TALLINN UNIVERSITY OF TECHNOLOGY
School of Information Technologies

Eusuf Hassan 194255IVGM

CHALLENGES TO INTRODUCE E-SUPPLY CHAIN MANAGEMENT PROCESS FOR PHARMACEUTICAL COMPANIES IN BANGLADESH

Master's thesis

Supervisor: Alexander Horst Norta
Associate Prof.

Tallinn 2021

TALLINNA TEHNIKAÜLIKOOL
Infotehnoloogia teaduskond

Eusuf Hassan 194255IVGM

VÄLJAKUTSED BANGLADESHI FARMATSEUTILISTE ETTEVÕTETE E-TARNEAHELE JUHTIMISPROTSESSI VÕTMISEKS

Magistritöö

Juhendaja: Alexander Horst Norta
Associate Prof.

Tallinn 2021

Author’s declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature, and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

Author: Eusuf Hassan

25.07.2021

Abstract

Technologically, the pharmaceutical industry is among the most advanced in Bangladesh. Among the totality, just 2% of the drugs are imported; the rest comes from the local firms. As a result of progress in the pharmaceuticals, Bangladesh has seen steady development in terms of export. Despite all the progress and improvements, the conventional supply chain was in place. The current manual system does not provide integrated and comprehensive supply chain analysis. For this reason, the total productivity is significantly reduced. Followingly, it expands the public's tax payments and expenditures. Many countries have an e-SCM system to solve the limitations.

The overall purpose of this master's research paper is to examine how e-SCM can facilitate in resolving existing pharmaceutical supply chain problems, with the primary focus being Bangladesh. This research employs a case study approach to identify the issues associated with incorporating an electronic supply chain management system in the manual supply chain system of the pharmaceutical industry. The data collection process included record analysis and expert interviews. The findings revealed that many procedures in the existing pharmaceutical supply chain are ineffective, including demand collection from end-users, delivery systems, production planning, and vendor contract management. Certain shortcomings in the supply chain could be avoided through the implementation of an e-SCM framework. For example, automatically collecting demand, monitoring distribution, and managing vendor contracts can be readily achieved through the means of blockchain technology. The study identifies a range of barriers to adopting e-SCM, including a lack of readiness in the existing IT infrastructure, a lack of ability to introduce modern systems, a high cost of implementation, and a shortage of qualified resources. The study then recommended a pilot project for introducing an e-SCM framework in Bangladesh's pharmaceutical supply chain system.

This thesis is written in English and is 46 pages long, including 6 chapters, 4 figures, and 6 tables.

List of abbreviations and terms

DPI	Dots Per Inch
BTRC	Bangladesh Telephone Regulatory Commission
BAPI	Bangladesh Association of Pharmaceutical Industry
SCM	Supply Chain Management
E-SCM	Electronic Supply Chain Management
DGDA	Directorate General of Drug Administration
RFI	Request for Initiation
RFQ	Request for Quotation
MRO	Medical Representative Officer
MPO	Medical Promotional Officer
RM	Regional Manager
ZM	Zonal Manager
WH	Warehouse
BDT	Bangladeshi Taka
USD	United States Dollar
PMO	Project Management Office
PMI	Project Management Institute

Table of contents

List of figures

List of tables

1 Introduction

In digitalization, the modern healthcare management system is a blessing for patients, doctors, and related stakeholders. Digitalizing the healthcare system is now a demand for all countries to keep patients' medical history and helps the government, pharmaceutical industries develop themselves to provide better services. In the year 2008, through the National Election of Bangladesh (http://www.ecs.gov.bd/), the winning political party and current government Bangladesh Awami League came with a political manifesto named “Vision 2021” [1], where one of the main goals is to transform current public services electronically. The name of this transformation is “Digital Bangladesh” [1]. This Digital government aims to provide better public services electronically to their citizens with greater efficiency, less bureaucracy, and transparency to interact easily. In the several public services, the healthcare sector is one of them where the Bangladesh government is focusing on digitalizing. Through e-health, it will ensure healthcare quality, ease of access, and developing countries' affordability like Bangladesh. Bangladesh's use of electronic knowledge and communication technologies in the healthcare field is progressing steadily concerning eHealth. The healthcare industry and the world have been developing electronic medical data infrastructure and practices because all industries have supplied e-Health capabilities to a variety of services. In short, in the present state of eHealth in Bangladesh, there has not been a comprehensive assessment yet [2].

In any healthcare system, either traditional or e-health or electronic healthcare system, pharmaceutical companies are also considered a vital partner because the pharmaceutical industry has a strong relationship with the medicinal trade traditionally. It plays an integral part in the promotion of medical care and promotes creativity and patient quality enhancement. Medical officials and health experts continue to address the relationships between medical professionals and the pharmaceutical industry through prescription medicines and drugs. The well-being of the country is profoundly affected by medications. The exploration, production, and successful use of medicines have increased the quality of life of so many people, minimized the need for surgery, and saved many lives. To meet this demand for medicines, pharmaceutical companies are being established for a long time, and Bangladesh is not an exception. Considering to other sectors in Bangladesh, only pharmaceutical industry is fulfilling the country’s drug

requirements by their own production . At the same time, many developing countries are still facing challenges to promote their local pharmaceutical companies to fulfill the national demand and reduce the import dependencies.

1.1 Research Problem

Pharmaceutical firms have learned that enhancing supply chain efficiency is essential to retain the strategic edge in today's competitive market conditions [3]. There are multiple players in the supply chain, and this cannot be very easy. As a result, the companies have to focus on many sections like medicines, price, availability, marketing, proper supply chain system. Moreover, these companies have to find out the black market for their business and citizen's safety. So the pharmaceutical companies have to deal with several types of business stakeholders, and their communication is not limited to inside the organization. As there are several parties are involved, so many complexities may arise in their supply chain process. For instance, from demand collection to distribution, the companies have to go through several processes like current proper research, clinical trial, medicine’s approval, pricing, and negotiating with relevant vendors and distribution. Besides these procedures, these companies must keep in mind that medicines should be available to the end-users by doing proper and correct distribution. Many facts are on-time delivery, appropriate delivery place, maintaining temperature, etc., which are very important to support the overall health sector. On the other hand, law enforcement agencies and pharmaceutical companies have to aware of drug safety. Because illegal drugs or medicines manufacturers respond to systemic vulnerabilities in medical supply and demand and do not just become opportunistic [4].

In the current supply chain process, the shortage of skilled human resources is another challenge. It is a national problem for pharmaceutical companies, and the overall Bangladesh Health care sector is having a crisis of skilled resources. The pharmaceutical business, among most sectors, claims that human resources are the organization's most important commodity. As per the human capital for health (HRH), it should be adequate for the number, capability mix, and delivery with complete competence and participation to build an appropriate, reliable. An equitable pharmaceutical supply chain system aims to enhanced equitable public safety in Bangladesh's formal and informal markets [5]. Therefore, the Pharmaceutical industry has made a substantial investment in recruiting and cultivating trained, competent workers.

Another issue is limited information and technological infrastructure. Though the Bangladesh government had decided to transform the traditional government into an electronic government, IT infrastructure is yet not ready. In the current scenario, "Bangladesh has no satisfactory level of IT infrastructural support such as electronic devices, country's internet networks, computers, and even electricity for supporting electronic health [2]. Furthermore, very few portions of people have access to computers [6]. Conferring to Bangladesh Telecommunication Regulatory Commission (BTRC) reports that the number of internet users is 112.554 million, around 68% of the total population [7]. Internet prices in Bangladesh are still high and incredibly inefficient. Additionally, capacity is not adequate to support practices related to e-Health. The time between hardware procurement and custom software creation, on the other hand, is high, such that the hardware becomes outdated by the time the software has been available to be used.

National safety issues are considered for the safety and supply of medications. Consequently, a secure pharmaceutical supply chain through an electronically integrated chain management system must also be necessary to the government. Currently, the Bangladesh government had understood the necessity of e-Health and implementing E-SCM in this sector. For this safety and security reason, the government had taken a plan to use Blockchain technology in the healthcare system and their supply chain management system [8]. This electronic integrated supply chain system can be easily expanded to other economy sections like tax and revenue boards, trade license issuing agencies, etc. This paper intends to investigate the challenges of introducing an integrated electronic supply chain system for the pharmaceutical industry in Bangladesh.

1.2 Research Objectives

This article reflects on the problems facing pharmaceutical supply chain participants in Bangladesh and analyses whether these obstacles can be addressed by implementing a structure with an interconnected supply chain. The objectives of the research are highlighted below:

1) Describe the current scenario of SCM processes and the factors which prevent its effectiveness, efficiency, transparency, and availability.

2) Present an extensive description of how the Electronic Supply Chain process can be applied in the Bangladesh Healthcare Sector.
3) Analyze the impact of the electronic-based solution on the effectiveness, efficiency, transparency, availability, and cost-effective process.
4) Design a framework to detail the methods and practices for the implementation of an electronic supply chain process.

1.3 Context

Bangladesh is now an export-oriented economy, previously a volume importing country, and it has adopted newer technologies and has flourished contract-producing opportunities in Germany and abroad. The total size of the industry is approximately 12,100 million, having a double-digit growth (IMS Health, 2015) [9]. 98% of local consumer demand and limited imports of vaccinations, hormonal, and anti-cancer medication. The overall growth between 2011 and 2015 was almost 18 percent. Indeed, after the 1982 ordinance came into force, the actual growth of the local pharmaceutical industry started to curb mass imports and foster local pharmaceutical production. The industry concentrates on generic medicines, which constitute 80 percent of the overall market, which have had the lowest operational cost in 20 years to achieve steady growth [10].

The supply chain is a modern method of conceptualizing patient supply management in healthcare organizations. A supply chain is described as 'a virtual network to promote the transfer of the product from the healthcare supply chain to knowledge, supply, and finance-related in the procurement and undertaking of drugs, from the provider to the end consumer to maximize the clinical results while controlling costs [11].

There are several prerequisites for the broad-scale implementation of integrated electronic supply chain management systems. If we consider a hospital, its supply chain consists of four areas. These are the planning, sourcing, and leasing of goods and services, inventory management, and maintenance of working capital. Hospitals sometimes need to build an efficient governance structure, employ complex processes, and simplify IT structures with an exceptional supply chain [12].

Adopting any new technology is a great challenge. If an integrated electronic supply chain system is being implemented in Bangladesh pharmaceutical industries, it might slow down the overall service because most of this pharmaceutical industry's supply chain is paper-based. Though in 2008, the Government of Bangladesh released a "Vision 2021 [1]" which seeks for presenting a future Bangladesh system to become a middle-income nation without hunger, grow innovative and competent human capital, develop an interconnected economic and trade center worldwide, and becoming a more inclusive, equitable community, still 76% of overall population lives in the rural areas [13]. Apart from that, easy internet access, electricity availably computer literacy is the challenge.

With many challenges, integrated electronic supply chain management has a range of problems that can provide advantages for supply chain structures of multiple products like pharmaceutical products. It will accelerate distribution, ensure products' consistency and prove their origin [14]. On the other hand, the issues that arise in the existing supply chain may be broader than can currently be solved solely by the proper initiative. Hence, the Bangladesh government seems to be technically unprepared to implement the integrated electronic supply chain system. Still, the country has also taken initiatives for the "Bangladesh eHealth Standards & Interoperability Framework" [15]. In parallel, the pharmaceutical companies are also developing their internal policy and organizational structure according to global requirements [16]. However, the pharmaceutical supply chain is primarily paper-based and faces challenges in maintaining product safety. The desire to strengthen the pharmaceutical supply chain should also be paired with a chance to leverage the technologies [17].

This research intends to show the possible challenges for implementing an integrated electronic supply chain system for pharmaceutical companies whose supply chain could help achieve a smooth and efficient delivery of quality products to patients.

2 Related Work

The purpose of this chapter is to present an earlier analysis that forms the basis for this investigation and review the studies that are pertinent to the study aims. The chapter consists of three parts. The first section offers examples of their uses in Pharmaceutical companies and their approaches to the definition of management of the electronic supply chains, their advantages, and drawbacks. The second segment considers the current status of the supply chain pharmaceutical. This third part provides a summary of recent work in the pharmaceutical industries on the e-SCM system.

2.1 Electronic Supply Chain Management

This part will discuss various approaches to defining E-SCM and how to operate in pharmaceutical companies. Then an outline of e-advantages SCM's and drawbacks are given, and the rules in various jurisdictions are defined.

