A study to evaluate the impact of mobile technology on supply chain ecosystems in Irish enterprises

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Griffith College Dublin

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22nd May 2020

CANDIDATE DECLARATION

Candidate Name: Ashish V Singh

I certify that the dissertation entitled: **A study to evaluate the impact of mobile technology on supply chain ecosystems in Irish enterprises**

submitted for the degree of **MSc in International Procurement & Supply Management** is the result of my own work and that where reference is made to the work of others, due acknowledgement is given within the text & listed in references. Further, I declare that no content of this report has been published or used for any other academic award.

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Abstract

To gain competitive advantage Supply chain firms use mobile technologies. This exploratory study investigates the impact mobile technologies have on supply chain activities and also identifies the challenges firm face such as capital requirement, lack of technical skills and information security in relation to use of Mobile technologies in supply chain management. From the primary analysis of this study it is also revealed that the impact on supply chain is in terms of improved communication, collaboration & visibility between various stake holders, real time information access & sharing, faster & responsive supply chain functions. The study attempts to investigate & simultaneously probe for critical evaluation of this technology.

This qualitative study used interpretivism philosophy to gain understanding of the topic. Along with review of literature, a semi-structured interview questionnaire was sent to participants via email to capture their responses to infer primary findings. The participants selected randomly were key professionals working in Irish firms who are currently involved in a function related to supply chain.

The results obtained from primary data resonates with literature available in the academic & professional domain. Thus, results accord mobile technologies have a positive impact on the efficiency of firms. At a larger view, the findings of this study are hoped to become a centrepiece for future research work.

Keywords: mobile technology, wireless technologies, mobile supply chain management, mSCM, IoT, industry 4.0, supply chain

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1. Introduction

1.1 Overview

The introduction outlines the significant processes employed in the study to comprehend the impact of mobile devices & applications in the supply chain eco-system. It explains the drive to conduct this study and how this study could act as a knowledge base for other scholars doing research in similar kind of topic and professionals working in the industry. As exemplified in the writing survey, examines are accessible on related points, explicitly on the consumption of data innovation or frameworks in supply network. Especially, why wireless devices like mobile phones and applications are getting presented in the supply chain stays unanswered.

We are living in a fast-paced world and businesses are coping extensively with this change. Customers whether internal or external want their requests and orders to be executed quickly. Companies try all gimmicks, tact's & strategies to compete and in order to please their customer go the extra mile to fulfil customer's orders. Moreover, globalization has led companies to shift their manufacturing factory and concentrate on the developing countries market (Elfirdoussi, 2018). This in turn leads to increased pressure on each supply chain element to deliver goods, services & information in real-time which directly adds to increased labour, transportation & other operational costs. Thus, it calls for the integration of mobile solutions within entire supply chain.

As per research conducted by Peerless group, in their report Kewill_Improving_Supply_Chain_Effeiciency_Research_SCMR (2014, p3), showed that 49% of supply chain problems is due to lack of visibility in various stages of supply chain and 30% accounts to non-adoption of new technology capabilities. There are numerous devices, applications, systems employed in the smooth functioning of the supply chain network. All these technology components are employed in various functions of the supply chain like e-payment, warehouse shipment tracking, inventory management, cloud & mobile connectivity (Marchi, Maria and Gereffi, 2017). This industry specification is focused on mobility, fast,

reliable, autonomous, M2M (machine to machine), cloud capabilities (Kersten, Blecker and Ringle, 2015).

Supply Chain is extensible and disjointed network of elements that range its activities from the acquisition of raw materials needed for manufacturing or processing of inputs, finally ending as consumables goods. Each element of the supply chain is integrated in a chain of network in such a style where succeeding stage knows the outcome of the previous stage. Although the information systems like ERP has provided immense robustification of the network architecture to facilitate smooth supply chain functioning, often there are discrepancies in the supply chain which result in failure of tracking goods. Many a time supply chain data is inadequate for end customer which eventually could result in the recall of certain goods like highly perishable food items & medicines(Beier, Bhagwan, Funk, Arthur F Kaufmann, *et al.*, 2017). Mobile technology has emerged as the miraculous wand which significantly attempts to dissolve such shortcomings. Improvement in IT technologies, wireless networking & telecommunication have taken a progressive seat & presented us with a unique choice of disseminating business needs through mobile supply chain management *mSCM*. The next generation of mobile devices are incredibly fast, easy to use, can multitask and with the provision of software applications can perform business tasks and now are emerging as an integral part of the supply chain. (*Smart Phone and Next Generation Mobile Computing*, 2006). The indispensable nature of mobile devices being wireless in nature makes them a more coherent and versatile medium to be employed in dynamic supply chain networks. Speed, accuracy, and time are the pivotal points when we measure the effectiveness of any process. The popularity & ingenuity of mobile devices with access to superfast wireless broadband makes them an unquestionable element in the supply chain to rely upon. A smartphone is a kind of mobile phone with an advanced operating system and typically amalgamate the features of simple cellular phone along with features of other mobile devices such as personal digital assistant (PDA), media player and GPS navigation system which now have a touch screen to give input commands and simultaneously display on the same screen. (Asoke Nath and Sneha Mukherjee, 2015).

As of now, the innovation is supporting the business world at each level and each hierarchical undertaking. Regarding the supply chain for products, mobile technology is assisting incredibly to the business association and having impacts at all business functions. It is steady on the grounds that the representative and laborers in the associations are utilizing business grade, ruggedized and multipurpose cell phones to a decent arrangement of transportation and warehouse activities. The utilization of these devices and applications are providing more support to effectively deal with the supply chain (Boehmke and Hazen, 2017). Additionally, usage of these devices also allows the managers to accomplish the supply chain tasks remotely from a different location. Whatever the new technology is available today, the smart phone manufacturing companies are exploiting the very inch of it to be used in its business and for its employees other than the personal satisfaction it provides. RFID (Radio frequency identification) is an auto identification technology that works on the principle of radio waves to identify & read exclusive physical objects. This technology concretely advocates the elimination of gaps in the supply chain (Rebecca Angeles, 2005). It is a successor of BARCODE technology. RFID tags have been doped with innumerable applications in a supply chain but are especially useful for logistics, retail business owners to keep track of inventory as every product is chipped with tags so it eliminates the gap of order discrepancies(Ahuja, Yang and Shankar, 2009). All these technologies RFID, mobile devices, sensors, computing devices can interact with each other to reach unanimous decisions revolutionising the phenomenon as IoT or Industry 4.0. Whereas on the other hand as per a report published by (*How digital reinventors are pulling away from the pack | McKinsey*, 2017) traditional practices of conducting business & dissenting use of mobile digital technologies leads to decreased revenue & profits. Thus, there is room for exploration in the study of the effect of mobile technology in Irish enterprises from all the research findings. Forty percent of Ireland's firms lack digital technology[1] absolutely (‘The

[1] Digital technologies as considered by the Digital Intensity Index are: internet for at least 50% of persons employed; recourse to ICT specialists; fast broadband (30 Mbps or above); mobile internet devices for at least 20% of persons employed; a website or homepage; a website with sophisticated functions; social media; sharing supply chain management data electronically; the use of Enterprise Resource Planning (ERP) software packages; the use of Customer Relationship Management (CRM); e-commerce web sales accounting for over 1% of total

digitalisation of small and medium enterprises in Ireland - Models for financing digital projects - Executive Summary | Innovation Finance Advisory at EIB Advisory', 2019). An effective approach to confront this problem is by employing mobile digital technologies in the supply chain.

1.1 Research Purpose

The purpose of this exploratory study is to explore the challenges which are faced by supply chains in adopting mobile technology & thus study the impact these technologies have on the firm's operations. It is anticipated that through an improved understanding of the motivation & needs of a supply chain professional, issues & challenges they face, and the pressure exerted on them due to the dynamic nature of the market, more informed and quick decisions can be made by them. This will in-turn benefit the supply chain professionals as well as the number of firms in the supply chain. The study is conducted with the viewpoints taken of the personnel who are shouldering responsibilities catering to the supply chain. The research uses an inductive approach with interpretivism philosophy & using semi-structured interviews with personnel in the supply chain in the geographical boundaries of Ireland.

This research focuses on identifying the impact of unsung heroes of the technology & communication world mobile devices & applications which are actively used in the supply chain ecosystem. This research is focusing on the significances of mobile technology in the supply chain environment to understand their impact. In a nutshell, several issues and problems that might be evident in an organization while not adopting the technology in the supply chain are also being analyzed in this research study. Moreover, the ways through which these challenges can be mitigated & that can be used by an organization to overcome these issues would also be examined through this research study.

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turnover; and business-to-consumer (B2C) web sales accounting for over 10% of total web sales. The value for the index ranges from 0 to 12

Mainly this study is proclaiming that this advanced technology is offering a massive change in the operational flow of the firms operating at the global level and adopting this technology. The supply chain ecosystems observe an increased capacity with higher mobility, speed of delivery, cloud capabilities, tracking system, etc. Supply chain provides an extensible and disjointed network to the organization- this is the rationale; the research study is considering on adoption of this technology.

This inherent proposition of using mobile devices in the supply chain ignites a few questions per se and led me to think – Why businesses are adapting to the use of mobile devices? Does the use of mobile devices in various stages of the supply chain is effective or not? What are the problems, challenges & risks faced by supply chains to implement this tech?

1.2 Significance of the Study

The research on the topic is limited in nature and data regarding the same in the public domain is not enough. Thus, this research will prove to give valuable insight into usage, adoption of mobile technologies in the supply chain network. The findings will attempt to solve certain challenges. The challenge faced by the supply chain industry is risk associated with loss of time, efforts, and money. Improper & delayed exchange of information between buyers, suppliers gives a risk of bullwhip effect (Nienhaus, Ziegenbein and Schoensleben, 2006). White-collar operators are deficient in terms of tech savviness and could also potentially increase the lead time associated with supply chain operations.

This research is probing the impact mobile devices & applications have in the supply chain ecosystem and simultaneously addressing the issues that are faced by the organization in the management of the supply chain. The traditional supply chain processes are time-consuming as well as they inflate the cost of operations for any organization. Numerous scholars have found that the adoption of new technology in the supply chain system will be supportive to overcome such kind of issues (Wang *et al.*, 2016). It is because of this reason the mobile application and Smartphone devices can minimize the cost of the supply chain. Furthermore, using these devices the supply chain tasks can be controlled and managed remotely. This

research also attempts to recognize issues that might be faced by an organization while implementing this technological change in the organization. This phenomenon will be supportive to the firms in order to have good information about these challenges and make strategic decision accordingly. Similarly, in this research few methods and techniques are also proposed that can be used by an organization to overcome issues related to the implementation of the strategies related to the supply chain. The new technology and methods will be effective to manage the supply chain operation timely. Timely adoption of innovative measures and ethical information practices is important to improve the efficiency of the supply chain and minimize the expense incurred on the products. Companies that are working towards the robustification of their supply chain, who want to achieve faster time for their go-to market strategies regarding their products by improving mobility and reduce their expenses on monitoring human & product traceability will be benefited from this study. Altogether, the study will also attempt to fill the gap which academics like me who are keenly interested to use wireless mobile technology in end-to-end business processes.

The study is noteworthy for the investigator as it incorporates the idea of portable application and gadgets which are ceaselessly encountering a powerful innovation move and are utilized in the supply chain framework to builds its adequacy. The specialist can utilize this information in future research just as it would be strong in proficient life. In this context, when the analyst would work in an enterprise or in an office taking into account the gracefully chain side of the business than these undertakings can go about as a source of perspective point to viably oversee flexibly chain. Then again, this research would reveal the issues that can be looked by a firm in the selection of devices and applications in the supply chain management. The specialist can utilize this figuring out how to settle on viable vital choices and defeat the issues in the association identified with the usage of this innovation. This exploration likewise cultivates an extra essentialness of understanding another procedure of supply chain framework that are as of now utilized in the worldwide association to alleviate issues identified with time and expenses. This learning will likewise be strong for the researcher to utilize and execute in future vocation plans and display abilities in the association.

1.3 Research Objective

The paper attempts to provide a comprehensive view of the objectives elaborated below:

- To identify the significance of using mobile technologies in the supply chain ecosystem
- To recognize the challenges that an organization might face in the supply chain while implementing mobile devices and applications
- To demonstrate the ways by which the supply chain system can be improved and overcome these identified challenges.

These objectives would fulfil the requirements of the above research aim and provide an effective outcome of the research study when all objectives would be covered through the data collection and analysis.

