different results and implications on agility aspects such as on the market opportunity detection, creation and exploitation when compared with the existing research. Such results from future researches can also contribute to further reduce the theoretical research gap that exists in Indian SME literature and can provide insights and measures that needed to be implemented for improving the agility of Indian SMEs.

The dynamics and relation between IT and agility can be examined though various viewpoints and by using different research tools. Hence there is a wide scope to examine and research the role and effect of IT on the agility of SMEs in general. Future researchers can implement or employ

different research mechanisms specially related to data collecting options and sources. Because this can affect the way the research proceeds or generate the results. Therefore, the future researchers that are interested in this research area can use more than a single source of data collection option, so that the data or responses received from the respondents can be cross checked to ensure its authenticity and reliability. For example, the data can be collected from two different sources of the same organization such as one from the SME managers and the other from the SME employees. This can provide more weightage to future researches in this direction. Moreover, the research findings and results of this study cannot be generalized conclusively to specific SME sectors or industries or even to other countries. Therefore, the future researchers can adopt a different research model contrary to the current research model where they can focus more on targeting a substantial number of samples from specific SME sectors in India. Or they can choose a research model focusing more on different countries, and regions. Since it can ensure the generalizability of this research results if future studies are conducted in the same research area but in a different country. Moreover, this research has emphasized and focused more on the positive aspects and effects of IT capabilities (IT infrastructure and IT skills of employees) on enterprise agility of Indian SMEs. This led to oversighting the negative effects or limitation of IT capabilities on the agility of Indian SMEs. Therefore, the future researches can also consider the limitations and shortcomings of IT on agility of SMEs while investigating the positive aspects.

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Appendix

Questionnaire: Attachment 01

How big is the size of your company/shop?	What kind of business is your firm involved in?	The annual turnover is [USD]:	The age of your firm is:	What is the customer base of your company in which you operate?
a) Less than 10 employees b) 10 - 49 employees c) 50 - 249 employees d) More than 250 employees	a) Merchandise b) Services c) Manufacturing d) Agriculture e) Medical f) Other	a) Up to 250.000 b) Up to 500.000 c) Up to 1.000.000 d) Up to 2.000.000 e) Up to 5.000.000 f) Up to 10.000.000	a) Up to 2 years b) Up to 7 years c) Up to 10 years d) Up to 20 years e) More than 20 years	a) Only in local town b) District level c) State level d) Country level e) International

Iv1) How common is business use of IT such as: Internet explorer, websites, dedicated software applications, and spreadsheet?	Iv2) How beneficial are Office automation tools for your company	Iv3) How helpful is Enterprise Resource Planning (ERP) for managing resources of your company?	Iv4) How effective is E-commerce for improving the sales of your business?
1) We do not use IT tools 2) Minority of staff use them 3) About half of staff use them 4) Majority of staff use them 5) All staff use them	1) We do not use Office tools 2) Not so beneficial 3) Limited or moderately beneficial 4) Satisfactory level beneficial 5) Very highly beneficial	1) We do not use (ERP) 2) Not so helpful 3) Moderately helpful 4) Satisfactory level helpful 5) Very highly useful	1) We do not use e-commerce 2) No improvement are noticed 3) Moderate improvement 4) Satisfactory level improvement 5) Very high levels of improvement

Iv5) How improved is your business efficiency by using E-commerce Online-Payment system?	Iv6) How effective are online/electronic-contracts (e-contracts) on Sales and Performance of your business?	Iv7) How effectively does Cloud services handle your business resources?	Iv8) Are social media platforms beneficial for marketing of your business?
1) We do not use e-commerce 2) No improvement 3) Moderate or little improvement 4) Satisfactory level improvement 5) Highly improved efficiency	1) We do not use e-contracts 2) Not very effective 3) Moderate improvement 4) Effective improvement 5) Very highly improved	1) We do not use Cloud services 2) Not very effective 3) Moderately effective 4) Effective handling of resources 5) Very highly efficient s	1) We do not use Social Media 2) Not very beneficial 3) Moderate or limited beneficial 4) Satisfactory level beneficial 5) Very highly beneficial

Questionnaire: attachment 02

Iv13) How effective is Artificial Intelligence (AI) for the coordination of machines, equipment, processes and people in your business?	Iv14) How supportive is Artificial Intelligence (AI) for your enterprise in problem solving and decision making?	DvB1) The company monitors and scans changes in the macroenvironment (political, legal, economic, technological):	DvB2) The company monitors and scans changes in the industry environment (customers, suppliers, competitors):
1) We do not use (AI)	1) We do not use (AI)	1) We do not monitor and scan	1) We do not monitor and scan
2) Not so effective	2) Not very supportive	2) We do not very systematically	2) We do not very systematically
3) Moderate coordination	3) Moderately supportive	3) We do in moderately systematic way	3) We do in moderately systematic w
4) Satisfactory level coordination	4) Satisfactory level supportive	4) We do in systematic way	4) We do in systematic way
5) Very highly effective coordination	5) Very highly efficient and supportive	5) We do in very systematic way	5) We do in very systematic way

DvF1) Our operational technology enables us to offer customers:	DvF2) The competence and skills of the company's employees enable us to offer customers:	DvF3)Cooperation with suppliers and subcontractors allows us to offer the customers	DvI1) We train our employees:
1) Single line of products	1) Single line of products	1) Single line of products	1) We do not conduct training
2) Very narrow range	2) Very narrow range	2) Very narrow range	2) Very rarely
3) Narrow range of products	3) Narrow range of products	3) Narrow range of products	3) Occasionally
4) Wide range of products	4) Wide range of products	4) Wide range of products	4) Systematically
5) Very wide range of products	5) Very wide range of products	5) Very wide range of products	5) Very systematically

DvI2) As a result of our company innovations we introduce new products to the market:	DvI3) As a result of our company innovations we hold patents on our products/technology:	DvS1) We adapt our products and technologies to the needs and expectations of our customers:	DvS2) If new market opportunities arise, we adjust supplier and subcontractor relationships accordingly:
1) We do not make products i	1) No solutions nor hold patents	1) We do not do this	1) We do not adjust
2) Very rarely	2) own solutions not patented	2) We adopt very slowly	2) We adjust very rarely
3) Occasionally	3) We have few patents	3) We adopt slowly	3) We adjust ocationally
4) Often	4) We have many patents	4) We adopt quickly	4) We adjust often
5) Very often	5) We have a lot of patents	5) We adopt very quickly	5) We adjust very often

DvS3) We enter new domestic markets:	DvS4) We enter new foreign markets:	DvRe) We get feedback from customers on the need to change/modify our products:	DvPro1) We develop new products for existing markets:	DvPro2) We develop new products for new markets:
1) We do not enter new	1) We are not present or	1) We do not get feedback	1) We do not develop r	1) We do not develop
2) We enter very rarely	2) We enter very rarely	2) Very rarely	2) Very rarely	2) Very rarely
3) We enter ocasionally	3) We enter rarely	3) Occasionally	3) Occasionally	3) Occasionally
4) We enter often	4) We enter often	4) Often	4) Often	4) Often
5) We enter very often	5) We enter very often	5) Very often	5) Very often	5) Very often