2.1.1 Electronic Supply Chain Management Definition

Intelligence is essential for ensuring all the connections in the supply chain system are coordinated and integrated. Recent technological advancements such as information management allow for the virtual integration of the whole supply chain. As operations connected to the internet are associated with expansion, this integration is often referred to as E-SCM deployment [18].

The e-SCM is a modern layer consequential from the old supply chain management paradigm established by the development of IT and the regeneration of business processes of companies in the context of Internet-enabled partnerships [19]. That means that with the help of Information technology, the traditional supply chain system has transformed into an E-SCM system. Unexpected issues for the SCM are created by the advancement of information and communications technology. It contributes to establishing E-SCM, a part of the evolving organization's e-business system, using technological resources for businesses' internal and external operations.

2.1.2 Operation of the E-SCM System Pharmaceutical Companies

Today, pharmaceutical firms are multi-product, multi-use, and multi-site operations in various countries that globally address the foreign customer base. Multinationals work in several globally dispersed production sites and negotiate with a foreign market in various consumer areas. Therefore, when settling on the company's optimum multi-site investment policy, the matters relating to its trade structure must be considered. For this reason, most pharmaceutical companies are using the E-SCM system in their regular operation [20]. Considering that the pharmaceutical industry is challenged by numerous stakeholders who demand affordable pharmaceutical drugs, the key is strategic planning. For the pharmaceutical industry, it is of particular importance as medical commodities should also be supplied in a timely, accessible, and available manner via the electronic supply chain in order to satisfy their needs and demands. E-SCM is a series of actors, procedures, knowledge, and tools that move and distribute the raw materials and elements to the consumers for their finished goods or services. It comprises providers, intermediaries, third parties, and consumers. The Situation also covers all logistics, engineering processes, and other activities in IT production with cross-functional departments such as admin, finance, management, etc.

Though E-SCM provides a lot of improvement areas like accessible and real-time communication, real-time forecasting, improved partnership relation, and customer relationship, implementing the E-SCM is very challenging. Among them, the technologies used by the different groups in the supply chain are among the main challenges relating to integration issues. It cannot be denied that a company uses a technological framework that does not readily communicate with other companies or technology suppliers. This causes a challenge because one provider has to adapt the method so that integration is possible. This could be no concern whether the provider has one big client and that multiple vendors have different clients [21]. The lack of coordination and interference with transactions or products in the supply chain with consumers will lead to a breakdown in the supply chain, which causes inefficiencies, lowers market speed, and eventually raises costs [21].

The collaboration part is a challenge of E-SCM, but the pharmaceutical companies have to focus on their strategic issue while implementing the E-SCM. It is an additional factor that quality, capacity, as well as research and development processes, and operational

capabilities to be addressed along with only having the capacity and planning, as part of factories and supply chains, because expanding the overall performance, as well as retrofitting/designing facilities, improving inventory management, and redoing research and development processes, are all required to manage reverse logistics, lean SCM, green SCM, and overall quality together [22]. On the other hand, the challenges facing pharmaceutical firms are complex. They include a broad spectrum of political, fiscal, social, technological, and legitimate aspects. The pharmaceutical industry is a group of organizations, techniques, and measures involved in pharmaceutical inventiveness and innovation; thus, the pharmaceutical supply chain includes medicines providing companies that play an essential role in satisfying customers [23].

2.1.3 Benefits of E-SCM in Pharmaceutical Industry

By sharing information instantly, the E-SCM allows pharmaceutical companies to be linked with consumers. When necessary, the company has enough inventory. There is no deficit or market surplus. Stock shortages drag down the company's prestige. The excess stock also unfairly blocks the company's funds. Through the E-SCM, companies can,

1) Improve their work efficiency.
2) Reduce their inventory & cost.
3) Help the company to take competitive advantages over competitors.
4) Improve the capability of implementing “JIT,” which helps to improve customer satisfaction.
5) Help to reduce cost over cycle time and which directly impacts revenue growth.
6) Improve the order fulfillment or order management, forecasting, data predictability, demand & supply plan with the proper distribution.
7) Reduce the administrative cost and time, more importantly, the paperwork.
8) Automated pedigree-based technology will make it more difficult and distract criminals to protect healthcare and life sciences from fake products. This is a safe document containing information on shifting commodities in the supply chain from producers, wholesalers, pharmacies, and healthcare providers [24].

2.2 The current state of the pharmaceutical supply chain

In the first section, the current pharmaceutical supply chain process is being presented with an accurate description. After that, several facts are being considered directly related to the current supply chain management system in pharmaceutical companies.

Marketing: Marketing is the backbone of introducing any company, and pharmaceutical companies are not an exception. While drugs produce lives-saving drugs, promotion is still needed. However, their promotion differs much from other sectors. The following main features of the marketing sector are Medical Representative officers, Distribution channels, Targeted groups for promotion such as doctors, surgeons, etc. Also, most of the time, special motivation packages are given to the doctors or surgeons for their product marketing which is very expensive [25].

Order Management: Order management is a crucial part of the pharmaceutical industry in Bangladesh. After doing proper marketing, it is pretty necessary to collect orders from the field. In Bangladeshi pharmaceutical companies, this job is performed by the MRO (Medical Representative Officers). Though they are part of an operational team, most of the jobs are marketing-related. In some cases, the big pharmaceutical companies use application-based order collection software, but small companies are not. For their business, they still collect orders manually from the field.

Import: There is a fair range of expensive imported medication available for sale in the local market procured from inappropriate roots. Any valuable, expensive, and reputed medicines can be replicated and developed locally for black door firms by using illicit means and means. The goods are not produced concerning the requisite quality management measures to meet the current enormous demands on the market. These are only repeated and sold to make money for the richest of the night [26].

Export: A self-sufficient market comprises numerous countries, particularly those in Europe and Europe's close ally, Great Britain, such as China, India, and Denmark, importing essential products, including industrial supplies. If the API park runs in total production, Bangladesh will produce APIs instead of importing raw materials. Owing to their impact on the consumer industry, suppliers, APIs have much influence in drug agreements. [27].

Raw Material Supply: Inadequate raw material processing facilities in Bangladesh are still sufficient. Only the finished goods manufacturing in Bangladesh is engaged in the pharmaceutical industry. Now Bangladesh imports almost 80 percent of raw materials. APIs local (raw material) production can contribute significantly to the pharmaceutical industry in increasing the number of exports and can also lower reliance on other API-producing countries [27].

Production Process: Pharmaceutical industries are in Bangladesh usually follow two steps to produce their medicines. For the first one, industries produce API or Active Pharmaceutical Ingredients. This process is a little bit technically complicated and high demanding. Moreover, these APIs are sophisticated in the biochemical fermentation and synthesis process. Usually, Bangladesh is an import-based country in importing API, and the importing countries are China, India, Japan, Germany, France, Switzerland, etc. [10].

On the other hand, the second steps contain the final formulation of a drug. As a chemical business for manufacturing, API is the ultimate formula right belongs to the manufacturing sector. It is called a generic product. Bangladesh is good at producing generating products, and in the current market, approximately 8000 generic products are available [28].

Quality Control: The most challenging part of medicine production is quality control. The Bangladeshi pharmaceutical companies have to face many challenges for quality control only for lack of proper commercial power. If it is not adequately ensured, the, medicines will lose their effectiveness and may harm to the patient. Following the rules and regulations provided by the authorities, the companies have to ensure product quality in several steps. These are the Manufacturing process, Processing Technology, Marketing Raw Materials, Medicinal Site, Plant Harvest time, Planting Technology, Geographical Environment, Plant Source, Drug Regulation Application, and Preservation Complexity [29].

Packaging: One of the essential roles of packaging is to protect items from the harmful effects of the outside environment. Many formulations become unstable when exposed to air, moisture, or light. Thus these elements must be avoided to guarantee medications stay effective and safe. So, medicines' effectiveness also depends on the proper packaging

[30]. Moreover, all pharmaceutical companies must follow the packaging rules and regulations provided by the Bangladesh authority [31].

Distribution: Distribution is a crucial development in the pharmaceutical managers' integrated chain. 'Additional GDP for pharmaceutical products' rules aid with ensuring that all sections of the dispersion technique have the quality and character of pharmaceutical artifacts. These views are consolidated but are not obliged to acquire, buy, store, pass, ship, refresher, re-label, register and log. Transportation: all prescription products should be carefully handled and dispersed in shipping compartments, which have no advisory impact on the concept of the products and have palatable safety against external consequences, including damage [32].

Above all these fundamental processes, there are a couple of things which needed to be considered for keeping the supply chain system smooth, these are,

Temperature Control: Temperature control or maintaining the proper temperature for drugs is another challenging job for pharmaceutical companies. It shows that many drugs lose their effectiveness because of not maintaining proper storage temperature. This thing mostly happens during transportation. It makes a loss for the company and loses medicine’s effectiveness and which may cause harm to the patient [33].

Law enforcement: The rules and enforcement requirements have been stricter in the US and some European countries because of the health reform [34]. The accurate identification of any possible changes in the composition of pharmaceutical goods that could impact production and sale helps companies communicate this information with the manufacturer and the people who may be using or buying from them. Wholesale aider than this, it is the duty of the pharmaceutical wholesaler to secure drugs from breakage, infiltration, regulate the temperature in shipping, prevent medication errors, guard against fraud, and guarantee proper conditions during shipment. Although maintaining the appropriate storage conditions or within reasonable limits defined by the manufacturer, the drug should be treated to be safe from harmful environmental influences, such as excessive temperature or illumination [35].

Transport: One of the most considerable parts is smooth transportation. To have a better and flawless supply in pharmaceutical industries, they must consider the secured and

smooth transportation system. Disruptions of the transport occur when current flows are stopped that delay delivery from one node to another of the supply chain [36]. Disruptions to the transport of goods can also be damaging. Therefore, transport interruptions can influence the entire supply chain, resulting in difficulties such as a shutdown, loss of revenue, late delivery, and reputation loss [37]. Also, the impact will be too much in the health sector because the primary mission of pharmaceutical companies is to deliver medicines in exact time and exact place. During transportation, the companies have to keep a couple of things in mind that may interrupt a smooth delivery system, any natural disaster, made-up human problems, and financial factors [37].

In these circumstances, the existing pharmaceutical supply chain management mechanism is complicated and inefficient.

2.3 E-SCM in Pharmaceutical Companies

The section is intended to review studies into the future of E-SCM use in pharmaceutical firms. It also provides some examples of an automated supply chain management system that functions well and is likely to include more individuals.

During present globalization, IT production helps businesses use the electronically identified electronic supply chain management system through the internet more quickly. E-SCM is easier and quicker than the data transfer between vendors and dealers and the data flow. In the information age, the development of organizations requires creativity, including creating the Supply Chain Management electronic management paradigm. The e-SCM can make the decisions, the process and the knowledge flows, an enterprise, the productivity of the organizations, and customer loyalty, which can be radically improved [38].

In recent years, supply chain management systems are gradually becoming complex in business. It is becoming difficult in terms of different supply chain-related activities and the involvement of stakeholders. Also, there are few organizations that e an integrated view of the entire supply chain management systems. Some big companies use their platform or integrated tools or systems developed for their organization and identities and maintain a good coverage of operations. As there are external stakeholders are involved, so there might have low transparency issue. This poor level of transparency leads to

several security issues, traceability, authentication, and verifications challenges in the supply chain mechanism.

Interestingly, E-SCM system through blockchain technology, these issues can be easily identifiable, and adopting the blockchain can be a good solution [39]. Also, in recent times, blockchain is recognized as an emerging technology, with potential for the tracking and tracing of pharmaceutical drugs and ingredients, fraudulent identification through information verification by supply chain participants, and an avenue for the integration of counterfeit devices into the internet and interoperability. It also provides management possibilities, including traceability, record ownership, incentive automation of intelligent contracts, and policy promotion through multisectoral disturbance [40].

At this point, E-SCM should be implemented in such a way as to define requirements and administration by the industries that can use it. Some technical criteria for implementation of the E-SCM (scalability, consistency issues) are still not met. If the first things are done, the willingness to implement an electronic supply chain management framework should be affected. In this case, we can say the e-SCM arrangement of internet and supply chain management where the essential things are providing accurately on time. Through E-SCM, a pharmaceutical company can improve the relationship between customer, vendor or suppliers, and their services, demand, and order management, which transform into e-fulfillment, purchasing the materials or services through e-procurement, internal manufacturing management, product development through research, and continuous improvement, commercialization, and integrate their business process through the internet [41]. Here we will discuss some of the issues that may directly impact the SCM after transformation to E-SCM.