1.4 Structure of the Study

The research study is inclusive of 5 chapters which constitute the structure of the research in an orderly fashion. The genesis of the research report starts with chapter Introduction, which provides information in a summarised manner for the topic to be researched. A crisp description of the study is punctuated here which also includes purpose and drive for which the research is been conducted. Also, it includes the various aspects of business where mobile technologies are being employed and types of mobile devices & applications are helping the supply chain to flourish. This is further extrapolated to significance the research makes in the supply chain industry and explain why such kind of study is helpful for the industry & academics.

Second chapter- Literature review starts with the description of various terminologies or concepts which are coherent in the supply chain industry and directly or indirectly influence the scope of use of mobile based technologies. Each concept is supported by the arguments and related research in the filed by other scholars. The secondary data fostered here is collected through an online databases of research articles, media reports, journals & news reports widely available on

google scholar, research gate, science direct etc. Most properly, the researcher would select the literature content related to improvement occurred in supply chains after adopting mobile applications and smartphones. The section also explains benefits & challenges about the use of mobile devices and finally concludes at proposing a conceptual framework which is the outcome of the relevant & critical literature assessment.

Third chapter- Research mythology comprises of the succeeding section of the research. This segment of the research elucidates the method involved in carrying out the research. It throws light on the approach of research philosophy, the research strategy, which is the overall framework of conducting the study, along with this it also provides details of the tools & techniques to collect, source and interpret data ultimately to achieve the objective of the study. Additionally, it will also clearly depict the participant selection and interview technique to carry out the research and how each tool is beneficial for the study.

Fourth chapter- Presentation & Findings formulae this chapter where a detailed outcome of the result concerning the use of mobile solutions by enterprises in Ireland is presented. The data or information gathered from interviews is coded & correlated with secondary data searched. This resulted to come at a juncture of our findings of the research

Fifth chapter- Conclusions forms the final chapter of the study. Here we conclude our findings w.r.t the investigation and study we undertake.

2. Literature Review

2.1 Theoretical concepts overview

This section provides a description of theoretical concepts, published articles, research studies & academic writings which have helped the scholar to attain an understanding of the topic at hand. The information is scanned from a wide pool of academic & business world database available online or in few cases offline. The paper provides a significant classification of literature and the mode of data that the research has touched upon. However, it can be said that the academic research area would be considered in relation to Supply Chain Management (SCM), SCM with mobility technologies, and mSCM with ERP. In this, the academic view would consider mobile applications and devices in the field of logistics, operations, supply, and product manufacturing with a higher speed at lower cost and time consumption (Boehmke and Hazen, 2017). In recent years as stated by (Kalem *et al.*, 2016b) that the use of digital technology has gained tremendous interest. Many of the organizations in their supply chains demystify advanced mobile systems and technologies particularly when pleasing customers is a priority agenda for the businesses. It is seen that the significance of an all-around view oversaw supply network has been expanding step by step as the usage of versatile innovations, for example, the Internet of Things (IoT), Smartphones, portable applications, and tablets has become a most basic part for the powerful supply-chain network (Van Wassenhove, 2006). The propelled mobile innovation is composed in an imaginative manner in the SCM network; however, it is likewise considered as an entrenched methodology in different supply chain regions or zones such a coordination's, distribution center and retail locations.

2.1.1 *SCM (Upstream & Downstream): -*

As per Author (Blanchard, 2007) Supply chain management can be described as the process inclusive of activities such as planning, managing, sourcing, procurement to distribution & logistics, inclusive of 3rd party partner coordination, collaboration with vendors & suppliers. Any supply chain comprises of two channels namely Upstream and Downstream. This context of supply chain network is well explained by (Oghazi *et al.*, 2016) where SCM network comprises of a

specific firm which generally is a manufacturing firm. Its supplier and supplier's supplier form the upstream tiers of the chain while its direct customer & customer's customer forms the downstream tier of the chain. The members of upstream & downstream vary in numbers and are dependent upon industry or any specific supply chain business. The flow of information, product, and financial transactions are done both ways (Oghazi *et al.*, 2016). As per (Nowakowska-Grunt and Grabara, 2007) coordination happens along the different members of the supply chain.

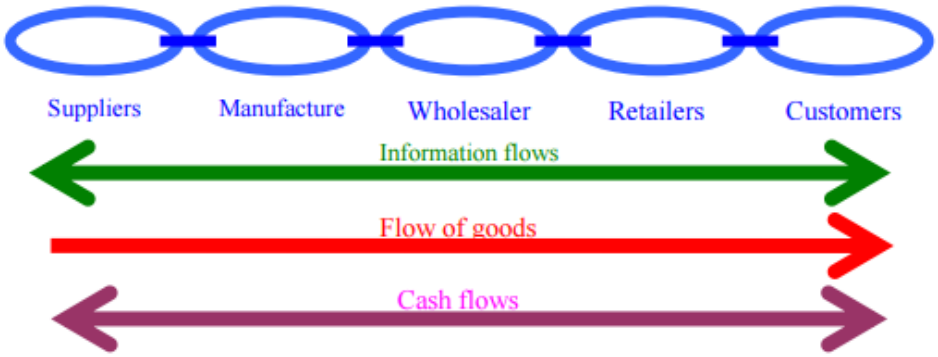

Figure 1: ***Flow model of supply chain*** **(Nowakowska-Grunt and Grabara, 2007)**

Upstream SCM establishes the relationships between an enterprise & its suppliers and supplier's supplier while **Downstream** establishes relationships between enterprise & customer. (Lysons and Farrington, 2006). In general notion, the relationship development in SCM is seen as an upstream supplier and downstream customers(Huemer and Furlan, 2011)

An ideal model was adopted for supply chain practices under the guidance of the Supply Chain Council (SCC). The de-facto model was christened as Supply Chain Operations Reference Model (SCOR model). It was used to provide 3 basic advantages:

1. Evaluate & compare supply chain performance potential.
2. Analyze & improvise supply network with the logistics chain.
3. Identify relevant places for deploying software applications & devices within the supply chain. (Poluha, 2007).

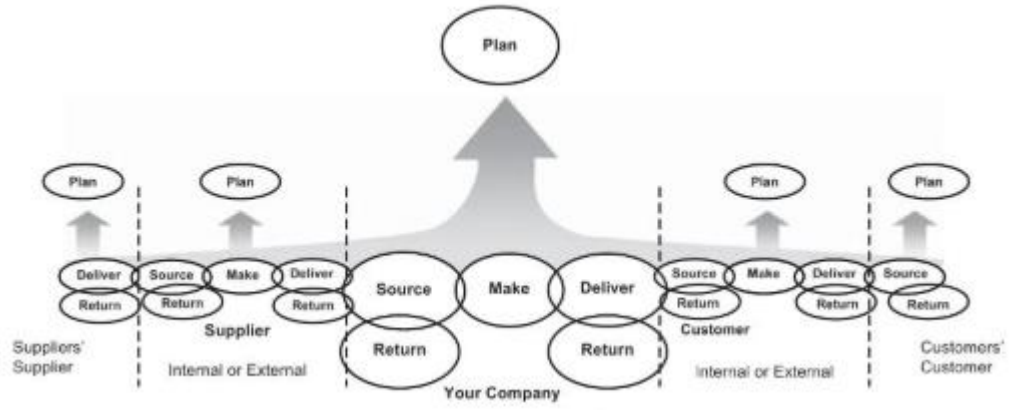

Figure 2: ***SCOR Model*** **(Council, 2012)**

Each level of SCOR model serves a definite purpose in supply chain. SCOR is a business reference model (Council, 2012)

SCOR Process Definitions

Plan- This process gathers customer requirements, collect information on available resources, calibrate requirements to govern planned capabilities & resource gaps.
Source- This process details the ordering of receipts of goods and services.
Make- This process mentions activities concerning the conversion of materials or the creation of content for the services.
Deliver- This process provides information regarding the creation, maintenance, and fulfillment of orders made by customers.
Return- This process performs activities associated with the flow of products back from the customer, i.e. in reverse order (Council, 2012)

Business & enterprises big or small around the world are involved in flow of goods & services to the end customer where the activities involved in these transactions must be efficiently managed, this calls for the need for supply chain management. Big global companies like Proctor &Gamble, Hewlett- Packard have demonstrated supply chain management practices which when integrated intelligently result in saving cost & low inventories (Chapman, Ettkin and Helms, 2000). The need of supply chain management practices for every individual business is different and it could be said they have conflicting needs. Every company bring their product & services to serve a segment of market or demography. As per their strategic plan the supply chain requirements are laid out. For instance, if a company's strategy is to

compete in the market based on convenience & customer service than the supply chain intended for such business is to be responsive(Hugos, 2018).

2.1.2 *Mobile technologies (devices + applications) in SCM: -*

Different organizations have different need of technologies, where one may be more relied on fixed hardware requirements such as desktop only others may need bespoke sophisticated applications, devices or even one can even be sufficed with modest off-the shelf IT components such as mobile phones & laptops (Hugos, 2018). As evident from the introduction there are differentiating technologies which are elements of Industry 4.0 like mobile devices, Barcode scanner, RFID, augmented & virtual reality, cloud, IoT which have high potential to be assimilated with commercial supply chain management.

As indicated by (Kalem *et al.*, 2016b) the fundamental destinations of associations are to build a piece of the overall industry, productivity, and consumer loyalty. These destinations can be cultivated by improving supply network viability and delivering creative items. It is seen that the association can diminish the cost of items and builds productivity by improving the supply-chain. The supply chain must be overseen progressively to fulfill the interest of clients. With regards to this, (Büyüközkan and Göçer, 2018) said that supply network comprises of provider sections, retailer, wholesaler, and maker. There are three streams among these portions which incorporate money, data, and item. It is important to have brisk and productive data between these portions to fulfill client needs on schedule. For example, Apple Inc is concentrating on inventive items to deal with its store supply-chain successfully so the organization can set up its first place in the Gartner supply chain top 25 list. The organization is additionally ready to increase higher gainfulness by decreasing it's all out expense of items. Van Wassenhove, (2006) confirmed that mobile SCM is considered as the utilization of cell phones and applications that encourages the organization to execute inventory network exercises and supporting the organization to diminish items and procedure costs. It is likewise ready to increase the upper hand and quick responsiveness. In one research (Briggs, 2017) states laptops as computational devices purposefully used by salesmen & outdoor staff have now been replaced by smartphones & tablets which are integrated with cloud based applications like Salesforce. Mobile devices with inbuilt capabilities to read RFID tags are in the development stage, a similar kind of research was carried out by

(Lautner *et al.*, 2018). The concept was to use a smartphone to capture information from nearby IoT devices via RFID and update surrounding status to the user. The solutions present as on date relate to UHF RFID reader which are standalone devices or are deployment based attachment to a smartphone.(Lautner *et al.*, 2018). Another experiment conducted by (M. Yuan *et al.*, 2015) used RFID tags on the package and the tags were coded with information using RFID writers, the same can be read by smartphones or laptops and can act as a mechanism to track packages.

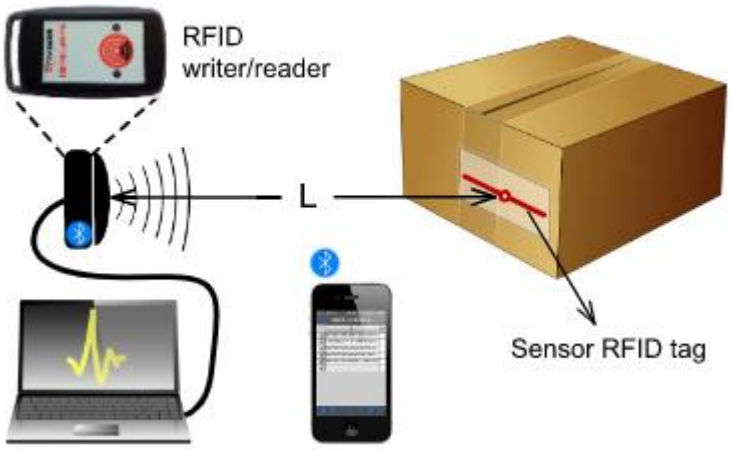

Figure 3*: RFID tags integrated inside a package & interrogated by mobile devices* (M. Yuan *et al.*, 2015)

A real time instance of RFID tracking in SCM was studied by (Holmqvist and Stefansson, 2006) for Volvo automotive business and the conclusions were a reduction in labour cost, lead time productivity improvement.

As per the findings of (Barata and Cunha, 2016) the clients are utilizing portable Internet-associated gadgets, for example, cell phones to buy items as opposed to buying from physical stores. The development from a physical model to web models is opening a boundless and new measurement for customers to buy the item. Innovation is worthwhile in such manner as it has breakdown topographical hindrances where purchasing and selling is thought of and in the long run expands advertise territories. It is known as Omni-direct retailing in which customers can pick any communication channel dependent on their ease & comfort.

(Kalem *et al.*, 2016a) points out barcode tag scanning is additionally utilized as a portable mobile based gadget in SCM. It encourages the shoppers to see the

accessibility and cost of the item on the internet. The utilization of RedLaser application is valuable to examine scanner tags and search item costs. The utilization of EPCIS is additionally used to meet supply chain that help to trace & track vital information. To add on to this (Ullah, Shah and Zhang, 2016) opined the utilization of RFID empowers services in retail markets that help to oversee promotional ideas in stores, modify the dynamic cost of transient and new items. The mobile connected gadgets are utilized by firms to send verification of conveyance and field deals. Smart cell phones are utilized as versatile payment gadgets among the supply chain section from clients to logistics. In addition, the Internet of Things can change the procedure of business by synchronized data. The firms are utilizing 6C system of IoT based system which incorporates change, setting, capacity, participation, integration, arrangement, and build (L. Coetzee and J. Eksteen, 2011).

According to (Suresh *et al.*, 2014) location independence via mobile communication technologies such as 4G, 5G have a distinct advantage in supply chain management operations. It is additionally viable for each level in the supply chain for the executives as a versatile application used by the experts, supervisors, drivers, laborers and engineers who are engaged with the SCM. The utilization of versatile mobile SCM applications can make viable progression of data between various elements of the business all through the supply chain network. It implies the progression of items is smooth when arriving at the end purchaser. Besides this (Kalem *et al.*, 2016b) contends that the utilization of mobile devices and applications is giving different focal points of sensible costs, rapid decision making and expanding productivity. It is seen that the new age of the mobile application can improve the use of the SCM application by upgrading Wi-Fi and mobile network coverage. It additionally empowers workforce to be synchronized through constant real time interaction in SCM. This is often considered to be a catalyst of tracking the activities at the right intervals (Bo Li and Yulong Li, 2017). Likewise, it guarantees the optimization of workforce outstanding tasks at hand to be simpler in SCM through mobile tech. Adopting GPS application and gadget direct the employees to the correct client premises at the requested time. The organizations can decrease the lag time to meet demands of the client and upgrade the efficiency of the business.

Imagine an instance when a transaction is completed online via internet, several participating firms and elements are working to make it possible: starting from a

bank, a telecom provider, an encryption ID provider, payment solution provider, a device (mobile) application in the device to access the portal. There are so many elements across the supply chain that completes one single transaction for creating value in real time. Deep diving further in mobile communication industry several players providing mediation services, telecom operators provide an infrastructure of radio waves to transfer the data/messages/information digitally & wirelessly through SMS or WAP hosts with payment or billing solution providers like (Paypal) and online merchant that offer an exchange of service or good over mobile phone network(Huemer and Furlan, 2011). This further adds to our knowledge to comprehend the complex network of transactions involved at myriad stages in a supply chain.

2.1.3 *mSCM with ERP: -*

To attain a competitive advantage in this ultra-competitive dynamic business environment one of the primary sources is to speed up the supply chain process. This behaviour led to the development of versatile information systems christened as ERP (Enterprise resource planning) systems (Oghazi, 2009). ERP is a logical extension of the MRP(Material requirement planning) tool of 1970's and MRP-II (Manufacturing resource planning-II)systems of 1980(Akkermans *et al.*, 2003). There are significant benefits ERP software packages provide in managing and integrating cross-functional processes, but these cost millions of dollars to buy & maintain its long life. (Klaus, Rosemann and Gable, 2000) expressed ERP as application software which holds features of customization interconnected with business activities to perform functions of production, planning & control while simultaneously doing administrative functions of accounting, human resource, customer relationship management of an enterprise. Enterprise systems are quite vital if we view the same from an economic point of view as they have attained much popularity in terms of investments by firms (Cotteleer and Bendoly, 2006). ERP functions as an enabling role in reengineering the company's existing way of doing business. ERP deployment in a firm contributes to success & benefits (Al-Mashari, Al-Mudimigh and Zairi, 2003).

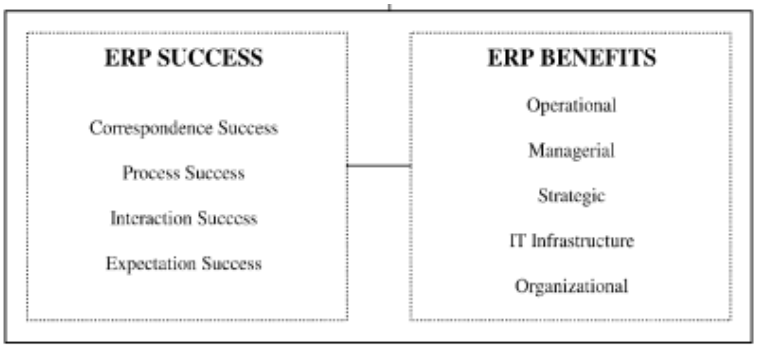

Figure 4: ***ERP success & benefits*****(Al-Mashari, Al-Mudimigh and Zairi, 2003)**

Information lag & discrepancies occur due to the fragmentation of the information systems (MCAFEE, 2002). These anomalies could result in the famous *Bullwhip effect*(Forrester, 1997). Thus in a supply chain, ERP could be very effective by enhancing transparency, removing communication gaps (Akkermans *et al.*, 2003). ERP advantages come into picture slowly & gradually within an organization in terms of time & experience with the system (Cotteleer and Bendoly, 2006). There are many contenders in the market of ERP software offerings for diverse business needs. Every ERP software package is built keeping in mind the customer requirement and thus are often characterized as bespoke ERP architecture. A typical ERP model from SAGE shows the integration of various functions while giving access to mobility for users.

Figure 5: ***SAGE ERP integration***

(https://www.enterprisemanagement.com.au/software/architecture/)

Due to the growing mobile behaviour of the users in the business environment the ERP systems should be compatible with mobility features (Kurbel, Dabkowski and Jankowska, 2003). Mobility is just not providing ERP access to mobile users outside the building but it also relates to any worker that has access to ERP system must be able to take timely decisions within the facility (CaileanandSharifi,2014)

2.1.4 *Enterprises in Ireland*

Enterprises are conceived due to the notion of the economic development of a country or nation (Coase, 1995). There are many definitions concerning the enterprise. An organization designed for continued operation leading to economic activity whether it is for profit or not is defined as Enterprise (Maisto, 2011). An enterprise could be a large multinational corporation, public & private firms, limited companies, etc. thus there are many classifications of criteria & sub-criteria for defining an enterprise. In the context of a contemporary laissez-faire economy, it's absolutely necessary that small, medium-sized and huge enterprises are ready to coexist in an exceedingly rationally proportional balance, each of them having their pros and cons (Dobrin, 2015).

As per KPMG report (*Types of Irish Companies | KPMG*, 2015) there are broadly 3 types of enterprises that operate in Ireland, namely: a limited company, an unlimited company & Investment funds. Another classification of enterprises in Ireland is based upon the nationality of ownership for instance: Irish owned constituted 98.9% of enterprises in Ireland & only 1.1% are foreign based. The approximated furthest breaking point in explicit European locale, Asian sub-landmass is taken as 250 workers., while the USA considers SMEs to incorporate firm less than 500 representatives. Small firms are described with less than 50 workers. Another model to distinguish enterprises is done premise market related execution. For example, large enterprises are termed to have a market capitalization of more than $5bn, medium enterprise have turnover between $1mn & $5mn while SMEs must have a market cap of less than $1bn (Moore, 2017). The ironic point here is Gross value addition by type of organisation (large, medium, small): large enterprises generated 58.6% of GVA, medium-small combined generated 23% of GVA while micro enterprises generated 19% of GVA (*Business in Ireland - CSO - Central Statistics Office*, 2019). It is realized that in any nation SMEs consider a bigger piece of the

organizations working business contrasted with the number of huge open or private division organizations. SMEs speak to around 90 % of organizations and over half of businesses around the world (Jenkins, 2004). SME's are autonomous firms that utilize not exactly given number of representatives. There is critical ascent in SMEs in many created and creating topographies. This has prompted another type of business enterprise. Areas like discount exchanging, eateries, correspondence, development, and ICT (Information and correspondence innovation) are ruled by SMEs. A genuine model can be identified with "Silicon Valley" which has gone about as a business person center point for some creative organizations which began as a small firm and have ended up being huge goliaths like Facebook and Yahoo (OECD, 2010). Across EUR28 region, 99.8% of all non-money related organizations, 58% of complete worth included and 66.8% of absolute work are provided by SMEs (Briozzo and Cardone-Riportella, 2012)

In the year 2016 Ireland constituted approx. 250,000 active SMEs. Some 92% of undertakings had under 10 workers (small scale), 6.8% had between 10-49 representatives (small), 1.2% had 50-249 workers (medium), and as it were 0.2% had at least 250 workers (large) (*SME productivity in Ireland | SME and Entrepreneurship Policy in Ireland | OECD iLibrary*, 2019)

To survive the market today and to reach expectations, it has become necessary for organizations to distinguish themselves based on capabilities and competencies. We need to compete on different dimensions, such as product design and development, production, expense, distribution, communication, and creative marketing methods (Gupta, Guha and Krishnaswami, 2013). There is a bit of uncanny details available regarding providing jobs, some studies have shown that few top global companies & large corporations hire more employees. One of the key jobs of the capability of SMEs in a progress setting is producing occupations, in this manner assisting with an engrossing piece of the workforce gave came about because of financial rebuilding. While, in most changing economies, small firms have been one of only a handful hardly any wellsprings of new openings (Ionica, 2012). As per the study done by (Levy, Berry and Nugent, 1999) SMEs are playing a progressive growing role in the economies for example of (Indonesia, Japan, Korea & Colombia).

A study done by (Pinkovetskaia and Slepova, 2018) shows the investigation permitted us to make an inference that issues of investment are pertinent. Such factors as size classes, specialization of SMEs, and districts in which they are found, have a noteworthy impact on the measure of speculations into fixed capital. Large enterprises have access to many financial resources to fund themselves for tech & innovation whereas medium & small enterprises around the world face various problems in gaining access to debt & equity finance which needed for various technological R& D (De Maeseneire and Claeys, 2012). One of the reasons provided by (*SME productivity in Ireland | SME and Entrepreneurship Policy in Ireland | OECD iLibrary*, 2019) is the need of collateral by banks in Ireland for loan disbursement., along with restricted budgetary capacities among SME supervisors and business people likewise speak to a test, as indicated by government partners who offer monetary types of assistance.

2.2 Role of digitisation of supply chain in Irish enterprises

Many international studies contend that Ireland is suited to be called "Digital Front runner" in European region due to its scalable industrial digitization. The international composition of Irish manufacturing and relatively high export focus has helped the country to build strong global supply chain management expertise (*Study on digitalisation of the manufacturing sector and the policy implications for Ireland | Policy Links*, 2018). (Christopher's (2016) study highlights the role of communication technology in the supply chain in improving the relationship between suppliers, distributors, and the client. Traditional supply chains have already seen massive changes due to technology integration. The addition of wireless communication & mobility has extrapolated the supply chains ability to share data, exchange info remotely & process real time information to elevate smooth communication channels between external & internal participants. The blend of Internet usage on mobile devices have created unparallel opportunities of mobility in terms of e-commerce to m-commerce(Lu *et al.*, 2003). As per Eurostat report 31% of Irish businesses employed Customer Relationship Management (CRM) software in 2017 to exploit marketing information to other business functions information about its clients, versus an EU average of 32%, Enterprise Resource Planning (ERP)

software was used by 28% of businesses in Ireland in 2017 versus 34% in Europe (ranking Ireland 21st out of the EU28), 12% of Irish owned businesses have shared information electronically via Supply Chain Management (SCM), versus a EU28 average of 18% nonetheless 11% of Irish firms used Radio Frequency Identification (RFID) technologies, versus an EU average of 12%. It was concluded that most generic criteria for using RFID was for personal identification or access control; a small number of firms used RFID in their production and service delivery process and for product identification after the production process(*E-business integration - Statistics Explained*, 2017)

One of the recent publications by the Irish Department of Business, Enterprise and Innovation which proposes the future strategy for the year 2020- 2025 is adoption & supporting digital technologies 4.0 in the supply chain. The report encapsulates 6 strategic themes for manufacturing industries which have complex supply chains. The roadmap is to make existing the supply chains more mobile, agile, digital, robust, and more responsive using 4.0 trends which will further help in new R &D, and re-skilling of the workforce(*Ireland's Industry 4.0 Strategy 2020-2025 | Department of Business,Enterprise and Innovation*, 2019, p. 0) Development in digital business and developments in technology also provided additional criteria for Internet-based and mobile enterprise management solutions. The unquenchable need of accessing information quickly becomes more prevalent in today's time as we excel towards rapidly inflating digital business (Gasos and Thoben, 2012).