The management of customer relationships (CRMs) aims to build and sustain customer relationships. There can be two distinct kinds of impacts on the internet in the supply chain linked to CRM. The inner influence is the first. The client or all business divisions may receive the exact details via the internet where they can negotiate. The second one is a downstream result. The result refers to the online effect on customer relationships that enables companies to provide new services for customers and to increase the company's goods and customer services. The crucial thing is that companies can collect data while users browse the website. However, it has to keep in mind that, Marketing relationships

promote customer loyalty and retention. Win-win is built using value exchanges to achieve lasting promises [42].

The demand and order management process is another part of SCM, which involves estimating the requirement and synchronizing with the distribution, manufacture, and purchase or purchasing. Its upstream and downstream connections are affected by the effect of the internet. The better provision would reduce the expense and stock levels of the order operation. Besides that, the management of the electronic supply chain shares not only details but also expertise. It makes data processing and modeling possible for partners to improve strategy and decision-making collectively.

After managing the order and demand, here comes the fulfillment. When it goes through the internet, it is called e-procurement. This method involves integrating production, distribution, and marketing roles to ensure customer loyalty and minimize overall costs. There are two significant facets to the effect of the internet on the order execution process. Firstly, e-commerce involves carrying out consumer orders over the internet and thereby improving productivity. The second factor concerns Internet use to increase the reliability of the distribution process, which allows a great deal of customer order data to be accessed and manipulated to inventory levels.

Another critical part of supporting the above functions is procuring the materials or services, which can be done through e-procurement. Activities are sourced via Internet technology which enables practical cooperation between consumers and providers. Several companies have introduced e-procurement platforms to cut unnecessary expenses and share information since this mechanism entails the collection, exchange, and storage of a considerable number of data and information. Not but the lease, the product development or improvement by continuous feedback, and commercialization process. There were three forms of consequences: internal, downstream, and challenging. The internet facilitates the cooperation in the new product creation process between various functional units. While downstream, the internet allows companies to research the destination market more quickly and cheaply. The upstream impact allows vendors in the chain to minimize costs and time as quickly as possible [21].

Bangladeshi pharmaceutical sector is one of the technologically advanced sectors in Bangladesh, but most of these companies fulfill the domestic and international

requirements through manual or traditional supply chain management systems. Nowadays, the supply chain management system's each stakeholder's identity is easily understandable, and for supporting them, several technology-based applications are being developed and developing. In the near future, there is a possibility of implementing an integrated E-SCM management system, but there might be several obstacles to prolong the process. This research indicates the challenges of implementing an integrated supply chain management system in pharmaceutical companies in Bangladesh.

3 Case Study Design

This chapter will outline the research design used in the study. Five parts comprise the chapter. The first segment summarizes the study questions and discusses why they were chosen. The second section discusses the case and the topic selection method. The third section discusses the research's data collection techniques. The following two parts describe the interpretation and validation protocols that will be used in the study.

3.1 Research Question

The main research question is: How challenging is it to introduce an E-supply chain management system for pharmaceutical companies in Bangladesh?

To support the main research question, we have segmented the questions into three-part. These are,

RQ1: How efficient is the current pharmaceutical supply chain process?

- Sub 01: What manual processes are needed to be followed in the supply chain process?
- Sub 02: What kind of unwanted situations may arise for the pharmaceutical companies during the end-to-end supply chain?
- Sub 03: What can be a complete solution for these unwanted situations?

The questions mentioned above can assist the pharmacist in determining if there is a strong understanding of how the electronic interconnected supply chain operates and, therefore, whether an appropriate E-SCM framework can be comprehended. As sensitive or undesirable conditions are known in advance, introducing an automated digital supply chain management framework becomes more feasible. Additionally, by incorporating an E-SCM solution into the existing manual or conventional supply chain system, pharmaceutical firms and all associated stakeholders can be digitalized.

RQ2: How can the feasibility and the parameter of measuring benefits of integrated E-SCM system for pharmaceutical companies be determined?

- Sub 01: What could be the feasible way/s to transform the traditional or manual pharmaceutical SCM process into E-SCM?
- Sub 02: What could be the main parameters of an effective supply chain system for pharmaceutical companies in terms of an integrated E-SCM system?
- Sub 03: What are the indicators of efficiency in an integrated E-SCM system?

This research topic and its sub-questions assist in determining if optimized E-SCM can be extended to the new conventional or manual supply chain structure. Then the feasibility of implementation would be investigated. Additionally, there are sufficient metrics for assessing the system's reliability and efficacy.

RQ3: How can integrated E-SCM influence the actions of stakeholders of the pharmaceutical supply chain system?

- Sub 01: What are the standards of ideal stakeholders in the pharmaceutical supply chain system?
- Sub 02: What kind of challenges do the stakeholders face in the current pharmaceutical SCM process?
- Sub 03: What are the benefits that E-SCM can bring to the stakeholders?

These research sub-questions aim to elucidate the possibility of defining stakeholders' positions in the existing supply chain structure. If necessary, they should be able to distinguish their identities within an advanced E-SCM structure. Additionally, if the challenges faced by stakeholders in the existing framework are identified, it is possible to solve them using the integrated E-SCM method.

Finally, we will assess what challenges may arise during the implementation of the E-SCM framework in Bangladesh's current pharmaceutical industry.

3.2 Case and Study Selection

The selected case for this thesis is the Bangladeshi pharmaceutical industry. There are 257 licensed players, of which 150 are active. Pharmaceutical producers in Bangladesh

meet 98 percent of the country's requirements [43]. While the regulatory environment is supportive and the technical readiness to utilize advanced electronic supply chain technology is not commonly practiced. These considerations make it an intriguing case for prospective pharmaceutical firms to investigate the E-SCM in Bangladesh.

3.3 Data Collection Procedure

Various data sources have been used to confirm the quality of the research, which is intended to reduce the difficulties associated with evaluating data from a single source and strengthening the reliability of the results. This study's data collection method involves performing expert interviews (primary data collection) and paper analyses published after 2011 (secondary data collection).

3.3.1 Expert Interviews

The interviews are also often used in the case of studies since they have important insights. This feature allows the topic to be studied from several angles, as it was used over the process of the inquiry from different participants. It further broadens the scope of the research by presenting various examples from interviews with the interviewees' personal experiences. Also, the results of an interview can be used to check what was found during the data collection process.

In this research, we used semi-structured interviews. Large amounts of information can be included in these questions, enabling the interviewee to speak about his or her background and thoughts in an open-ended fashion. It will be helpful to investigate different topics related to the phenomena. To serve as an aid in solving the research issue, the following questions were formulated. More information was gathered from the interviewees, and supplementary questions were asked if appropriate.

Since engaging the critical parties in the supply chain, **ten (10)** interviews were performed with suppliers, logistics providers, and pharmacies. The experts here are influential because they help in a diverse way to explain the phenomena that they were trying to examine, from top executives to secretaries. After the interview, answers were subsequently transcribed, coded, and then subjected to natural language processing to simplify with NVIVO.

3.3.2 Document Review

Document review gathers information by reviewing existing documents because the healthcare and pharmaceutical sector is traditionally a heavily regulated industry. To understand the process of the pharmaceutical supply chain and the implementation of the E-SCM system in the overall pharmaceutical industry in Bangladesh, we had to go through a lot of rules and regulations provided by DGDA (Directorate General of Drug Administration) and BAPI (Bangladesh Association of Pharmaceutical Industries).

The additional time from 2011 enabled us to gather relevant articles, papers, reports. So they helped us to solidify the study theory, which was beneficial in their consideration of previous theory and literature and studies. Additionally, the possible challenges associated with E-SCM integration, especially pharmacy informatics in the pharmaceutical supply chain, were explored.

3.4 Data Analysis and Procedure

In this case study research, NVIVO will be used to analyze qualitative results. The data gathered during the interviews were analyzed by coding, which entails labeling the concepts or codes gleaned from the interviews and categorizing them according to their characteristics.

To begin, the transcripts of the interviews were extensively read. Second, the transcript data was organized, and codes were created. Thirdly, themes/categories of codes were created based on common trends, interesting or important data. Fourth, topics were examined to ensure that they aligned with the study questions. Fifth, a report is being produced containing the effects of the logically organized themes and codes.

3.5 Validity Procedure

The quantitative approach to analysis is rigid, and the qualitative approach is credible. In 1985, Lincoln and Guba attributed three facts: ease of usage, iterative growth, and testability. These are the basic standard quality testing criteria. They laid out four standards for creating trustworthiness in qualitative research. These are, Credibility, Trustworthiness, Confirmability & Transferability [44].

To make it credible, it is essential to guarantee that the measurement is consistent with expectations to ensure accuracy. We used a mix of research and interviews of experts to examine the article, which is also intended to answer the document's question about how the pharmaceutical supply chain works according to federal and legal legislation. Such in-qualified individuals expound on various supply chain operations, including suppliers, customers, investors, and financiers. One of the major purposes of the participants of a media interview is that participants participate in a wide range of roles, contributing to their public standing. Additionally, the investigator is more knowledgeable of the types of pharmaceuticals than their marketing, as a wholesaler makes his understanding of the subject more concrete.

As studying transferability is expanded, it is the degree to which results of single research may be extended to other contexts. To ensure that implementation of the E-SCM system can be applied to other industries, the report provides additional context details on the supply chain system of the pharmaceutical industry. The Bangladeshi pharmaceutical supply chain management system is extensively mapped and may therefore be compared to global pharmaceutical supply chains.

To ensure dependability, the testing method is outlined, allowing a subsequent investigator to replicate the work. To ensure that the work results are the product of the informants' perceptions and ideas, and therefore confirmability, we appeal to the interviewees who raised the ideas and feelings. Furthermore, we acknowledge the study's shortcomings, which detailed in the future work’s limitations section.

4 Results

This chapter goes into considerable detail about the case and subject selection. We will define the Bangladeshi pharmaceutical market and discuss methods for ensuring the availability of pharmaceutical products. Additionally, we will discuss the legal framework associated with implementing an integrated E-SCM system in the pharmaceutical industry. The case summary requires a document analysis. The chapter then presents and interprets the findings from the conducted interviews. The interview transcripts are arranged in such a way that they answer the study questions. A review concludes the chapter.

4.1 Case and Study Description

This segment will provide an overview of Bangladesh's pharmaceutical industry. Following that, we will discuss issues that occur during final product delivery and the legal structure surrounding electronic supply chain systems.

4.1.1 Overview of the Pharmaceutical Industry in Bangladesh

Bangladeshi pharmaceutical companies are representing by the Bangladesh Association of Pharmaceutical Industries (BAPI). The Bangladesh Association of Pharmaceutical Industries (BAPI) is the country's oldest and most influential pharmaceutical manufacturer association. Since its establishment, BAPI has been instrumental in defining the market. Associations' members incorporate significant, moderate, some small local, and overseas companies, which together are liable for 97% of the country's requirement. This indeed proves the success of BAPI as a respectable and acceptable body [45]. According to the Bangladesh BAPI and DGDA, some 257 approved pharmaceutical manufacturers are active in Bangladesh and about 150 functional pharmaceutical manufacturers [16]. Approximately 97% of the needs of the total market for these manufacturers are covered by their factories. The remaining demand for specialized goods, such as cancer treatments and hormones, is produced in limited quantities in order to satisfy the 3% of the population's needs. Most of the drugs manufactured in Bangladesh are generic; a small minority, on the other hand, are pharmaceutical drugs that have been patented. The director-general of drug administration cites the various numbers ranging from three thousand allopathic medicines, two thousand homeopathic medicines, and

three thousand three-one hundred seven hundred and seven hundred (two thousand three hundred and seventy-one) Unani/Ayu medicines to estimate that the industry has 3, 571 generics. [46]. Now Bangladesh is also exporting their produced medicines to around 164 countries, and these demands are increasing day by day.