2.3 Factors influencing mobile technology usage in supply chain

In an ever changing highly competitive business environment (Fawcett and Waller, 2014) believes that there are several factors or drivers that influence the use of mobile technology in supply chain management. The usage of mobile technologies in the supply chain is a result of the immense number of applications it caters too. One of the most significant factors for following mobile tech in SCM practices is internal and external integration. (Bo Li and Yulong Li, 2017) proposes that internal integration is achieved through effective communication skills like push to talk & voice call services. On the other hand, external integration is achieved through mobile applications that act like a purposeful remote control for an easy access of

information to transporters, logistics, consumers & retailers. Mobility is beneficial and practical for different countries due to global roaming services. The security features like electronic signatures & confirmation of delivery receipt via mobile devices message flow is providing enriched SCM practices (Amaral *et al.*, 2011) One of the studies conducted by (Iskandar *et al.*, 2012) highlights the use of mobile technology in the field of logistics and transport by retailers due to the need for tracking of shipments in real-time and simultaneously monitor the delivery systems. Warehouse managers, supply chain planners are extensively exploiting the need for remote monitoring of their warehouses primarily through mobile tech. Initially concept started with reading temperature at cold storages via sensors which were programmed to transmit information to basic phones (non-smart) on SMS (Chaudhri *et al.*, 2010), this process was actually called Telemetry. With time this has been replaced by cameras and applications in mobile devices which use ultra-robust IoT tech to provide more accurate & highly sensitive information for warehouse management(Mostafa, Hamdy and Elawady, 2018). The inventory numbers are read, stored & updated instantaneously i.e. movement of goods inward or outwards can be viewed & tracked remotely. This in turn facilitate collaboration among supply chain partners along with smooth process execution & tracking leading to competitive advantage (*Mobile Communications: Managing Supply Chains on the Go - Inbound Logistics | Amy Roach Partridge*, 2011).

(Govindan and Hasanagic, 2018) advocates that use of mobile devices & applications results in effective & efficient cost management in SCM of an enterprise. Managers & supervisors adopt the practices for mobile technology to reduce their operational expenses.

Another influential factor which advocates the adoption of mobility systems in supply chain is its availability to various stake holders in an enterprise. There are endless elements which adds business value to supply chains and when functionality of wireless connectivity is added to traditional functions of the supply chain the system becomes quick, responsive and encounters fewer human errors. In his book (Brans, 2003) described importance of adding wireless mobility to enterprise functions and how personnel's whether company executives, sales/ service managers, IT managers, technology managers takes advantage of this ICT feature.

However, he also made existent the necessity of security protocols that need to be adhered too while conceiving mobility in enterprises.

2.4 Benefits of mobile information in business

As per (Wiredu, 2007) many organizations adopt the use of exclusive mobile devices to sanctify a way of managing information on the move beyond the concept of fixed. The benefits presented below are the holistic view of mobile information services to supply chain and may be generalised as:

Benefit	Mechanism & Effect	Parameter
Omnipresence	These are location independent at any time thus minimizing time and space constraints in information management.	Reach dimension
Opportuneness	Size and ability to be easily carried anywhere, makes them preferred way to access variety of information in digital form.	Responsiveness
Interactivity	Immediate and interactive transactions, communications, and service providers thus can benefit enterprises that rely on customer support and delivery of services. This can result in improvements of efficiency and productivity.	Responsiveness & range of services
Personification	Mobile devices are specifically designed to be operated by a single individual. This caters to provide bespoke services provision related to the delivery of information, products, and services for an individual.	Automation & Range dimension

Table 1: ***Benefits of mobile devices*** **(Keen and Cummins, 1993)**

2.5 Challenges of implementing mobile SCM

As indicated by (Chan and Chong, 2013) the supervisors of supply network are continually confronting difficulties that dissuade the ability of transportation items effectively and rapidly. The issues can harm the whole SCM and the production

network of the organization. The organizations are moving their enthusiasm towards versatile information assortment arrangements to streamline the operational activity and SCM network. The arrangement identified with voice picking arrangements can bring request exactness, brisk delivery, and upgrading representative efficiency. Be that as it may, numerous workers in the associations are yet concentrating on manual information assortment answers for infiltrating and evacuate information physically. It is critical to thinking about that manual information preparation brings blunder and ineffective. Also, (D. Singh, G. Tripathi and A. J. Jara, 2014) contend that organizations are not utilizing the greatest digital security programming. The organizations are not evaluating providers and measure how helpless or solid the supply network is. The execution of mobile web administrations requires ability identified with control, nature of administration, administration revelation, and arrangement to be enlisted in the open library. The supervisors are not permitting data access to the procedure of an SCM network continuously and furthermore not imparting to the members. (Ojha, Misra and Raghuwanshi, 2015) said that the administrators are not fundamentally clinging to the nature of administration while executing versatile web administrations. The organizations are required to concentrate on machine association and client communication, for example, scanner gadgets, production line, and others. It makes issues while executing versatile SCM in the association. Hence, different difficulties can be exploited to propose mobile-focused SCM classified in two settings. The principal setting is concentrating on the joining of great web administration in the supply chain network with portable adaptation. The subsequent setting is concentrating on the improvement of mobile administrations dependent on nonexclusive design for the mechanization of the SCM procedure (Ben-Daya, Hassini and Bahroun, 2019).

Another categorisation of challenges has been classified as internal and external problems. External obstacles include implementation and maintenance costs, return on investment, limited capital and other resources, lack of ICT awareness, while external obstacles to ICT usage are political, economic, socio-cultural, technical and regulatory issues(Oyebiyi *et al.*, 2018). According to (Smith and Huber, 2005) One in five businesses agrees that their technology systems are not well integrated around the enterprise. Through embracing World Class SCM and utilizing broadband-based technology like 4G OR 5G to monitor the accelerated flow of key management

knowledge, Ireland will maintain higher value functions such as R&D, marketing, distribution and customer relations while performing real manufacturing processes at a remote location.

2.6 Ways to manage the identified challenges in supply chain

It's very well may be said that the utilization of distributed computing advancements, versatile and wireless technologies in retail area has gotten upgrades exactness, proficiency and straightforwardness in business activities in supply chain management. (Singh, Garg and Sachdeva, 2018) advocates the primary work of a manager in a firm is to build strong collaborative supply chain management team that must adapt quickly to dynamic environment. The manager is required to concentrate on the division of work, involvement with SCM, social aptitude and the all-around fabricated comprehension of how exercises in the supply chain influencing different functions or departments inside the firm. The manager or supervisors are required to recruit right workers on the principal endeavor and furthermore guarantees to diminish errors and HR costs that may ruin the procedure of information assortment. In similar accordance, (Arunachalam, Kumar and Kawalek, 2017) stated the use of 3PL system (3rd party logistics) by firms to offer outsourced logistics services. It helps to manage any contract discrimination in times of trouble for supply chains. This directly relates to control cost structure for effectively while keeping the management's attention towards the core competencies of the firm. Nevertheless, firms are also required to keep IT threats at bay, with the use of best cyber security software in their supply network devices. Altogether an economic lookout focusing on rising price of fuel, energy, technology is affecting the product shipping should also be of importance for the manager. Also, the manager should consider to increase the minimum wage that can affect the bottom line of the company after observing all the parameters (Chan and Chong, 2013).

Based upon the analysis described above it can be stated that the use of mobile technology is an essential part of supply chain as it transcends information pertaining to the product & processes in real-time to meet the expectations of the customers (Yu and Deng, 2011). Relying on the usage of mobile technology total cost of the supply

chain could be minimized and an effective agile SCM strategy could be laid. The present times calls for a nimble & scalable supply chain management.

2.7 Conceptual Framework

The framework expresses the analysts see in a run of the flowchart way. It goes about as a kind of perspective point for different researchers to pick up understanding of the exploration subject. Individual educationist has provided their own unique definition & understanding of the conceptual framework. An incorporated perspective on the issue is portrayed in a Conceptual system (Liehr and Smith, 1999). In their study (Adom, Hussein and Joe, 2018) has identified the importance of conceptual framework.

To increase the productivity of various business process management and enterprise resource planning systems an arrangement is extremely significant between different parts of business reference models and information exchange innovation/frameworks (Millet, Schmitt and Botta-Genoulaz, 2009)

The study in consideration that is applications of mobile technology in supply chain management (SCM)has limited availability. The researcher has attempted to develop the conceptual framework for this study through the flow chart. This in-turn will immensely support readers to understand the insight of the research topics on mobile technologies in the supply chain. It also throws light on how numerous variables are interconnected with each other. The exploration is concentrating on the use of portable innovations in SCM that enables the organization to diminish item expenses and fulfill the need of the clients. The utilization of versatile, tablet, and IoT based innovation is helping associations to upgrade production network exercises. It is proposed that both the researchers and industry experts would profit by the structure created.

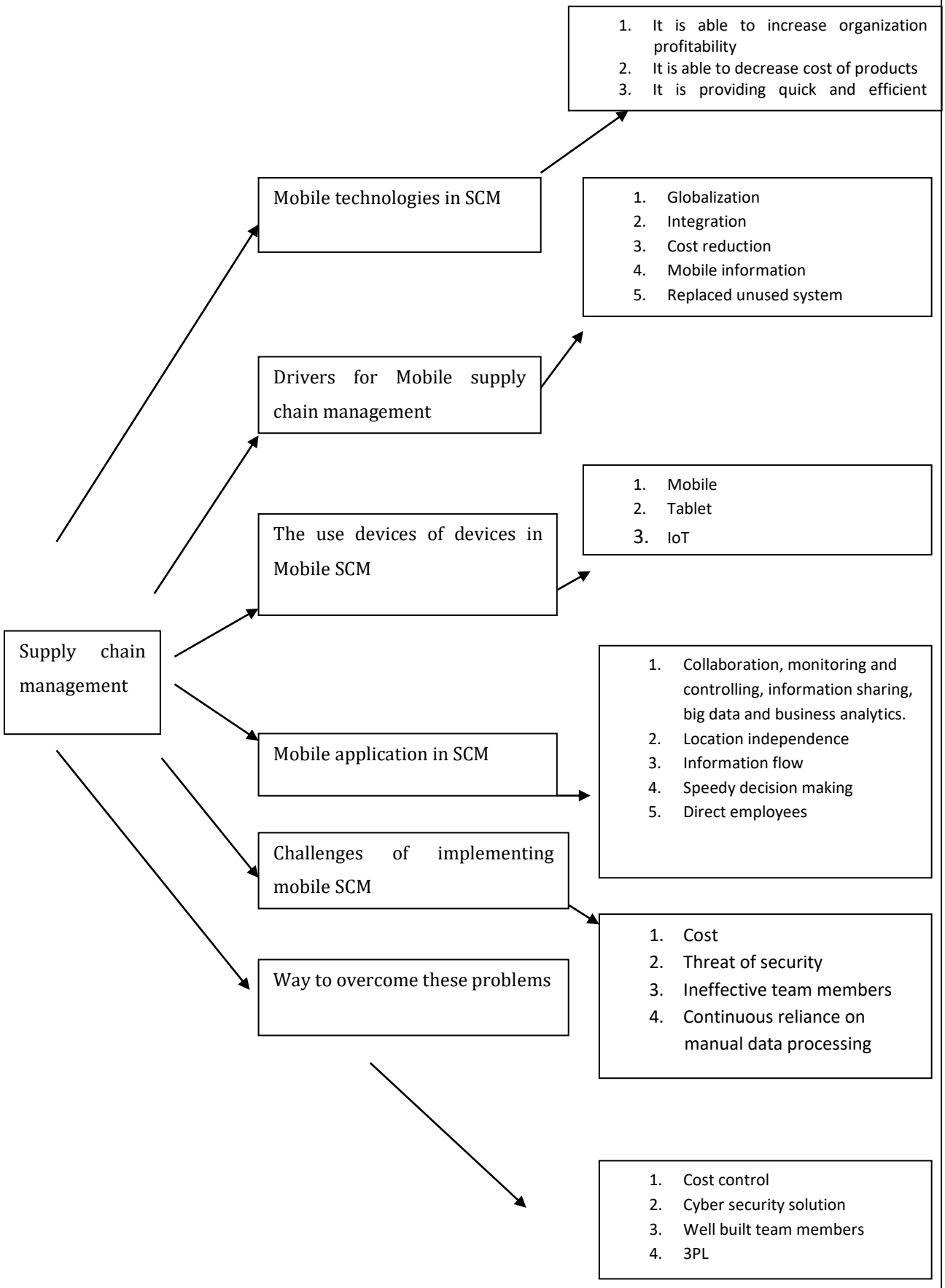

Figure 6: ***Conceptual Framework (Source- author assembled)***

Information technology & systems employed in SCM helps to connect all the activities of the supply chain using performance indicators recorded, utilization of resources, and thus finally improvise operations(Gunasekaran and Ngai, 2003). For a robust, scalable supply chain ecosystem mobile technology supports by reducing the total cost of products and gather information to meet the dynamic demands of the customers. The technology also is a boon for the process & owners as it provides information about various data in real time. Significant factors like cost reduction, globalization, integration, mobile information sharing, impacts the operational architecture of mobile based supply chain management as it allows customers to check the availability of products, price and others dynamics in real time (Büyüközkan, & Göçer, 2018). The utilization of IoT is additionally upgrading the inventory network exercises of the organization. It additionally assists with estimating customer propensities which can be controlled remotely through Smartphones. The associations are likewise confronting issues while actualizing portable SCM. It is on the grounds that a few representatives depend on manual work which carries blunders and irregularity to the work. The usage of versatile SCM additionally builds security dangers, for example, hacking, misrepresentation and others. In this way, the utilization of versatile based innovation will be useful for the organization to oversee in SCM. The firms involved at each stage of the SCM network have to focus on cyber security solutions to manage cybercrime (Kalem *et al.*, 2016a)

2.8 Conclusion

To summarise, the study of theoretical concepts of Supply chain, mobile SCM, ERP, enterprises along with benefits & challenges of the research conducted is detailed out. To add on to this a conceptual framework is proposed & explained which promptly portrays the supply chain ecosystem around the smart mobile devices. No doubt, the technology is growing at a very rapid rate but still concepts like going wireless in real time scm processes are still in the infancy stage.

3. Methodology and Research Design

3.1 Overview

In this part of the research, I have attempted to provide details of the methods employed used to collect the data for research purposes. The details also include specifically the method used for data collection and the type of research it constitutes too.

3.2 Research Philosophy and Approach

The researcher focuses on the guidelines of research philosophies for getting the research outcomes. For this study, I have considered the **Interpretivism** philosophy over other research philosophies available. (Crotty, 1998) suggests, a researcher should be clear about the choice one makes in order to be taken seriously. Interpretivism regards humans to be distinct from physical phenomena as they create meanings and interpretivist researchers study these meanings.

The interpretivism philosophy has been endorsed by the researcher to overcome & answer the research problems in the research process. It is assumed to be of unique standard and takes less time rather than a positivism research philosophy. According to Schoonderbeek (2018) interpretivism philosophy is effectual to focus on the behavior of the supplier during the many processes of supply chain. The researcher has observed, captured & assimilated the views of the users regarding the usage of mobile devices and applications in the supply chain ecosystem. This philosophy helps to address the problems that are faced by the users during the various phases of supply chain process. This research method is effective to consider knowledge in the context of research issues. Finally, the researcher has used this philosophy to get the research results effectively. This method is best suited for the research as it helped me to gain critical knowledge of the research problem being subjective in nature. Seeing the problem from every angle and taking into consideration the opinion of the social world around is a challenge for interpretivists.

The research paradigm was first used by Kuhn in his philosophical research work. As per (Kuhn, 2012) research paradigm is “an integrated cluster of substantive

concepts, variables, and problems attached with corresponding methodological approaches and tools". The research philosophy caters assumptions that helped the scholar to source, collect data, and guide in data analysis to arrive at a conclusion in a systematic manner. It forms the base for research to comprehend the nature of the research problem by constructing a contextual model of knowledge. The research philosophies studied in practice are positivism, interpretivism, pragmatism, and realism. Each of these philosophies is unique in working & guides research in shaping and identify significant thoughts to visualize the nature of the research. Each philosophy is attached with specific theoretical values that provide guidance to the researcher to settle on research tools, techniques and approaches (Creswell, 2013).

This area signifies the plans, procedures for research that provide information on the method of data collection, analysis, and interpretation to address the objectives of the research. The approach guided me on identifying a specific research technique and to arrange the research plan in a systematic manner by selecting research instruments & techniques as per the nature of research. The research approaches available in the research environment are deductive, inductive and abduction (i.e. blend of inductive and deductive) (Hair, 2015).

I won't be considering deductive theory in research since I do not have a hypothesis.

The research approaches are characterized to be an effective way in the research for identifying the research problems by using the methods of data collection. It considers the deductive and inductive approaches that is used by the researchers to address the research problems and achieve the research objectives timely. For this research, the **Inductive** approach was selected which also gels with interpretivism philosophy (Creswell, 2014). An inductive approach gives a bottom-up approach towards reaching the problem. It provides a simple, straightforward findings in the context while establishing a clear link between my research objectives and the summary findings (Thomas, 2006). Regarding the research approaches, the author has used inductive approach for analyzing the research plan in the context of the supply chain ecosystem. Author feels that this approach is congruent & fitting to reach the problems in the research. It is also important for research findings and achieving the research goals. Advocate of this approach Wang et al (2016) proclaims to be very helpful in regard to address the issues of mobile devices during the supply

chain process at the workplace. The inductive approach is based on the derivation of new theory that provides the relevant data to the researcher where the researcher focuses on the supply chain ecosystem.

3.3 Research Strategy

The research strategy is a guided mechanism used by the researcher to get the quality results. This technique helps the researcher for laying down the plan to achieve the research outcomes as well as objectives effectively. It is an effective framework where a researcher has applied this context for addressing the research questions. It is said to have a positive effect on the research process to overcome the research problems or issues. The researcher focused on the supply chain ecosystem by implementing the research strategy. Additionally, this method is also proven to be highly efficient to reduce the research gaps effectively. Overall efficiency of the research could be improved by using this method. Ultimate requirement of this research is relevant and reliable information to get positive outcomes or results in the research (Bandaly, Satir and Shanker, 2016). The research strategy contemplates the overall information about the research process. It is very straight & down forward classified medium for conducting the research and to fulfil objectives in an accurate manner.

I have adopted the **Qualitative method** as a design framework for my research, as I have interacted with opinions generated from different people to understand the phenomenon. The qualitative design has turned out to be extremely useful for such descriptive and exploratory case study research to obtain and collect inclusive information and quality data to realise research objectives with an in-depth perspective using qualitative data collection techniques (Bryman and Bell, 2015).

The research method has 2 phases:

Primary phase: Exploratory- This has made me familiar with the context of the research, brainstorm, and explore new questions or reasonings. It includes literature review & analysis of secondary data and followed by interviews with individuals/professionals working in supply chain

Secondary phase: Descriptive- This activity instilled me with the process to analyse & interpret phenomenon studies in detail. A semi-structured interview works along with field observation.

This design philosophy also contributed the researcher with knowledge of selective observations to a wider overview to arrive at conclusive results to realise the association of mobile devices with supply chain management. (Bahari, 2010). The research strategy gives an overall view of the research process. It is a systematic plan to study a problem. It includes elements of research projects like research focus area, research design & research methods while proposing to answer the research questions & the way chosen methodology is implemented.

Research design acts as a framework to seek answers to research questions using suitable research tools and methods (Groenewald, 2004). Thus research design bridges a link to the rationale behind the research problem with a suitable research tools to make research achievable and conclusive (Bell, 2014). The basic research methods available are qualitative, quantitative, and mixed research methods (i.e. blend of qualitative and quantitative designs).

3.4 Collection Primary Data

Data collection methods are significantly classified as primary methods and secondary methods.

The primary data collection is directly done by the researcher using methods such as interview, direct observation, survey, focus group, personal investigation, questionnaire, opinion poll. The secondary data is collected through some media like existing reports related to the study, from the sources such as handbooks, articles, journals, published market researches, business magazines, news articles, blogs & websites, etc. (Srivastava, 2011). The data should be relevant and reliable to get a positive outcome in the research. The primary data is collected by the researcher for the first time by using different methods like survey, interview, questionnaire, and direct observation (Korstjens and Moser, 2018). This data is called the fresh data that can be implemented in the research for accurately achieving the goals and objectives.

In my research, I have followed both primary and secondary data collection methods to ascertain new qualitative research data and retrieve existing data from secondary sources. The basic source behind the research is the collection of secondary data first & extrapolate the search towards primary data sources.

Since the study is a blend of exploratory & descriptive methods, the primary data is collected via semi-structured interviews which could be done face-2-face or through online mode whereas the secondary data is an ongoing collection with the review of existing literature from books, published market research, journals. The secondary data is collected by the researcher as the research has progressed time to time that is based on the primary data. Nonetheless, secondary data may be related to published journals, articles, handbooks, and websites. Thus, researcher has also adequately focused on secondary data that was collected from books, journals, and articles. The primary data is more effective rather than secondary data for addressing the research issues. For understanding phenomenon under supply chain management, the researcher can focus on primary data (Moser and Korstjens, 2018). The primary data gives better efficiency in the research. The primary and secondary data altogether has turned out to be more effective for this research to get the research outcomes. All the methods employed by the researcher to carry out interviews helped to collect reliable information regarding mobile devices with the supply chain ecosystem. Regarding the research, the primary and secondary data are characterised as effective to gather information in the context of supply chain management. It is learned that many researchers focus on primary data rather than secondary data for increasing the effectiveness of the research (Alase, 2017). The selected methods have provided more effective outcomes to the researcher for getting fresh and reliable data for getting success in the research.

3.4.1 *Sources*

To fulfil the objectives of the research, I made an attempt to gain the best possible information from company key executives/employees in order to gather primary data. A sample questionnaire with open-ended question was designed for the interview. The theme was strictly towards the use of mobile devices used in business & supply chain scope. The questions were kept similar for each participant to

maintain the coherency & generality as well as it helps to identify coding in content analysis. Interview questions were derived from the research questions & objectives. Participants were not guided any time for their responses. Their response is purely their own knowledge of the topic.

1. What part of the supply chain you are particularly involved in your organization?
2. How long have you worked in this role or department?
3. What sort of technologies are helping you to perform your duties well?
4. What is the importance of implementing mobile technologies like mobile devices and applications in the supply chain system?
5. How to improve the supply chain ecosystem in the organization using mobile devices and applications?
6. What are the main issues that might be faced by an organization to implement mobile devices and applications in the supply chain ecosystem?
7. What are the techniques that can be used to overcome these identified challenges and improve the supply chain more effectively?

3.4.2 *Sampling*

The researcher chose participants basis probability sampling method rather than non-probability sampling method. Sampling is vital for recognizing & choosing a relevant subgroup from the target population size. Simple random sampling has been chosen under the probability sampling. This method allows the researcher to provide each participant a fair opportunity to be selected in the research from the target population size (Gaganpreet Sharma, 2017) this also resulted in prevention of any selection related bias.

3.4.3 *Population & sample size*

There are many big & small firms operating in various locations of Ireland. There are many industrial & IT regions across Ireland and each region has its own development. Researcher has considered to choose supply chains of enterprises only operating within Ireland. They firms may or may not have their operations beyond the Irish geography but participants for interview are strictly located in Ireland.

Sample size includes the numbers of subject's researcher has chosen from the target group as a representation of the target sample. Participants who are working in Irish

firms were randomly selected & approached via LinkedIn & social contacts for participation in research interview. Participants criteria is as of location, employment in any Irish firm and experience of working in supply chain. The position of participants is account manager, store manager, supply chain manager and warehouse operator. Both genders male & female are the part of the sample. Position, work profile and their relevant experience is best suited as per the nature & topic of the research.

3.4.4 *Access and Ethical Issues*

The ethical information is important to the research questions that help to address the relevant results in the research (Schoonderbeek, 2018). I have done all activities to collect data & conduct interviews within the scope of professional networking. Some ensured familiarity with the scope of study and how their denominations could be used. Simultaneously I have ensured to maintain the anonymity of the research participant wherever the same is requested. Non-Disclosure agreement too was provided to participants wherever the request is made. A list of interviewees was maintained and was shared with the supervisor to ascertain his/her view on the respondent's capacity to be eligible for an interview. A professional demeanour was maintained with everyone.

Apart from primary data, secondary data ethical concerns also strictly adhered too. I have considered plagiarism, intellectual rights & privacy of data. Finally, all the protocols guided by Griffith college were maintained with integrity & trust. The research has ardently ensured that under any circumstance's college reputation is not hampered at any moment of time & space.

3.5 Approach to Data Analysis

Qualitative data analysis presumes to be descriptions of the story & themes that originate from the context. During the process of analysing the data the researcher collaborates with the research participant by examining the story description & negotiating the outcome of database (Ollerenshaw and Creswell, 2002).