Table 1: Medicine Export Statistics for Bangladesh (Source: DGDA Annual Report 2018-2019, page: 13)

Year	Export Amount (million USD)
2012	64.24
2013	73.80
2014	87.27
2015	95.38
2016	267.51
2017	380.51
2018	418.37

It shows that the growth of export medicines is upwards from the year 2012 to the year 2018. The highest growth happened in 2016 because of government agency took the proper initiative and emphasized the export. For instance, 40 common raw ingredients usually used in drug production were lowered to 5% — with effect from its original level of 10% — thereby expanding the number of products that may be imported into the nation. The 14th drug-related item on gating provisionally authorized by the FDA has been eliminated, and the federal customs duty has been lifted. Budgetary Allowance 2014-15 When raw material is first imported, the government makes it easier for industries to have their tradition. There has recently been approved government land on which to build the API Park, which is 200 acres in size. Another idea that the government has proposed to attract pharma investment is offering a 10% cash bonus [10].

If we look inside the pharmaceutical industry, 257 approved pharmaceutical companies are working in Bangladesh [16], but from these companies, major fifteen to twenty companies are controlling the overall market. Furthermore, that is around 85% share of the total market. Local companies control the industry, more than ninety percent of the share. This is an unusual occurrence in the real world. All top ten companies, for example, are examples of local, publicly traded companies, Square, Incepta, Beximco, Opsonin,

and Eskayef and Renata. Many NGOs like Sanofi have recently acquired Novo Nordisk, and several NGOs are already calling Novo Nordisk and Novartis, including GlaxoSmithKline. The big corporations, such as Sanofi, Novo Nordisk, are tiny players in Sanofi's market shares are minor relative to its major competitors, which operate in similar industries. The biggest are Sanofi at 1.9 percent and Incepta and Novo Nordisk, at 1.8. (10.4 percent) [47].

Nonetheless, the tremendous rise in production and exports in the post-war era has become inconsequential regarding global economic expansion and increases in the API level. Whereas some firms wholly or partially rely on imported APIs, as can be seen in the sections below, this is a serious issue for Bangladesh.

4.1.2 Overview of Ensuring Drugs Availability through Manual SCM System

Though Bangladesh's pharmaceutical industry is one of the advanced sectors, it is still running its operation in a traditional or manual system. They are following a manual supply chain system. Inside the organization, some of the companies may have good IT infrastructure, but others do not have it. First, we will discuss the current supply chain system of the pharmaceutical sector with their related obstacles.

First of all, we will go through the end user’s data collection and distribution process. MRO or MPO is responsible for collecting the demand from the local areas. For each area, there is one MRO/MPO assigned. After collecting the demands from end-users, they send those demands to their Regional operation manager. Each regional manager reports to the Zonal supply chain manager. Usually, in Bangladesh, zones are segmented based on each state’s name. Each zone contains a minimum of one local or zonal warehouse. During the demand collection, very few pharmaceutical companies MRO use their software. Otherwise, in most cases, they maintain a diary or notebook for the requirements. End on a working day, they combine all the requirements and send them to the regional manager. The regional manager also does the same except pen and paper. Some regional managers use computers to place their orders to the Zonal Manager. At the end of the day, the Zonal manager accumulates all the orders and send that to the local warehouse to arrange distribution. While preparing the order’s packages, the warehouse manager also informs the transport suppliers for package collection and distribution. The transport suppliers' responsibility is to distribute the medicines or drugs to the Regional

Officer, and then the regional officer informs the MPO's to collect those products and distribute them to the end-users.

There are several challenges in this system. Sometimes ordered medicines or drugs may not be available at the local warehouse. In this case, the MRO or MPO does not get the ordered drugs and must wait for several days. Another challenge is that the MROs have to collect the medicines from the regional office. The regional manager keeps those

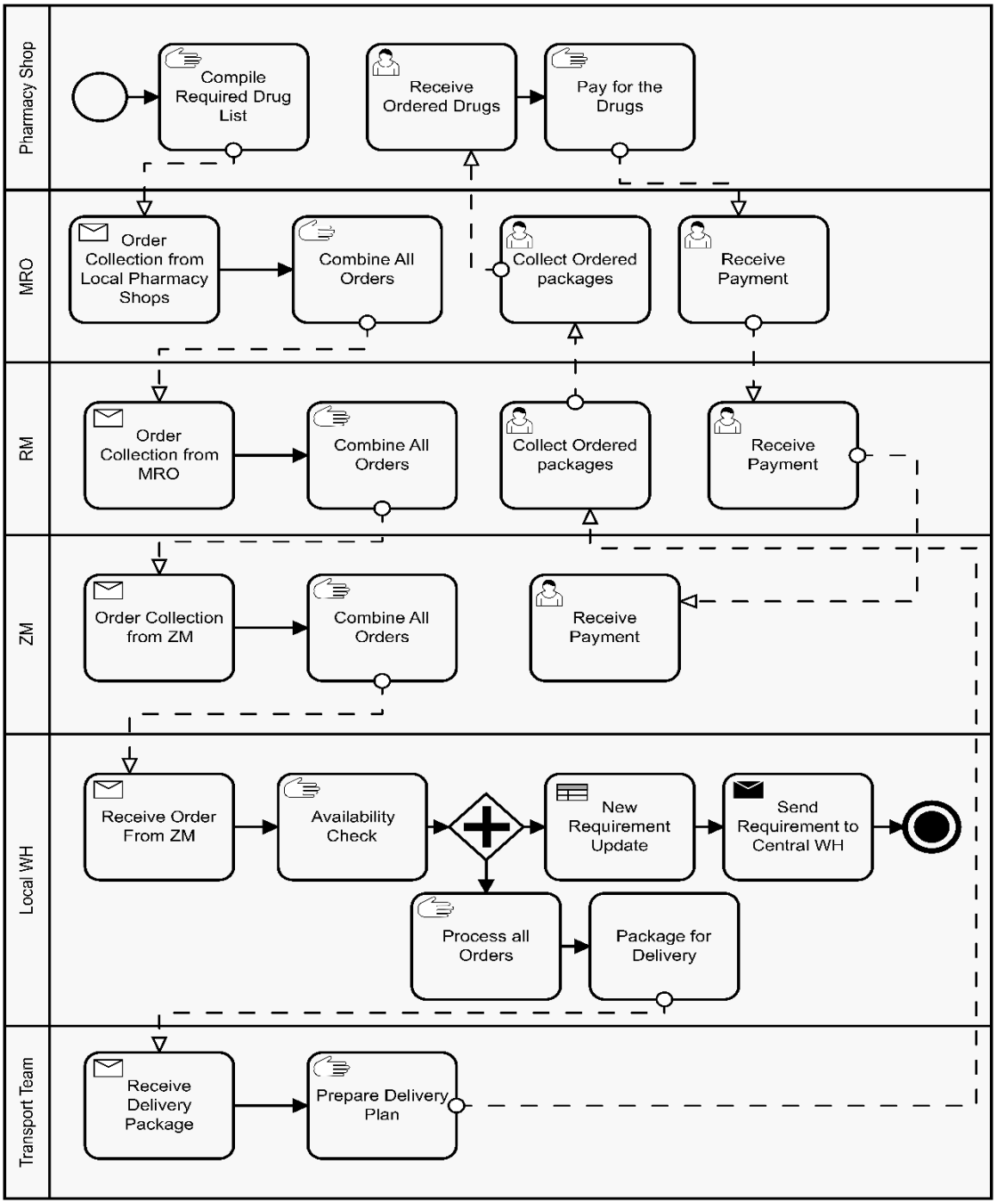

Figure 1: Order Collection & Distribution Process, Source: author

medicines at room temperature, which is a problem for some special type medicines and may degrade their quality.

Now, if we go to the central warehouse part, their work is comparatively simple. They check the requirements from local warehouses and then prepare the packages for

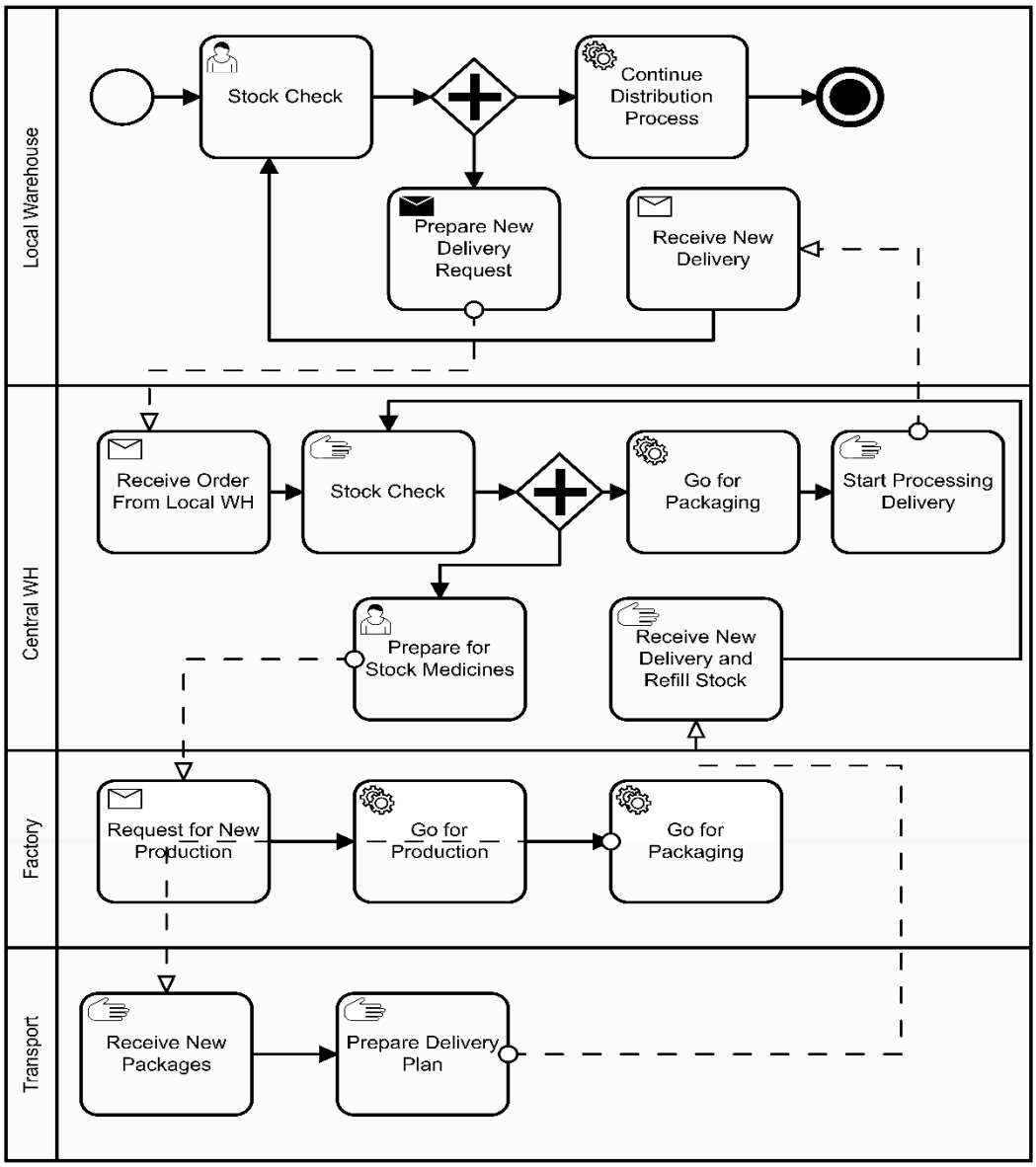

Figure 2: Central Warehouse to Local Warehouse Distribution, Source: author

distribution. After that, the transport and distribution team collects all the packages and transports them to the local warehouse. The central office checks with the warehouse

about stock products and then processes for new products if the stock goes down from a certain quantity. In most cases, the companies keep the stock for six months.