The researcher has analysed the data that was more important to achieve the research objectives accurately. The researcher has considered the different kinds of data

collection methods such as content analysis as well as statistical analysis for gathering reliable and valid information (Korstjens and Moser, 2018). In the context of research, the researcher has applied the content analysis for the interview method to analyse the responses from the participants. The statistical analysis was used by the researcher in the concern of the survey method for gathering reliable and relevant data or information.

Consequently, the researcher analysed the qualitative method for collecting the data with quality that helps to get the research outcomes precisely. The qualitative methods are more useful to get a positive outcome and improve the efficiency of the research outcomes as well as research objectives. The researcher considered the primary and secondary data for collecting valid information regarding the research topic. The research philosophy and research design are more effectual for data analysis in the context of supply chain management and the use of mobile devices and applications at the workplace (Bandaly, Satir and Shanker, 2016). The researcher has adopted the research strategy for maintaining the research approach.

The data analysis methods employed by the scholar are more effective in this research for getting better outcomes by reducing ethical issues. The ethical information helps to achieve the research objectives and research findings in an accurate manner. The data is measured by the researcher that is probably effective in the research outcomes. All the data analysis methods are effective to the researcher for evaluating the data or information regarding the research objectives ethically.

3.6 Conclusion

The preceding section showcased the principal methodologies, research approach & strategy and their inter-relationship to answer the research questions & objectives. The study produced successful results with the usage of testing tools and strategies. The research onion framework helped the researcher to identify the positive impact of mobile devices and their application in the supply chain ecosystem. This learning will be more effective if the researcher is to succeed in the future.

4. Presentation and Discussion of the Findings

4.1 Overview

This section of the dissertation attempts to translate the results obtained from Primary & Secondary studies conducted by the researcher. The collected data is keenly & deeply re-viewed to identify meaningful findings. Response captured from the interview questions are analysed to determine the extent of success. The researcher has attempted to reach & finally obtained the answers for the research questions which provides affirmation of achieving research objectives.

4.2 Findings

The researcher interviewed 5 participants from different companies involved in various functions of sales, warehouse, retail & technology sector in Ireland for this report. The following is the study of the answers to the interview questions from the viewpoint of the various research objectives. A pattern is observed & established with the responses received in reference to cover 3 broad objectives themes: significance of using mobile technologies in the supply chain, challenges that an organization might face in implementing these technologies, ways by which these challenges can be overcome.

4.2.1 Significance of using mobile technologies in the supply chain ecosystem

To fulfil the scope of the research objective, it was investigated from the participants how important is contribution of mobile technologies in their companies' operations. From the responses captured in the interview, majority of the participants convey that tools like email, laptop, software applications like cloud, Customer relations management (CRM) and even landline all are important, while smartphone use is a necessity. Not only it provides ease of communication to reach out to their clients, customers, co-workers via calls in time but it also gives them liberty & flexibility to check & approve their order quotes. As confirmed by one of the sales account managers of a retail chain, she has been provided with accessibility of Salesforce CRM application to check and update the status of orders on the go. This thought has been well resonated with findings of the article (Szymczak, 2013), as per the article applications like CRM gives opportunity for field service employees to confirm their

operations using smartphone which is recorded in the companies ERP system. One of the supply chain managers acknowledged the use of versatile software package significantly used for procurement & supply chain solution “Ariba”. One of the most popular solution provided by SAP gives access to mobile device integration i.e. the application could be installed on the mobile and user can perform functions irrespective of location & availability.

It is very interesting to learn from one of the retail store managers of a convenience store that the use of handheld PDA mobile devices is used to scan the products serial-barcode for price-check and expiration dates (for chilled and fresh produce). This is much better accepted practice as compared to taking deliveries in manual or traditional ways. The benefit of using PDA scanners was also advocated by (Pihir, Pihir and Vidacic, 2011) in their research. These devices have drastically improved the process execution in terms of cost & time and eliminating potential human errors. A similar view is received from an executive working in logistics & procurement function. Barcode scanning, fleet management, shipment tracking etc applications are being employed along with mobile devices to perform & assist in work activities which drastically improve tracking of the consignment.

One the contrary one of the software engineers who works in development of procurement-based solutions highly advocates for cloud-based solutions. He regards such solutions are accessible anywhere & from any device can be used for variety of purposes in supply chain. This helps in quicker decision making and can also prevent firms to deploy any other high cost massive systems.

4.2.2 Challenges in the supply chain while implementing mobile devices and applications

The objective of this section is to infer the potential challenges which are faced by executives and is impacting the adoption of mobile technologies in supply chain. The interview findings reveal some fundamental problems. One of the challenges briefed by an account manager is consistent rapid changes in technology leads to a paradox for companies. It leads to a conundrum that if they implement one set of technology today in their supply chain, it will be over-run by another new technology in near future. This is an issue of sustainability of technology. Any technology adoption requires investment in terms of finances, resources & efforts. This is a one-way street where at one end firms faces FOMO (fear of missing out) in implementing any new system & on other

end they fear of losing resources on technology that may get obsolete. Thus, a balance has to be made in a strategic way.

Another participant working as store manager feels that Research & development of the organization is not taking much interest regarding adopting new technology. As per the response received it could be sensed that firm is not taking any initiatives to develop applications that can be installed in mobile devices, which can inherently turn the mobile devices to do the work of PDA scanner. The resistance to change and adopt new technology could result in losing of competitive advantage for the firm. This thought is well advocated by (Russell Dawn M. and Hoag Anne M., 2004) in their journal. In another research by (Khan, Ahmad and Abdollahian, 2013) they emphasized "resistance to change" as the main challenge for firms to adopt new technology in supply chain.

One of the supply chain mangers put emphasis on cost incurred to implement & maintain such technologies. As per her, if company has global presence it becomes difficult to maintain unanimity in the process keeping in mind all legal & regulatory specifications of the geographies the company is operational. She also put focus on data leakage due to mobile devices being too vulnerable. (Kalem *et al.*, 2016a) and (D. Singh, G. Tripathi and A. J. Jara, 2014) also have similar theories concerning security of companies data and it can impose serious challenge for a company. To add on to this another logistics executive broadly states that the challenge are the expenses during the process of implementing such technology. Another sporadic problem is internet connectivity issues for mobile devices as applications & servers need data recorded from wireless terminals. To share information on the go one needs internet connectivity or on the other side to provide a procedure to record data offline i.e. even if the mobile device is not connected to internet, the mobile application still can scan, record information. This problem is emphasized both by the logistics executive & software engineer.

Thus, finally it is discovered from all the respondents that cost is the most significant challenge that affects the companies to adopt & accept any new technology in the supply chain of Irish firms.

4.2.3 Ways of improving and overcome these identified challenges

As per my final objective to materialise, I also asked participants about their view to overcome the challenges they stated and what could be the solutions to improve the

supply chains. From the responses, it is concluded that supply chains are an integral part of the business and using mobile technology impacts various functions of planning, sourcing & delivery of product, services. One of the participants mentions communication between the departments is a very possible solution. If department jointly addresses the need for technology like mobile in any function of supply chain, it would bring out a clear picture. Lack of communication & correspondence between various stake holders like IT, technology, marketing & retail would not allow scalability of any new technology.

Another participant argued that investment of right people or workforce is extremely important. If R&D employees are lacking technology innovation than they are just making the entire supply chain obsolete. The emphasis is on employees who understand the need for mobile technology and can devise measure to exploit it for business needs. Along with-it other employees who are lacking the skill to use mobile based technology have to be re-skilled and trained for maintaining smooth operations of the supply chain. This phenomenon is also accredited by logistics executive who feels workforce should be well equipped, knowledgeable & skilled.

On the contrary another manager proposed to use less complex technology as maintenance of the mobile devices could become tedious with time and integrate security measures for systems which fosters mobile technology. Finally, the engineer working around procurement applications request the need of mobile devices with internet connected to all vendors who are working for any firm.

4.3 Discussion & Conclusion

The section comprehends results as a relation between various findings based upon secondary & primary research. Since the conceptualization of the topic the researcher kept his focus to investigate the primary objective of the research to understand the significance & impact of mobile technologies in supply chain. Glancing thru secondary data to interpret existing literature it can be discussed that mobile technologies in the form of mobile devices & applications are the quintessential for enterprises. One of the crucial tasks of communication & correspondence to run the supply chain is only possible through mobile technologies. Irish firms however face certain challenges

regarding the use & implementation of these technologies. Cost factor being the prominent one. Nonetheless, at the same time it is learned that mobile technologies have immensely benefited the firms by streamlining the supply chain processes and making the operations fast, transparent & reliable. According to (Khan, Ahmad and Abdollahian, 2013) supply chain becomes profitable when they adopt mobile SCM. It very well may be discussed that mobile tech performs a massive job in supply chain activities in different measures like real time controlling & monitoring, upgrading relationship with members of SCM, decreasing operational costs, lessening delays and shorter lead cycles.

Considering the facts that emerged from primary findings, it's evident that majority of the respondents have agreed to the usage of mobile technologies such as smart phones, laptops, ERP/CRM software, barcode scanning & tracing devices as per there role requirements. For instance, scanning of barcodes by PDA mobile devices is only used by store & warehouse managers. The significance of mobile technologies in Irish firms is affected by various factors & challenges. The discussion probes that certain mobile devices & applications have differential usage in supply chain i.e. various functions of supply chain may or may not adopt to all modes of mobile technologies. At a macro level it is viewed that mobile technology provides remote accessibility of services and at same time barrier of communication is eliminated. At ground level it is very clear that human errors are minimised in daily activities of supply chain personnel.

Our literature emphasized the use of next generation RFID devices for tracking purpose but in our primary findings it never came into picture. This also corresponds to the limitation of the study as it could not reach out to acquire more participants for the research. Although all the participants concurred the fact that mobile technologies have provided benefits in their work environment. Investment is regarded as the major consideration when the decision must be taken for adopting & implementing any new technology. This investment is weighed against the benefits like real time tracking, faster supply chain activities & performance attributes for the enterprise.

It can also be discussed from the findings relating to improvement of supply chain in Irish enterprises considers management of the firms to take smarter initiatives where research & development is concerned. Cloud based applications are gaining popularity and thus firms should open doors to garner the need of such tech. Till the time a

company won't visualise the benefits & efficacy of mobile technologies it will repel any new initiatives. Collaboration between various stakeholders is extremely necessary to fulfil supply chain requirements. R&D departments needs access to funding's & resources to experiment with technologies. To gain competitive advantage it is needed that firms should adopt new technologies & skill training for their employees. It is conferred that use of mobile technologies in Irish enterprises exalts impact in their supply chain operations.

5. Concluding thoughts and Suggestions for Further Research

This section introduces the many major & minor conclusions of the study. The present implications of the research, limitations & the future possibilities of this research are discussed. Since this study is conducted on exploratory basis & the researcher considers the domain of introduction of mobile technologies in supply chain is gaining momentum & future is purposeful.

5.1 Implications of findings for the Research Questions

The main question asked in the research regarding the significance & impact of mobile technologies in supply chain is evidently answered by the supportive primary research findings. Probing the findings, it comes to light that many firms in Ireland are dependent upon various types of mobile wireless technologies such as barcode scanners, internet based mobile devices aka smart phones, software like ERP mobile applications that can be accessed on the go. Conducting this research, we understand the relevance of mobile technologies exclusively in supply chain activities. As per (Szymczak, 2013) the most popular devices in any supply chain are mobile devices. Since supply chain activities are too wide too address and covers planning, production, manufacturing, controlling, distribution, marketing, retailing, and finally selling to end customer, it is inferred that at every stage one or more than one type of mobile technologies is in play. Study also highlighted the factors through which supply chain activities can become more robust, reliable, and responsive and thereby reducing cost structure. It also put emphasises on the need for innovation by the firms to develop & deliver time reducing & economical systems. The primary analysis illustrated the impact mobile technologies have in supply chain functions through which competitive advantage is achieved. This resonates with

the study of (*Mobile Communications: Managing Supply Chains on the Go - Inbound Logistics | Amy Roach Partridge*, 2011) that stated flow of information is maintained at all levels in a firm due to usage of mobile technologies. Lack of technological infrastructure & resources acts as a limitans for diffusing mobile technologies in supply chain. Unskilled manpower and personnel with technical skills are lacking in the industry who understand business dimensions for innovation in supply chain. (Kalem *et al.*, 2016a) have studied the role of mobile devices & applications in supply chain by understanding the characteristics of mobile SCM. However, in my study I have probed the impact of using mobile technologies in Irish firms by using a semi-structured questionnaire and concluded the importance of R&D, cost and trained skilled employees in mobile SCM. The results support the previous research conducted by other researchers in the field of use of information & communication technologies in supply chain.

Finally, the study generates an insight that if the firm wants to establish and gain over other competitors in the market one has to evolve technologically & use mobile technology in their supply chain to become more responsive to the dynamic supply chain conditions.

5.2 Contributions and Limitations of the Research

This study is exploratory and will contribute to exiting literature & studies already available in the context. This will certainly help in the supply chain industry & particularly to the departments of enterprises which are engaged in automation of their supply chain. The trend around mobile IoT, industry 4.0 is gaining much light and in near future the research on this topic will become more attractive to academicians and professionals. Working on this subject, the researcher's outlook & knowledge towards the field of supply chain management has drastically improved. Since the research is a factor of qualitative analysis the validity of findings is characterisation of thoughts, ideas, feelings & experience of various experts involved in the study.

The primary limitation of this study is the time & mode of interview the study is conducted. Regrettably the research is taken at the time of COVID-19 pandemic which is highly contagious & deliberately affects human life. Thus, the interviews which were initially planned to be conducted face to face and on wide scale is replaced with online

(email/whatsapp) mode. The semi-structured questionnaire is sent to the participant via email and their responses are captured & observed for further interpretation.

Another limitation of the study is choice of sampling methodology & the response rate. The interviews were investigative as we were seeking to understand the impact of mobile technologies in supply chain management of enterprises of a specific geography. Simultaneously, secondary data available was universal in context and not specific to any location to probe a strong outcome. The response rate of the participants who were requested for interview was low. Out of 30 invitations sent only 5 turned up. Possible cause is as described earlier is pandemic due to which majority of the economic activities have taken a big blow and lives of people is severely impacted.

5.3 Recommendations for Practice

In practise the technology could be sensed to be at a nascent stage as not all firms in operation are exploiting the benefit. As the study is limited to few organizations the trend of adoption, challenges could be significantly different in enterprises of other countries.

5.4 Recommendations for Future Research

The research has kept its focus on usage of mobile technologies in supply chain of the enterprises. This research was conducted as a base point for the future researches. The scholars can consider this research to better extrapolate their findings. The studies narrowed its findings only on mobile technology impact on supply chain management in terms of communication & exchange of information in real time tracking, cost reduction, productivity & efficiency.

As deduced in the findings innovation & competitive advantage play a significant role in supply chain evolution. There is enormous pressure on supply chain professionals and overtly on the departments & industries to innovate & improve the capabilities of supply chain and foster competitive advantage.

The research at this stage need further exploration in regard to the mobile technologies that are consistently evolving and how the same can be integrated at various levels of

supply chain. Industry professionals can envisage the challenges & barriers in adoption & use of mobile devices & applications from a macro to micro level of functions of supply chain management.

5.5 Final Conclusion and Reflections

The conspectus of this study reflects the correlation between the findings obtained from primary data and the research objective. It is ascertained that mobile technologies have a profound effect on the supply chain activities. Different firms in Ireland have a differing use of this technology however, limitations cannot be neglected.

In lieu of the study, certain subjects which cover core technical understanding of mobile technology is beyond the scope of the study. The author suggests further probing by technologists & engineers to establish a road map of futuristic mobile technology. Contribution, limitations & future implications are also provided in this chapter and author hopes that this research would act as a bridge for further studies.

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Appendices

Appendix A – Interview participation request – First contact (LinkedIn)

Hi ABCD,

I'm a student at Griffith College Dublin, conducting a research to study the impact of mobile devices-applications in supply chain eco-system & thus looking to interview (via email) supply chain professionals in Ireland.

Please let me know if you are interested in participating.

Thanks!

Appendix B – Interview Confirmation Mail –briefing with questions

Dear ABCD,

Thank you so much for providing your consent to participate.

There are few questions in this email which are requested to be answered & same will be used purely for my research purpose. The contents of the answers you provide, or any specific information revealed during this process will be treated in strict confidence. Also, use of the information obtained in the interview will be such that your company or any of the persons interviewed will not be individually identifiable.

If you have any questions about the interview, or about being in this study, you may contact me at ashishvarun.singh@student.griffith.ie or by mobile (085 2236216).

The Graduate Business School at Griffith College Dublin has approved my project and can also answer any questions you might have about privacy.

Questions – There are 7 questions in all.

1. What part of the supply chain you are particularly involved in your organization?

   Example : Marketing/Sales/Retail/Ecommerce/logistics etc.

2. How long have you worked in this role or department?

3. What sort of technologies are helping you to perform your duties well?

4. What is the importance of implementing mobile technologies like mobile devices and applications in the supply chain system?

5. How to improve the supply chain ecosystem in the organization using mobile devices and applications?

6. What are the main issues that might be faced by an organization to implement mobile devices and applications in the supply chain ecosystem?

7. What are the techniques that can be used to overcome these identified challenges and improve the supply chain more effectively?

Feel free to reach out to me if you need any clarifications on the same.

Sincerely,

Ashish V Singh

Appendix C – Interview with Retail store manager

1. I am currently involved in the Retail Business owned by one of the biggest retail chain industry in Ireland known as Musgrave who owns all 'Centra' stores and 'Super-Valu' stores in Ireland.

2. I have worked in this role for more than 2 years now.

3. Technology plays a really important role to complete my task everyday. For instance, our day starts with emails with new prices and offers decided by Musgrave that sends it on to our store every morning. We also get the details of our delivery trucks via email and the stock that's coming with the deliveries. All day work also involves scanning the products serial-bar-code for price-check and expiration dates (for chilled and fresh produce) via PDA-scanner. All other enquiries and other duties like attending conference calls are done via Mobile-phones or store-telephone when necessary.

4. Mobile phones makes our job very easy as all the information that is necessary can be accessed and excessed anytime of the day just on our finger tips. We can organise the day/week/year planner and keep it on check via mobile phones. Not to mention the presentations and group-conference-video calls can be arranged and communication within all the different departments and stores even the head-office is so much easier, quicker and efficient all thanks to Mobiles. We wouldn't be able to manage the stores so well and efficiently or any other businesses without the help of mobile-phones.

5. I would be very happy if we can use mobile devices instead of the PDA scanners that are provided at the moment. PDA guns are handful sometimes and lags with connection. IF we can have some Apps build-up suiting our line of work and can be used with more user-friendly interface that would be such a life-saver.

6. I don't think there should be any issues to implement mobile devices to any organisation. They are cheaper and portable, the only issue that might come would be the R&D department need to find more easy and user-friendly apps for the devices that would work like the PDA scanners and contain all the necessary details that's needed to run our business. Other issue I would say would a resistance to Change as some companies would not like to go ahead with time but be more conservative to their approach to sun the business rather than to adapt to new faces-pace work environment.

7. For techniques to overcome these issues, I would suggest that companies should invest the right people at the R&D to have a special team working constantly and who is dedicated to make more efficient and better ways to use technology within the business and be able to handle the problems that might arise due to using new technologies. Special training should be provided to all the necessary people who would be using the mobile tech within the business for smooth transition for PDA or old-school ways to New Mobile tech or New-school.

Appendix D – Interview with Supply chain manager IT

1. I am part of global indirect supply chain organisation. Managing IT category.

2. I have been in this role for 6 months.

3. We are using number of tools but SAP, Ariba and Intellicat being the main ones.

4. Now more than ever implementation of the mobile devices is extremely important. As we've just witnessed the global impact of covid19 breakout we had to move all of our staff to remote online work. Without mobile applications that we could access remotely we would not have been able to continue working.

5. Importance of mobile application is ease of access and flexibility around location where you perform work. Covid impact aside, we rely on accurate and real time data that is easily accessible to allow us to monitor spend trends and compliance.

6. Main issues are the cost of such technologies and resources required to roll out and maintain them. Global companies face issues with localisation of certain applications when it comes to language, tax, etc. Application security is also a concern when it comes to mobile devices, there is more risk of data leak / loss.

7. Not sure I have a perfect answer. Perhaps avoiding heavy customisation for application to increase ease of maintenance and adopting secure practices to keep the data safe.

Appendix E – Interview with Account manager

1. I work as an Account Manager for a telecommunication company. The part of supply chain I am currently involved in my organisation is mainly sales and support for my base of customers.

2. I have been working in Sales for last two and a half years but only started at my current role half a year ago.

3. I'm using various systems for different products that we offer. All of the systems are encrypted on a work laptop that can only be used on a secured network. The landline and a work phone are also important for use to fulfil my duties as beside emails this is the most effective way to contact customers.

4. Mobile technologies in the supply chain is very important these days as everything is dependent on it now. People need the technology to be able to communicate if they want to have an effective business and implementing mobile technologies help this.

5. The organisation I work for has an internal system that allows the employee to see the ecosystem in the organisation which helps the employee to go to the right department when needed. However, I believe there is always a way to improve the ecosystem of the organisation as bigger the organisation is it's more likely to be more difficult to follow up as there may be different people in one department focusing on different aspects of the job.

6. The issue may be the technology that runs out of date very quickly and is replaced by something newer so the organisation may not be able to always keep up.

7. Communication. I believe the communication between the departments is a key however it gets more difficult the bigger the company gets. This is the biggest challenge everywhere but unfortunately as one person can't manage everything when this occurs I don't think any company will ever overcome this issue, but they can try their best to prevent from the lack of communication to be happening.

Appendix F – Interview with Logistics & Procurement executive

1. I'm currently involved with logistics and procurement in the company I work for.

2. I have been working in this sector for more than 6 months now.

3. Inventory management, barcode scanning, fleet management, customer service, shipment tracking and consignment protection against theft and hazards.

4. The use of mobile technologies can ease up the work and provide more information regarding the consignment, the type of work and all other factors.

5. Monitoring resources and provide good data capture, providing good labour management and improving them.

6. The expenses that are incurred during this procedure and then the tools can be divided into two parts

A.) Business oriented - offline data entry, disconnected mobile database application

B.) Consumer oriented - offline entertainment and LPIM

7. A strong data base with individuals knowing the data management and analytics. Knowledgeable and experienced skill workers.

Appendix G – Interview with Senior implementation engineer

1. Senior Implementation Engineer

2. I have been working in this role for the last two years.

3. I work with an organisation that creates Procure 2 Pay solutions for mid and large enterprises. Technologies like cloud based Saas systems are used by our clients.

4. Mobile technology plays a massive role in supply chain systems. It first avoids the process of implementing massive systems in the enterprise. The user can interface over the mobile technology much faster as he has access to the mobile device every day.

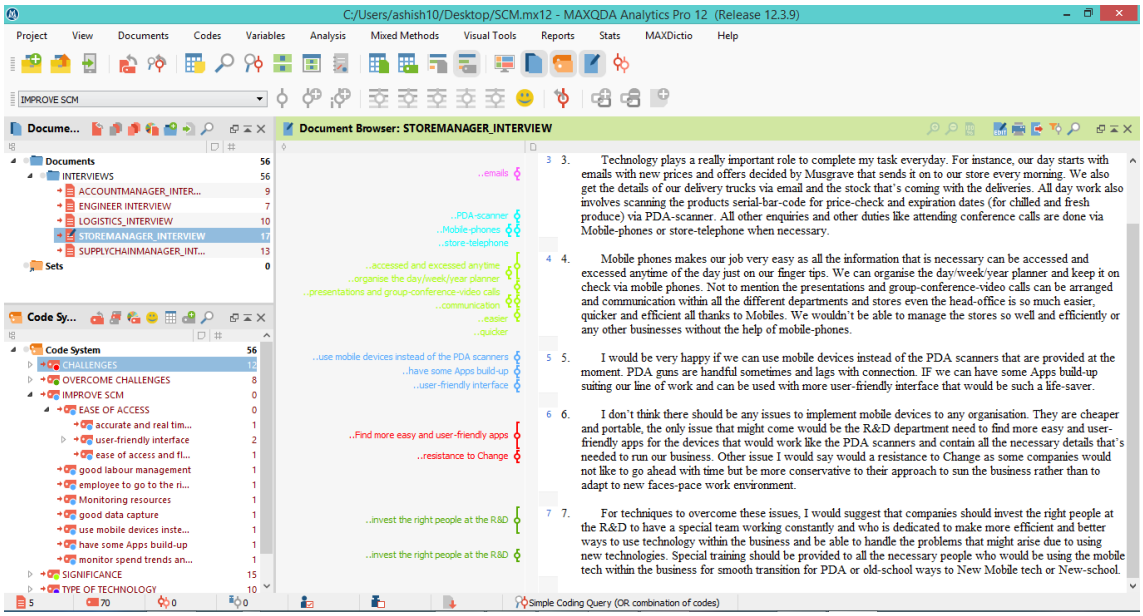
5. We provide the enterprise with vendor management software. The software is available on android and apple devices. The vendors can send their invoices through the mobile application making it user friendly for the clients.

6. The main issues faced are the access to internet to transmit the data from the user to the application. The user will have access to the application but without access to the internet he will not be able to share information.