In the warehouse. Here the central warehouse faces one problem is stocking the products for a long time. It is a reason for the high price of medicines. If we go for the overall general process, it would be easier to understand how the supply chain system works and who is involved with the team. If we look at the process, it is very simple to understand what the supply chain department is doing and its responsibilities. However, the overall

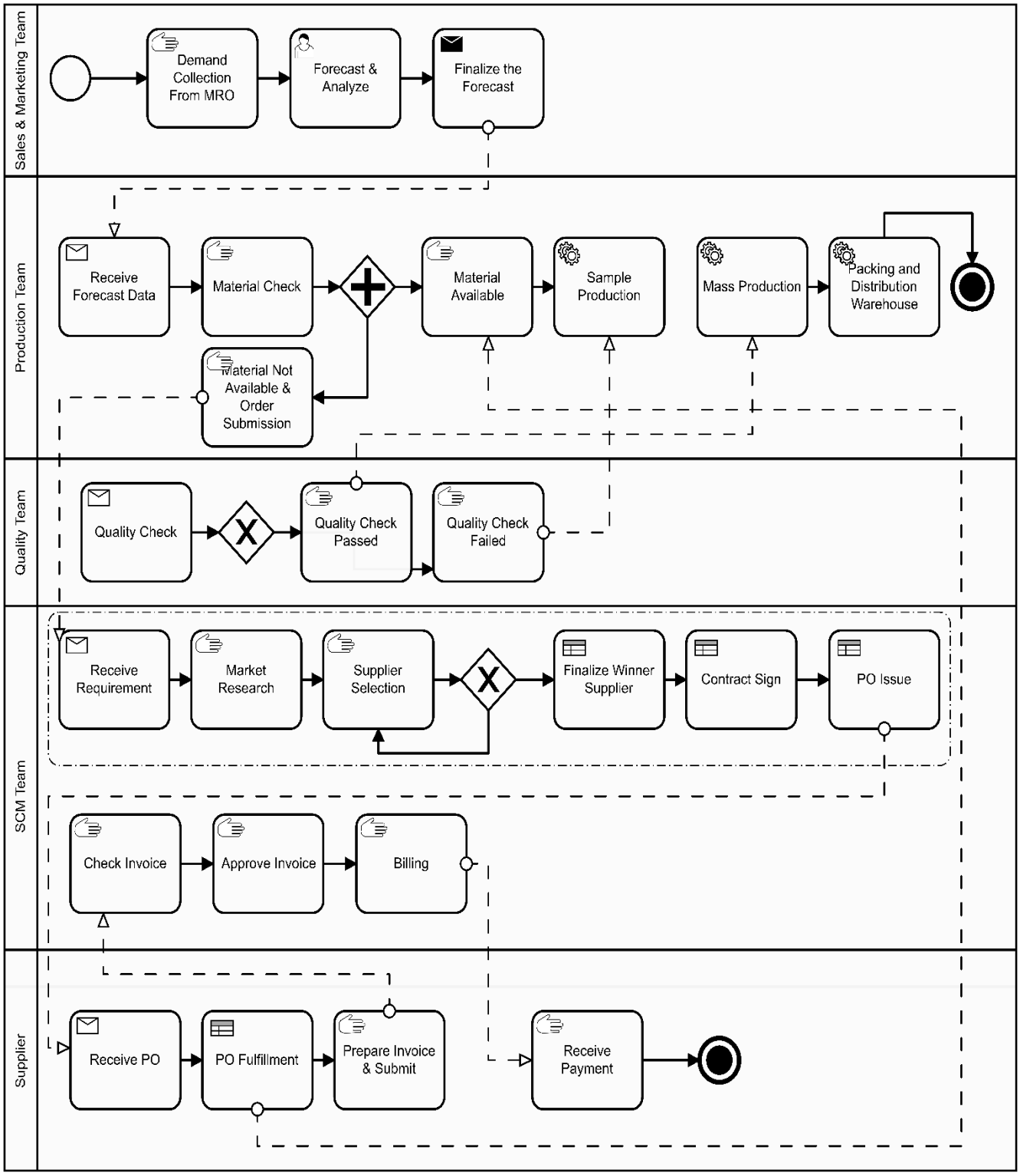

Figure 3: Pharmaceutical AS-IS Process, Source: author

process is in general manual and time-consuming. Many sections have several challenges. For instance, if we go for a distribution system, there are many challenges to focus on, like temperature control. We have to keep in mind that the availability of medical treatments is critical in terms of public service. The consistency of the drug must be

assured from the time of manufacture to the time it is being dispensed/distributed; hence control is taken at overall levels. “The selection, quantity fixation, procurement, storage, and distribution system of drugs must be strengthened so that drugs are accessible to the public throughout the country. Appropriate preservation methods, such as temperature and humidity control, must be ensured at all drug wholesale shops or pharmacies or drug storage facilities and during drug transport and distribution in order to maintain quality, appropriate use and dispensing”. Clause no 3.4 states that guideline approved by the Ministry of Health and Family Welfare, Bangladesh [31]. These protocols, basic operating procedures, would specify the records used to record the output of temperature, humidity, and other sensors. Particular care should be taken for medications that include strict adherence to a certain temperature controlling system while storing and distributing the medicines nationwide.

Thus, even a simple operation of this process can be damaging the quality and effectiveness of medicines and causing financial loss to the company. Moreover, it may harm the end-user for their health condition.

4.1.3 Overview of the E-SCM

In recent years, Bangladesh has devised a system for information usages in all areas of the economy, which has particularly benefited business operations and growth. In comparison, fast progress in knowledge transfer and technology adoption necessitated innovative ways for states to apply the regulatory system and ways of interacting with businesses. These new frameworks have often provided states with the capability to let different agencies know when it is appropriate to do so. In this respect, it is legitimate to assume that Bangladesh's legal structure resembles the majority of others in having a legal framework as an obligation to adopt, particularly in terms of expansion.

A notable characteristic of an electronic supply chain in Bangladesh is its reluctance to include a broader range of collaborations. That means only one party is not enough to have E-SCM systems. With current legal and technical restrictions on parties using the E-SCM, there is no defined need in the country of the scope of use in Bangladesh. For instance, if we consider the smart contract, then several arguments happened among the lawyers as there is not enough knowledge on that. This note can be added to the legislation on electronic documents and signatures: It also gives very vague meanings of the terms

electronic record and electronic signature. Once the parties have agreed to a single record of execution, they may be classified as smart contracts. Supported by the legislation does not contain the provision to preserve any details on the media held by the person for which the digital records are being created as well, following from the digital signature; finally, one may even assume that smart contracts use digital signature methods because of their exact consistency with encryption. In the context of contracts, a plain agreement may be used as a more or less complex written version of a smart contract. A reasonable belief developed that a contract was declared. The legal presumptions are that a group may prove it knew any of the terms and conditions are applied using a remote agreement because it could be believed that they have enough knowledge to ensure that their application adhesion is fulfilled, even though the contract had not been expressly defined. However, they could just deny such a transaction when they did not have enough information about it when it was first presented to them. In this way, the technical specifications of blockchain protocols mean that they have the potential to be used for smart contract development. Ultimately this will not be considered an efficient E-SCM system.

4.2 Presentation of Findings

This segment describes the information that was found from the interviews. Many of the questions in the study paper were based on a particular event to serve further the purpose of answering the actual issue they were intended to investigate. In the next segment, the interviewees are defined. These parts are based on characterizing and solving the interview problems, but they do describe and address the analysis questions in the process. All of the subsections are dedicated to a single topic.

4.2.1 Introduction of the Respondents

This segment covers the interviews, including their identities and backgrounds. The project wanted a sample that is to consist of large supply chain participants was made more difficult by the additional criteria of often including since the respondents are assigned diverse jobs in their companies, it provides a clearer idea of the kind of problems that could occur in the introduction of an electronic supply chain in the pharmaceutical process.

Table 2: Interviewees Detail. Source: author

No.	Interviewee Name	Workplace/ Company	Designation
01.	Interviewee 01	Pharmaceutical Company	Jr. Asst. Manager
02.	Interviewee 02	Pharmaceutical Company	Medical Representative officer (MRO)
03.	Interviewee 03	Pharmaceutical Company	Group Manager
04.	Interviewee 04	Pharmaceutical Company	Sourcing Manager
05.	Interviewee 05	Pharmaceutical Company	Procurement Specialist
06.	Interviewee 06	Pharmaceutical Company	Medical Representative officer (MRO)
07.	Interviewee 07	IT Company	Software Engineer/ Software Developer
08.	Interviewee 08	Pharmaceutical Company	Distribution Coordinator
09.	Interviewee 09	IT Company	Software Developer
10.	Interviewee 10	Pharmaceutical Company	Medical Representative officer (MRO)

4.2.2 Current State of Pharmaceutical Industry's Supply Chain System & their limitations

The main aims of the current study are to provide a concise and precise representation of the pharmaceutical supply chain. Related subsections are aimed to find the answer to the main research question "*How challenging is it to introduce an E-supply chain management system for pharmaceutical companies in Bangladesh?*". The interviews were conducted to find the relevant answers to this question.

Most of the interviewees had a clear understanding of the existing pharmaceutical supply

chain in Bangladesh during our conversation with them. According to several of them, and this is all done by hand. A couple of key points were found during the interview. These are,

1) Sales Forecast & Demand Collection
2) Production or manufacturing
3) Distribution or delivery
4) Vendor Management
5) RFI, RFQ, Bidding
6) Contract Paper Signing
7) Billing System
8) Quality Control
9) Local & Central Warehouse
10) Pharmaceutical Shops
11) Medical Representative officers.

These are the general terms used by most interviewees in the current pharmaceutical supply chain management process. The purpose of this section is to understand the answer to the research question, "How efficient is the current pharmaceutical supply chain process?"

For getting the probable answers, the interviewees have mentioned some of the limitations given below.

1) Black-market
2) Data Forecasting
3) Demand Collection
4) Distribution
5) Inefficient & Manual Process
6) Order Management
7) Procurement & Vendor Management
8) Regional Storage Problem
9) Supply Shortage.

After analyzing the interviewee's interview, some major limitations have been identified and described in the below table.

Table 3: Limitation in existing supply chain system, Source: author

Issue Type	Description
Black-market	1. Illegal sales of drugs in the market most of the time mean fewer sales for the company. This is because the consumers will be getting similar medicines in cheaper means (Interviewee 01).
	2. Some syndicates on the supplier's side do monopolistic business and increase the prices during a critical time and human dependency. Every section of work has a human dependency which is another cause of bribe (Interviewee 04).
Data Forecasting	1. Right now, the companies are doing well with their present system until unless the other system has been incorporated. Nevertheless, if something like an ERP system is being developed to track the patient (the main thing is to track the patients) in that case, the company they will show interest in the software because our forecasting and the company's sales, forecasting, and everything depend on the number of patients. How frequently they visit the doctors and get treatment from the doctors, how much patients may target for every box of processing of medicine sales. So, everything depends on the number of patients. Some survey teams like 4P collect the prescriptions, and from that, we get the idea that all such kinds of patients. Then we can assume that how one like or two patients are being prescribed that medicine. So, in that case, I can assume the entire scenario. I can focus my things like that. So, I would say data collection need to go through electronically so that we can work more on the sales and forecast (Interviewee 03)
	2. Demand Collection & Forecasting, Human resource dependency, Order management are the challenges for us. (Interviewee 01)
Demand Collection	1. For demand collection, we had to make a very good relationship with the pharmacists. Otherwise, they would not give us the orders. I had to just visit one pharmacy more than ten times to make

	relationships, though they were ordering medicines from us for a long time (Interviewee 02).
	2. First of all, the demand collection. No one can do anything without perfect data. We do not even get the 65% accurate data from the field. In this case, the sales team struggles a lot (Interviewee 04).
Distribution	1. The delivery system and the demand and data collection are challenging parts. Here we have too many resources, but we are not getting the correct data. The delivery system is not quite good because after delivering drugs from the central warehouse to the depot, it takes a lot of time to deliver the medicines. Because we do not have proper tracking or monitoring system from the depot or regional warehouse (Interviewee 04).
	2. It is quite lengthy to collect all the requirements from the end-users. For this, we have to engage MROs who work in the field for data demand collection. Distributing medicine to remote areas takes quite as long as 3-4 days. In this case, we cannot properly maintain an efficient distribution system (Interviewee 08)
Inefficient & Manual Process	1. We have to do everything manually, like the sample assessment. Sample assessment for a or different vendors, they are submitting the different samples as well as we have to input them in our SAP manually with a different price range (Interviewee 03).
	2. You have to go through a lot of section, for instance, their financial status, human resource, admin, their production, etc. Not only this but also, we have to do a regular quality audit for them, which is manual (Interviewee 04, Procurement Manager).
Order Management	1. Order management. Demand collection is purely manual. We need to use one mobile application for tracking. The second is a backup resource. MROs do not have that much backup. And the order management. It is double work (Interviewee 10).