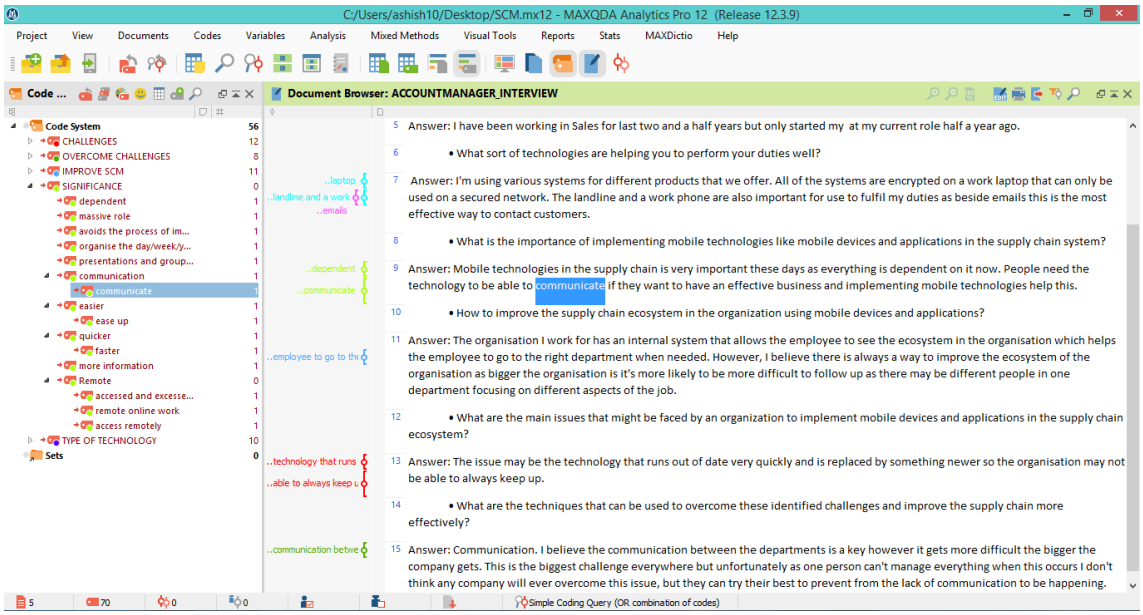
7. The organisation must ensure that all the vendors onboarded have access to mobile technology with access to internet.

Appendix H – Content analysis using MAXQDA (sample interview data)

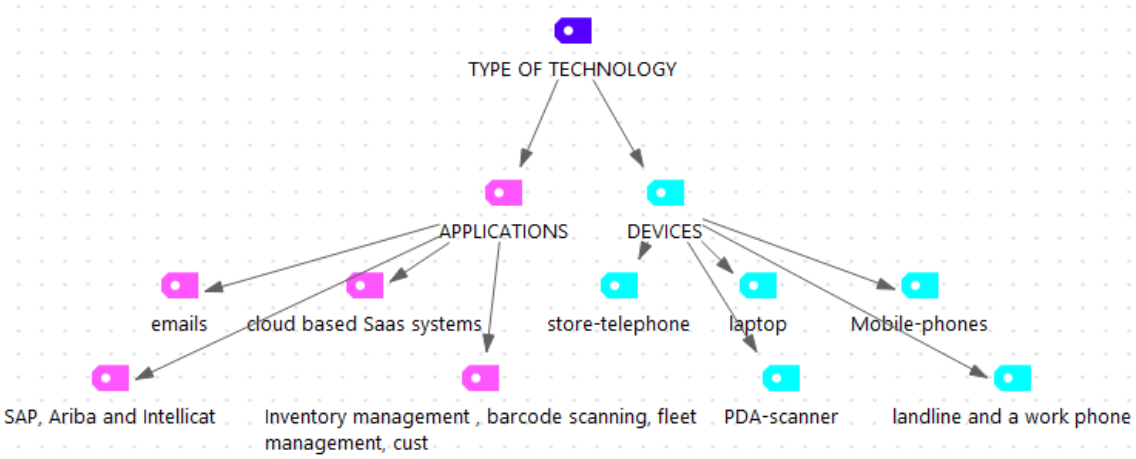
Coding segregation as per Objectives

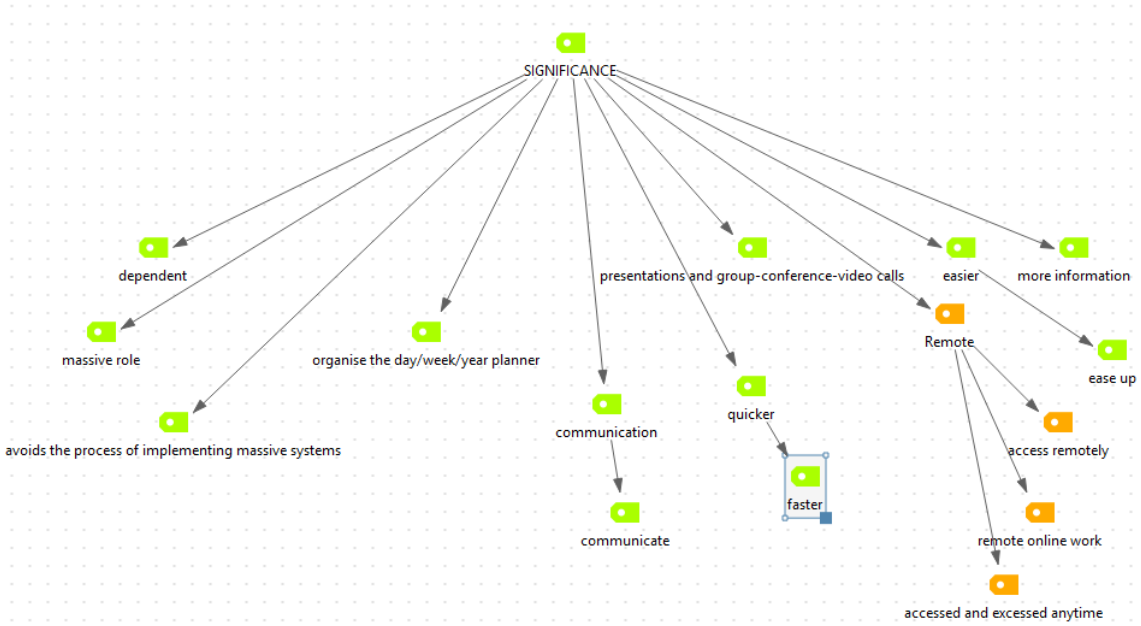


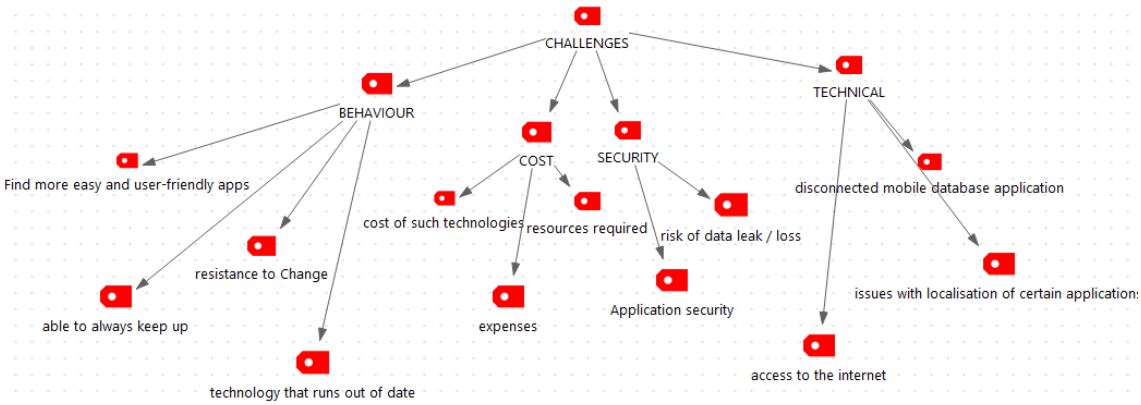
Coding fluffing Objective 1 & Questions 4

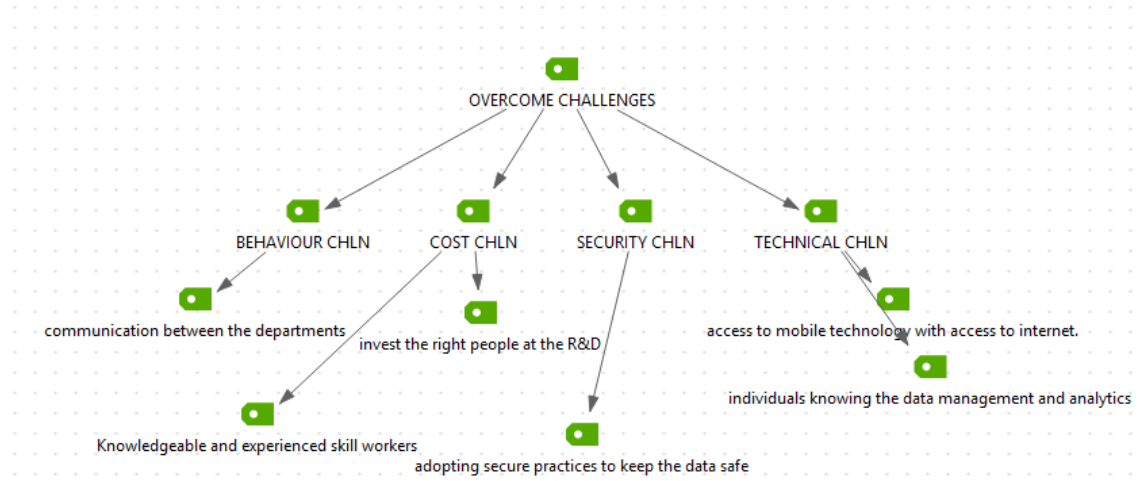


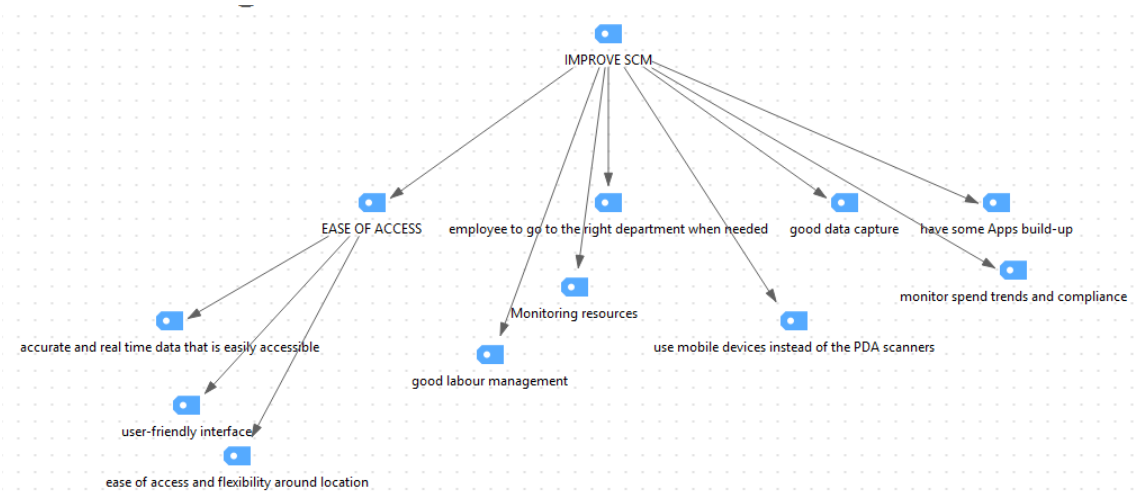
Coding Map Based on the Objectives






CHALLENGES
BEHAVIOUR
COST
SECURITY
TECHNICAL
Find more easy and user-friendly apps
resistance to Change
able to always keep up
technology that runs out of date
cost of such technologies
resources required
expenses
risk of data leak / loss
Application security
disconnected mobile database application
issues with localisation of certain application
access to the internet


OVERCOME CHALLENGES
BEHAVIOUR CHLN
COST CHLN
SECURITY CHLN
TECHNICAL CHLN
communication between the departments
invest the right people at the R&D
Knowledgeable and experienced skill workers
adopting secure practices to keep the data safe
access to mobile technology with access to internet.
individuals knowing the data management and analytics


IMPROVE SCM
EASE OF ACCESS
employee to go to the right department when needed
good data capture
have some Apps build-up
monitor spend trends and compliance
accurate and real time data that is easily accessible
user-friendly interface
ease of access and flexibility around location
Monitoring resources
good labour management
use mobile devices instead of the PDA scanners