Procurement & Vendor Management (Contract Signing)	1. One point I need to mention about the contract signing. When we prepare the contract with a vendor, like a frame contract or any new contract, we need a lot of signees. In that case, we face trouble for signing from higher management. Most of the time, they don't stay at the office for business purposes. In that case, if we can implement a smart contract, it would be beneficial. Our time will be saved for the final signature, and work will be faster. I heard that the Bangladesh government would introduce a blockchain-based smart contract. I hope soon it will be introduced. Then we will be one step ahead towards digital Bangladesh (Interviewee 04).
	2. In an emergency, it takes a lot of time to sign off the contracts. I believe it takes around two weeks to prepare and one week to sign off with a review if the clauses are unchanged. If not, then it takes around 5/6 weeks to complete (Interviewee 05, Procurement Specialist).
Regional Storage Problem	1. Regional storage systems are often not up to the mark due to a lack of electricity (Interviewee 01).
Resource Dependency	1. Person in the supply chain department assigned and their work is just giving the information through the excel files and does those manually because there is a time involved of the representative and man involvement additional men involvement (Interviewee 03).
Supply Shortage	1. Shortage of medicines usually is very common in our field (Interviewee 02).

4.2.3 The necessity of E-SCM in the Pharmaceuticals Industry

In this section, we will focus on the necessity of introducing the E-SCM system in pharmaceutical companies so that we can get a better understanding of another research question "How can the feasibility and the parameter of measuring benefits of integrated E-SCM system for pharmaceutical companies be determined?". The interview questions were targeted to understand the necessity of the E-SCM system.

Table 4: Necessity of E-SCM system, Source: author

Type	Description
Accuracy of Forecasting	1. Our medical representatives are working in the field to the doctor front as well. They are also responsible is also taking the orders from the chemistry as well, but that they are taking the orders manually after they have taken the order manually in and after that our there are several depot offices in the different regions. Then they input the manual order system to our internal software system okay so if the system is developed like you said if the chemists that ability or that software that they will incorporate the data and our that will be automatically generated to our system will be generated to our system then I think that will be beneficial for us (Interviewee 03, Group Manager).
Better Healthcare Support	1. Contract review and signing, if smart contract introduced, then demand collection. Finally, the E-SCM will push the government to digitalize the health sector, which is very much needed at this moment (Interviewee 04).
	2. As a pharmacist, I think it is important for our country to provide better healthcare services to the people in our country. So, for us, someone needs to step up with some solution, and I think that will be a good one (Interviewee 03).
Increase Efficiency	1. At the beginning of my job, we had to take orders manually and sending the orders to our RM by WhatsApp, Viber, or SMS. Then it was tough for him to organize the orders according to MRO's. End of the month, we had to match our record with RM's database and was giving feedback to him after correction. We had to keep another book for keeping a record of our orders. The sales commission depends on the orders. So it was needed. Later around 2008, the company implemented software for taking orders. Though it wasn't linked with the overall IT system of the company, it was keeping the record for our orders. Which was good. If the pharmaceutical companies can improve the system, obviously the E-SCM can solve these problems except willingness (Interviewee 02)

	2. Inventories, distributions, demand collections, procuring materials and services; everything will be fast and efficient (Interviewee 01).
Increases Organizational Profit	1. The final part of our SCM system is to deliver the medicines to the chemist shop. This is a vital part if we can maintain the system so well then the sale will be increased by 20%, not 20 more than 20%. Because other things are maintaining through the internal software, but the delivery system is not. So it is needed. I think here we need some like electronic things involvement to make it a proficient one (Interviewee 03).
	2. Necessity is, first of all, when every company will implement the E-SCM system, then they can reduce their operational cost (Interviewee 05)
Reduces Medicine Cost	1. If an organization incorporates an E-SCM System, it should be able to decrease operational expenses, which should be a primary goal. Once the operating prices are lowered, then the price of drugs would go down as well (Interviewee 05)
Reduces Tax Exemption	1. Sometimes, pharmaceutical companies and pharmacies hide some profit. In this case, they might not be able to hide those things if the E-SCM system implemented (Interviewee 02)

People who are not aware of electronic supply chains often aren't conscious of how the system works and are not in a position to use them in today's scenario. The subject was briefed on the matter by an interviewer, and they could at last address the questions after he/she had been educated on the matter. For instance, interviewees described the following ideas of how smart contracts can be useful. Apart from these, some others said that work synchronization between different teams would increase (Interviewee 02). Also, vendor management will be easier and smoother through implementing smart contracts (Interviewee 05).

4.2.4 Challenges of Implementing E-SCM System in Pharmaceutical Industry

Realistically, pharmaceutical companies will use electronic supply chain processes in the interviews to show what everybody expects, but it will be challenging to implement.

Among the major drawbacks to implementing E-SCM were going to have to face are the following:

1) High Implementation Cost.
2) IT Infrastructure Readiness.
3) Shortage of Skilled Workforce.
4) Willingness to Adopt.

Table 5: Challenges of Implementing E-SCM system, Source: author.

Type	Description
High Implementation Cost	1. Then the cost is also a fact. Because the companies are not maintaining proper IT system if you see their annual turnover is very low. So they can't effort the one-time implementation cost (Interviewee 04).
	2. The second problem, costing. Implementation cost will be a big fact. A lot of companies are still using papers because of capital. They don't have enough capital to implement an IT system. Then if we implement the E-SCM system, of course, we have to use the internet. Except for the divisional cities, there are a lot of areas where electricity supply is not available. Not only that one, but also internet availability is a fact. In this case, high-speed internet facilities are needed. If you see the countries maintaining this E-SCM system, they have very good electricity and internet infrastructure (Interviewee 05).
IT Infrastructure Readiness	1. All companies are not using the proper IT system. I would say, Bangladeshi Pharmaceutical company's IT system is one of the advanced IT systems. More than 300 pharmaceutical companies are doing business, and only the top 30 to 40 companies are using proper IT tools for their business (Interviewee 04).

	2. As a person working in the IT field, what I can say is that we would need an IT infrastructure, a good one. Currently, there isn't one. To reach that goal, we must initially conduct enough research so that the feasibility analysis proceeds well. We have to consider the networks and the threads as well in order to make the system run well enough. There would be many factors and requirements within the government legislative as well that should be met or at least considered (Interviewee 07).
Shortage of Skilled Workforce	1. Bangladesh does not have a special cybersecurity team to protect from internal and external threats (Interviewee 07).
Willingness to Adopt	1. Sometimes, pharmaceutical companies and pharmacies hide some profit. In this case, they might not be able to hide those things if the E-SCM system is implemented. (Interviewee 04)
	2. To be honest, not all people want to participate in something new. Digging deep, there are government officials who do not want this sort of implementation of automation of services. This is because, once automation in these services is implemented to a certain level, the faults in our existing system could not be taken advantage of. Implementation like this would cut out areas of bribes and extra "benefits." In the existing manual system, there are multiple gaps where monitoring and regulation are not possible. Since these advantageous pathways close, government officials and business venturers of the top-level sometimes tend not to initiate the digital or electronic implementation of services. On the other hand, many well-wishing people want the existing manual systems to be digitalized for the betterment of the country. What I am trying to say is you will find people of both types. But surely, digitalization will increase transparency and reduce the drawbacks of the current system (Interviewee 07).

One common topic of concern that all the interviewees mention is the possibility of E-SCM in the pharmaceutical industry. They also mention it is the possible blockages it may face. Considering the advantages and challenges of E-SCM in realizing them, the technology could progressively be implemented with the help of government agencies, 20 top pharmaceutical companies, and some leading manufacturing stores.

4.2.5 Impact of E-SCM System on the Stakeholders

There are several types of stakeholders involved in this pharmaceutical supply chain management process. From them, the main stakeholders are pharmaceutical shops, material suppliers, and transportation companies. In this section, the major challenges are being described in their daily business.

Pharmaceutical shops: The most common problem which they are regularly facing is buying medicines without any prescription. In Bangladesh, it is a very common practice that most of the time, patients buy medicines without any prescription. The pharmacy owner or salesman usually does not get enough training from the pharmaceutical companies, so it is very tough for them to suggest medicines. Sometimes, suggesting wrong medicines cause serious health issue to the patient. On the other hand, pharmaceutical companies often delay in returning their faulty or expired products. Due to business ethics, the pharmacy shop owner cannot destroy or dispose of those products in normal garbage. Ultimately, these are creating a hassle for the owners. Some other problems arise from time to time which is happening just because of the manual tracking system. For instance, one patient wants to return the remaining or unused medical product in a random shop. There is no single record of selling those products from that shop, so the owner must either return the product at a lower price or refuse. They are refusing to accept those medicines cause controversial relationships with the customers.

Material Suppliers: Material suppliers often face unwanted issues with the pharmaceutical companies if the agreement is not clear, or due to some unexpected situation, the price of raw material increases. In this case, if the counterparties deny changing the offered prices, then it causes financial loss to the material suppliers.

Transportation companies: Nowadays, many pharmaceutical companies use different transport companies to distribute their products. Transport companies' business is not that

much profitable business in these competitive days. Small package transportation does not make that much profit. Also, the companies have to think about transport security, temperature control inside the vehicle, and the fastest delivery.

Even, several issues need to be worked out, including teaching the partners regarding the medicinal drugs. Moreover, pharmaceutical corporations are handling these subjects with great caution, and they must also educate the latest systems or techniques they are developing. Most of the problem here is providing machine and internet access for chemistry lab personnel. Still, a future solution may be providing an easy-to-to-use smartphone-based program for all students. BTCL states that, according to their survey that over 110 million people [7] now use their phones to pay for things online. Pharmaceutical sector stakeholders are expected to embrace the strategy of increased exploration and development in the relevant areas. If everybody is given equally useful laboratory tools, chemists may feel more relaxed working in a user-friendly setting. Often, internet service companies would make a profit or provide a lower charge to keep our customers and potential ones as new ones happy. Electricity is being made available to meet people's basic needs and provide them with additional services in rural areas as well. Furthermore, the government would have to incorporate many of these e-supply schemes with assistance from large pharmaceutical corporations.

It defined the various supply chain problems each stakeholder had to contend with. As part of our research, we determined various general issues that people have with resolving commercial disputes and goods. The subsection has shown that E-SCM will fix some of the problems. At certain issues, it is only by regulation.

4.3 Research Findings

This chapter contains much information about the selected case of pharmaceutical supply chain organization and how the electronic supply system is essential in it. When it was finished, the study undertook a thoughtful review of the statements from the legal practitioners. A summary of the results of the interviews was done into subsections. This organizational framework guarantees that all research issues in this investigation can be addressed, which are shown below.

Table 6: Research Findings, Source: author

Research Question	**Findings From Interview**
RQ 01: How efficient is the current pharmaceutical supply chain process?	
What manual processes are needed to be followed in the supply chain process, and do you think E-SCM can be fitted here?	• Contract Management • Demand Collection • Distribution • Forecasting • Invoicing • Order Management • Purchase Order
What kind of unwanted situations may arise for pharmaceutical companies during the end-to-end supply chain?	• Error in documentation part • Inaccurate demand collection • Inaccurate forecasting • Shortage of medicine • Wrong Invoice Submission • Wrong purchase order issue
What can be a complete solution to these unwanted situations?	• Amendment contract • Correcting invoice • Correcting Purchase orders • Excess medicine production • Second time delivery
RQ 02: How can the feasibility and the parameter of measuring benefits of integrated E-SCM system for pharmaceutical companies be determined?	
What could be the feasible way/s to transform the traditional or manual pharmaceutical SCM process into E-SCM?	• Non-confident answers.
What are the challenges for implementing the E-SCM system?	• High Implementation Cost • IT Infrastructure Readiness • Shortage of Skilled Workforce

	• Willingness to Adopt
What could be the main parameters of an effective supply chain system for pharmaceutical companies in terms of an integrated E-SCM system?	• Increase efficiency. • Reduces Operational Cost
RQ 03: How can integrated E-SCM influence the actions of stakeholders of the pharmaceutical supply chain system?	
What are the standards of ideal stakeholders in the pharmaceutical supply chain system?	• Pharmaceutical Shops • Raw Material Suppliers or producers • Transport Companies
What kind of challenges do the stakeholders face in the current pharmaceutical SCM process?	<u>Pharmaceutical Shops:</u> • Controversial relationships with counterparties • Faulty product return • Money Recovery • Price Negotiation with end-users and MRO <u>Raw Material Suppliers:</u> • Controversial relationships with counterparties • Improper agreement • Price Negotiation <u>Transport Companies:</u> • Complicated transport process • Controversial relationships with counterparties

	• Maintain temperature during transportation. • Material lost or damage. • Penalty amount settlement
What are the benefits that E-SCM can bring to the stakeholders?	• Automatic invoice submission • Proper Contract Signing will determine the responsible party to determine the penalty amount. • Registering new pharmaceutical products.

5 Conclusion and Future Work

As previously mentioned in this study, the e-SCM system can solve many challenges in the pharmaceutical industry. However, the findings indicate that introducing an electronic supply chain structure in Bangladesh would present many difficulties. Additionally, such issues cannot be resolved by the implementation of this technology. As a result, this chapter discusses the research's primary results and contribution and its effects, shortcomings, and potential future work.

5.1 Research Finding's Summary

Here we will give a summary of the research findings, which have been described in Chapter 4.

The supply chain system of the majority of pharmaceutical companies in Bangladesh is reported to be paper-based. The contract signing and scanning techniques, including those used by vendors and other businesses, also lead to a quite complicated chain of processes and dependencies. It usually takes longer to realize the profit and loss situation, which is very unclear. Finally, the content of stakeholders' contract documents varies considerably, even though they are intended for trade.

Apart from the contract signing problems, we have found several major issues like the *black market, data forecasting, demand collection, distribution, inefficient & manual process, order management, procurement & vendor management, regional storage system problems,* and *supply shortage*. All these problems are correlated so that the emergence of one leads to the appearance of other issues.

For these problems, the specific solutions include traditional monitoring of production, distribution, and manual collection of demand by pharmaceutical companies and imposing a penalty or taking legal actions for selling medicines in the black market by the government agencies. However, these manual solutions do not completely ensure the smooth transportation and distribution of drugs or medicines. As a more effective solution, implementing the e-SCM system in the Bangladeshi Pharmaceutical industry is needed. The primary concern is the possibility of implementing an e-SCM system into the current pharmaceutical supply chain management, where the research indicates that

there is a possibility. The necessity of introducing e-SCM is demonstrated by the reality that many responders presented their concepts for using and implementing e-SCM in the pharmaceutical supply chain discussed in Chapter 4.

Most of the interviewees indicated the necessity of e-SCM and described new technologies like blockchain, smart contracts, and e-payment for their implementation. Although few interviewees did not have precise knowledge in supply chain management systems, they have shared extensive knowledge on the implementation process of the e-SCM system in Bangladesh. Besides, several challenges were mentioned: infrastructure readiness, willingness to adopt the new technology, high implementation cost, and lack of skilled resources. This indicates that though introducing an e-SCM framework in the pharmaceutical supply chain is technically feasible, the practical implementation may be delayed. As some interviewees stated, there should be a non-removable manual process. Alongside, if e-SCM systems are deployed consistently from large cities to rural areas by the involvement of related stakeholders, they can add more value to the healthcare sector.

5.2 Recommendations

The research results indicate that, to a certain extent, e-SCM will contribute to the improvement of the pharmaceutical supply chain process. Recommendations have been made based on the findings and principles discussed in the preceding chapters of this thesis.

Its purpose is not to hamper or create obstacles for the companies, patients, or other involved parties. Its main purpose is to bring transparency in the system, reduce the bureaucracy & dependencies, improve citizens' life, control the black market and increase the tax. Another fact is that any kind of public service transformation is mainly dependent on political will. As the Bangladesh government has decided to transform into “Digital Bangladesh [6]” so, in this case, the political will is considered as positive about

implementing this type of system. It is the fact that the implementation of E-SCM in the pharmaceutical industries has some strengths, which are,

1) It will help to improve the healthcare system for Bangladesh.
2) It will help to reduce the medicine cost for the end-users.
3) All data will be stored, and a single data falsification will not occur, which is needed to control the black market and tax evasion.
4) It will reduce human dependency and help to contribute more to the GDP.

Some limitations also exist in the E-SCM system. These weaknesses can be observed only in international cases, but the E-SCM can contribute to a great extent at the national level. Nevertheless, as we described earlier, some challenges still exist to implement the E-SCM system in Bangladesh for pharmaceutical companies, which are indicated below:

1) The IT infrastructure is not ready. While the lack of electricity and internet availability still exists in many parts of Bangladesh, this infrastructure may delay the implementation time.
2) High implementation cost is another considerable fact.
3) Bangladesh does not have many skilled human resources for implementing the project. Foreign expert resources can implement the E-SCM system, but the local resources are not ready for regular operation and maintenance.
4) Before implementing this E-SCM system, we must evaluate whether the related stakeholders will willingly adopt the system since it is not only for the pharmaceutical companies but also for the government agencies, pharmaceutical shops, transport companies, insurance companies, and healthcare systems.

After considering all the factors and there are many parties involved in this process, it is recommended to go for a pilot project to implement an integrated E-SCM platform. In order to the need for sustainability and significantly increased the business complexity, project management practices have emerged to address global sustainability challenges, which necessitate the engagement and coordination of broader competencies from stakeholders across the supply chain [48]. In this case, the pilot project can be breakdown

into five different phases. Usually, these phases are recommended by PMI (Project Management Institute). These are,

1. Phase 01, Project Initiation: This phase is also known as the project charter. Here the project's details are described. The purpose or necessity of the project gets more priority over here. Also, the project steering committee is being formed in this phase. So, for implementing an integrated E-SCM system, it must form the committee, and the purpose of the project needs to be defined in this phase.
2. Phase 02, Project Planning: In the planning phase, the project management team will prepare the pilot project's detailed plan, scope, budgeting, communication, and responsibility matrix. After getting approval from the authority or project owner, the project management team will forward to the execution phase.
3. Phase 03, Project Execution: During the project execution phase, the team has to deploy the project. In this case, the execution will deploy the integrated E-SCM platform to selected government agencies, pharmaceutical companies, and other stakeholders like pharmacy shops, insurance companies, and transport companies.
4. Phase 04, Project Monitoring & Controlling: During the project execution, it has to consider that if any obstacles arise, then the project management team takes immediate actions to resolve the obstacles.
5. Phase 05, Project Close: The most and important part of a project is project closure. After completing the project, it is required to release all the project members and come up with a result. The project might be successful or not, but there should be one result. Even in this phase, it is recommended to prepare a project report to collaborate with stakeholders and user experience.

In addition, it is recommended to have proper documentation of each phase. As it is a pilot project, so in the future, when the real project will be implemented, these documents will help come up with proper solutions. If the result is successful, the committee should approach the real project to implement the integrated supply chain system in pharmaceutical industries nationwide. During this time, the committee should have kept in mind that resource training is very much important. Suddenly, the project should not implement and impose every stakeholder to use the system. Each department should learn how to use the system and bring benefits to the involved users in this system. Gradually,

the committee should implement the necessary cybersecurity team to protect data and any cyber attack.

5.3 Limitations

The research's shortcomings can be attributed to the single case study approach used. The paper explores the relative use of electronic supply chain management systems in Bangladesh's pharmaceutical industry, but the conclusions from a particular case might not be generalized to all other categories of supply chains or any other country. Also, most of the interviewees are involved in pharmaceutical companies. No interview was conducted with doctors or government employees since establishing communication with them was impossible during the COVID-19 outbreak. So, this is also considered a limitation.

5.4 Future work

This study is based on the challenges of implementing the E-SCM system in pharmaceutical industries in Bangladesh. There are several examples of analysis that are relevant to the system integration, such as these may support with regard the corporate purposes. An analysis of the pharmaceutical company's performance concerning the introduction of the E-SCM would be conducted after the implementation of the E-SCM system. The end-user experience is essential in project success. Thus, users' feedback should be regularly gathered, and the system should be adjusted accordingly or improve continuously to make the system as user-centric as possible. It is also suggested that success must be measured in terms of users' awareness. After successful implementation, it will be easier to deploy for other sectors as well.

6 References

[1] D. A. Mazumdar and A. H. Helmi, “Digital Bangladesh – Vision 2021: What is the Digital Bangladesh Concept?,” *South Asian Research Journal of Engineering and Technology,* vol. 2, no. 1, February 2020.

[2] R. Hoque, F. A. Mazmum and Y. Bao, “e-Health in Bangladesh: Current Status, Challenges, and Future Direction,” *The International Technology Management Review,* vol. 4, no. 2, pp. 87-96, June 2014.

[3] A. Moosivand, A. R. Ghatari and H. R. Rasekh, “Supply Chain Challenges in Pharmaceutical Manufacturing Companies: Using Qualitative System Dynamics Methodology,” *Iranian Journal of Pharmaceutical Research,* vol. 18, no. 2, pp. 1103-1116, 2019.

[4] M. Tremblay, “Medicines Counterfeiting is a Complex Problem: A Review of Key Challenges Across the Supply Chain,” *Current Drug Safety,* vol. 8, no. 1, pp. 43-55, 2013.

[5] S. M. Ahmed, M. A. Hossain, A. M. Raja Chowdhury and A. U. Bhuiya , “The health workforce crisis in Bangladesh: shortage, inappropriate skill-mix and inequitable distribution,” *Human Resources for Health,* vol. 9, no. 3, 2011.

[6] G. Uddin, “E-governance of Bangladesh: Present Scenario, Expectation, Ultimate Target and Recommendation,” *International Journal of Scientific & Engineering Research,* vol. 3, no. 11, November 2012.

[7] BTRC, “Internet Subscribers in Bangladesh,” Dhaka, 2021.

[8] B. Information and Communication Technology Division, “National Blockchain Strategy: Bangladesh, Pathway to be a Blockchain-enabled Nation,” Information and Communication Technology Division, Bangladesh, Dhaka, 2020.

[9] S. Y. Arafat, K. Halder, H. A. Asad, M. I. Rahman, J. Hasan and Z. Ahmed, “Prescription Modifying Marketing Factors: A Survey among the Clinicians in Bangladesh,” *International Journal of Business and Management Invention,* vol. 5, no. 1, pp. 46-48, January 2016.

[10] A. Mohiuddin, “An A-Z Pharmaceutical Industry: Bangladesh Perspective,” *Asian Journal of Research in Pharmaceutical Sciences.,* vol. 9, no. 1, March 2019.

[11] R. B. Kazemzadeh, M. M. Sepehri and F. F. jahantigh, “Design and Analysis of a Health Care Supply Chain Management,” *Advanced Materials Research Vols. 433-440,* pp. 2128-2134, October 2012.

[12] N. Pervez, J. Mahmud and S. C. Bachar, “Supply Chain Management of Pharmaceutical Products in Hospitals: A Case Study In A Privately Owned Tertiary Level Hospital,” *Quest Journals,* vol. 4, no. 4, pp. 14-23, 2016.

[13] R. Hoque, A. N. M. Saif, A. Albar and Y. Bao, “Adoption of information and communication technology for development: A case study of small and medium enterprises in Bangladesh,” *Information Development,* vol. 32, no. 4, pp. 986-1000, March 2015.

[14] K. A. Clauson, E. A. Breeden, C. Davidson and T. k. Mackey, “Leveraging Blockchain Technology to Enhance Supply Chain Management in Healthcare: An Exploration of Challenges and Opportunities in the Health Supply Chain,” *Blockchain in Healthcare Today,* 2018.

[15] B. D. G. o. H. Service, “Bangladesh eHealth Standards & Interoperability Framework,” Bangladesh DIrector General of Health Service, Dhaka, Bangladesh, 2012.

[16] BAPI, “Bangladesh Association of Pharmaceutical Industry,” [Online]. Available: http://www.bapi-bd.com/.

[17] R. B. Kazemzadeh, M. M. Sepehri and F. F. jahantigh, “Design and Analysis of a Health Care Supply Chain Management,” *Advanced Materials Research Vols. 433-440,* pp. 2128-2134, 2012.

[18] D. Umesh , M. A. Kulkarni and K. Kalagi, “A STUDY OF E-SUPPLY CHAIN MANAGEMENT: REVIEW, IMPLICATIONS AND DIRECTIONS FOR FUTURE RESEARCH,” *IT and Production Management,* February 2019.

[19] L. Pulevska-Ivanovska and N. Kaleshovska, “Implementation of e-Supply Chain Management,” *TEM Journal,* vol. 2, no. 4, pp. 314-322, 2013.

[20] A. M. S. Bravo and J. C. d. Carvalho, “UNDERSTANDING PHARMACEUTICAL SUSTAINABLE SUPPLY CHAINS – A CASE STUDY APPLICATION,” *INDEPENDENT JOURNAL OF MANAGEMENT & PRODUCTION (IJM&P),* vol. 4, no. 1, pp. 228-247, January 2013.

[21] T. L. Tan and D. T. D. Tran, “Issues of Implementing Electronic Supply Chain Management (E-SCM) In Enterprise,” *European Business & Management,* vol. 3, no. 5, pp. 86-94, 2017.

[22] R. K. Singh, R. Kumar and P. Kumar, “Strategic issues in pharmaceutical supply chains: a review,” *International Journal of Pharmaceutical and Healthcare Marketing,* vol. 10, no. 3, pp. 234-257, 2016.

[23] A. Moosivand, A. R. Ghatari, and H. R. Rasekha, “Supply Chain Challenges in Pharmaceutical Manufacturing Companies: Using Qualitative System Dynamics Methodology,” *Iranian Journal of Pharmaceutical Research,* vol. 18, no. 2, pp. 1103-1116, 2019.

[24] K. D, V. RB and . D. D2, “An Overview on Pharmaceutical Supply Chain: A Next Step towards Good Manufacturing Practice,” *Drug Designing & Intellectual Properties International Journal,* vol. 1, no. 2, March 2018.

[25] M. A. Habib and M. Z. Alam, “Business Analysis of Pharmaceutical Firms in Bangladesh: Problems and Prospects,” *Journal of Business and Technology (Dhaka),* vol. 6, no. 1, pp. 61-77, 2011.

[26] . S. Islam, A. Rahman and A. Al-Mahmood, “Bangladesh Pharmaceutical Industry: Perspective and the Prospects,” *Bangladesh Journal of Medical Science,* vol. 17, pp. 519-525, 04 October 2018.

[27] J. Sultana, “Future Prospects and Barriers of Pharmaceutical Industries in Bangladesh,” *Bangladesh Pharmaceutical Journal,* vol. 19, no. 1, pp. 53-57, 17 February 2016.

[28] F. Rahman, “Window of opportunity for the pharma industry,” 02 February 2016. [Online]. Available: https://www.thedailystar.net/supplements/25th-anniversary-special-part-2/window-opportunity-the-pharma-industry-210937. [Accessed 2021].

[29] C. Liu, D.-a. Guo and L. Liu, “Quality transitivity and traceability system of herbal medicine products based on quality markers,” *Phytomedicine,* vol. 44, pp. 247-257, 2018.

[30] D. Haack and M. Koeberle, “How Advances in Pharmaceutical Packaging Are Better Meeting Patients’ Needs,” *Drug Development & Delivery,* vol. 17, no. 6, September 2017.

[31] M. o. H. a. F. W. Bangladesh, “National Drug Policy 2017,” Directorate General of Drug Administration (DGDA), Dhaka, 2017.

[32] R. I. Shojib, T. Hasan and A. R. Nayeem, “PHARMACEUTICAL SUPPLY CHAIN MANAGEMENT: AN EMPIRICAL STUDY ON BANGLADESH PERSPECTIVE,” *Cosmos An International Journal of Management (A Refereed Research Journal),* vol. 9, no. 2, pp. 45-49, August 2020.

[33] S. Claire , “Time- and Temperature-Controlled Transport: Supply Chain Challenges and Solutions,” *P & T : a peer-reviewed journal for formulary management,* vol. 43, no. 3, pp. 154-170, 2018.

[34] A. Chircu, E. Sultanow and S. P. Saraswat, “Healthcare RFID In Germany: An Integrated Pharmaceutical Supply Chain Perspective,” *Journal of Applied Business Research (JABR),* vol. 30, no. 3, pp. 737-752, 24 April 2014.

[35] E. COMMISSION, “INFORMATION FROM EUROPEAN UNION INSTITUTIONS, BODIES, OFFICES AND AGENCIES Guidelines of 5 November 2013 on Good Distribution Practice of medicinal products for human use (Text with EEA relevance) (2013/C 343/01),” *Official Journal of the European Union* , 2013.

[36] Z. Xueping , L. Yongjian , C. G. Gangshu and S. Dan , “Transportation Research Part E: Logistics and Transportation Review,” *Elsevier,* vol. 90, pp. 51-68, June 2016.

[37] P. Sumit, K. Golam , A. M. Syed and Z. Guoqing , “Examining transportation disruption risk in supply chains: A case study from Bangladeshi pharmaceutical industry,” *Research in Transportation Business & Management,* 2020.

[38] S. Akmal, S. Sinulingga, H. Napitupulu and N. Matondang, “Disruption innovation, electronic supply chain management in improving the competitive advantage and the company performance,” in *IOP Conference Series Materials Science and Engineering 505:012131,* 2019.

[39] H. Petri and H. Yuqiuge , “Blockchains in operations and supply chains: A model and reference implementation,” *Computers & Industrial Engineering,* vol. 136, pp. 242-251, 2019.

[40] S. Patrick , L. Fang , M. Alvin and F. Paul , “Blockchain Technology for Detecting Falsified and Substandard Drugs in Distribution: Pharmaceutical Supply Chain Intervention,” *JMIR Res Protocols,* vol. 7, no. 9, 2018.

[41] M. Abdel-Basset, G. Manogaran and M. Mohamed, “Internet of Things (IoT) and its impact on supply chain: A framework for building smart, secure and efficient systems,” *Future Generation Computer Systems,* vol. 86, pp. 614-628, 2018.

[42] S. Yerpude and D. T. K. Singhal, “Internet of Things based Customer Relationship Management –A Research Perspective,” *International Journal of Engineering & Technology,* vol. 7, no. 2.7, pp. 444-450, 2018.

[43] S. Nazrul, “Bangladesh Pharmaceutical Sector Wading through the Pandemic,” LightCastle Partners, Dhaka, 2019.

[44] Diane G. Cope, “Methods and Meanings: Credibility and Trustworthiness of Qualitative Research,” *Oncology Nursing Forum,* vol. 41, no. 1, January 2014.

[45] H. o. BAPI, “Bangladesh Association of Pharmaceutical Insdusty,” [Online]. Available: http://www.bapi-bd.com/about-us/history-of-bapi.html.

[46] M. G. M. M. Rahman, “Annual Report 2018-2019,” Directorate General of Drug Administration, Dhaka, 2019.

[47] S. Chaudhuri, “Evolution of the Pharmaceutical Industry in Bangladesh, 1982 to 2020,” *SSRN Electronic Journal,* p. 40, July 2020.

[48] J. Larsson and L. Larsson, “Integration, Application and Importance of Collaboration in Sustainable Project Management,” *Sustainability,* vol. 12, no. 2, p. 585, 2020.

[49] L. S. Sterling, The Art of Agent-Oriented Modeling, London: The MIT Press, 2009.

[50] F. Jamil, L. Hang, K. Kim and D. Kim, “A Novel Medical Blockchain Model for Drug Supply Chain Integrity Management in a Smart Hospital,” *Electronics,* vol. 8, no. 5, p. 505, 7 May 2019.

[51] V. Torta, “The impact of blockchain technology in business: a focus on Supply Chain Management,” Researchgate, January 2020.

[52] C. Tobescu, “Towards real-time temperature monitoring,” August 2017.

[53] I. Haq and O. M. Esuka, “Blockchain Technology in Pharmaceutical Industry to Prevent Counterfeit Drugs,” *International Journal of Computer Applications,* vol. 180, no. 25, pp. 8-12, 2018.

[54] “Enabling Trade Valuing Growth Opportunities,” World Economic Forum, 2013.

[55] J. S. Notland and A. V. Hua, “Project Thesis Blockchain enabled Trust & Transparency in supply chains,” 2017.

[56] T. Clohessy and S. Clohessy, “What’s in the Box? Combating Counterfeit Medications in PharmaceuticalSupply chains with Blockchain Vigilant Information Systems,” 2020.

[57] K. A. Clauson, E. A. Breeden, C. Davidson and T. K. Mackey, “Leveraging Blockchain Technology to Enhance Supply Chain Management in Healthcare: An exploration of challenges and opportunities in the health supply chain,” *Blockchain in Healthcare Today,* vol. 1, 23 March 2018.

[58] D. W. Allen, A. Berg and B. Markey-Towler, “Blockchain and Supply Chains:V-form Organisations, Value Redistributions, De-commoditisation and Quality Proxies,” *The JBBA,* vol. 2, no. 1, pp. 1-8.

Appendix 1 – Non-exclusive licence for reproduction and publication of a graduation thesis[1]

I Eusuf Hassan

1. Grant Tallinn University of Technology free licence (non-exclusive licence) for my thesis “Challenges To Introduce E-Supply Chain Management Process For Pharmaceutical Companies In BANGLADESH”, supervised by Alex Norta.
   1.1. to be reproduced for the purposes of preservation and electronic publication of the graduation thesis, incl. to be entered in the digital collection of the library of Tallinn University of Technology until expiry of the term of copyright;
   1.2. to be published via the web of Tallinn University of Technology, incl. to be entered in the digital collection of the library of Tallinn University of Technology until expiry of the term of copyright.
2. I am aware that the author also retains the rights specified in clause 1 of the non-exclusive licence.
3. I confirm that granting the non-exclusive licence does not infringe other persons' intellectual property rights, the rights arising from the Personal Data Protection Act or rights arising from other legislation.

25.07.2021

1 The non-exclusive licence is not valid during the validity of access restriction indicated in the student's application for restriction on access to the graduation thesis that has been signed by the school's dean, except in case of the university's right to reproduce the thesis for preservation purposes only. If a graduation thesis is based on the joint creative activity of two or more persons and the co-author(s) has/have not granted, by the set deadline, the student defending his/her graduation thesis consent to reproduce and publish the graduation thesis in compliance with clauses 1.1 and 1.2 of the non-exclusive licence, the non-exclusive license shall not be valid for the period.

Appendix 2- Interview Question

Introduction

1. In what type of company are you working?

2. What is the current role in your company? How long have you been working in this position?

3. What are the main duties of your role?

4. Do you need to use a computer in your current role and what level of skills do you need for the current role?

General Understanding of E-SCM

1. Do you have any idea of Digital Bangladesh and what is the purpose of this Digital Government? (In Bangladesh, the Digital/Electronic Government is known as Digital Bangladesh).

2. Do you use any electronic service in your country? Please explain about that service. (If Not, do you have any plan to use any electronic service?)

3. Do you think the health sector should be digitalized? Please explain.

4. Do you have any idea of Personal Data? Are you aware of personal data security? Can you please explain? (If no, I will explain first and record the feedback of understanding)

5. Can you make a short description of the manual or traditional pharmaceutical supply chain process?

6. Can you state some challenges of the current system?

7. Have you ever heard of the term "E-SCM" or Electronic Supply Chain Management System? If YES, please describe. (If no, I will describe and record the feedback).

8. Do you think that the implementation of E-SCM in the Pharmaceutical Industries of Bangladesh will help to overcome the challenges which you stated earlier? Can you please explain?

9. What do you think could be the major challenges to implement an integrated E-SCM system in Bangladesh for Pharmaceutical Companies? (Example: Cost, IT infrastructure..)

RQ1: Sub 01 (The application of integrated E-SCM can be implemented on the current pharmaceutical system).

1. What is the need for implementing integrated E-SCM in this industry? (Please explain)

2. Have you ever participated in any electronic service-related application implementation? (If yes please describe your role over there). If No, whether have you any possibilities to participate in such kind of activities?

3. Do you think that all the related agencies or stakeholders will cordially participate in this implementation? Please explain your opinion.

RQ1: Sub 02(The implementation of an integrated E-SCM system to identify the problems of the current manual supply chain management system).

1. What area of the current supply chain process do you think is not producing the best result?

2. What aspect of the current system do you think needs to be fixed to be more effective?

3. What do you consider as the biggest challenges with the current supply chain system? Please name 3 of them and why?

RQ1: Sub03: (A seamless and trustworthy integrated and electronic-based supply chain system will be considered after the digitalization of the stakeholder's management system).

1. Do you think that all the stakeholders will cooperate to introduce the integrated E-SCM in this pharmaceutical industry? Please explain.

2. In this integrated E-SCM system, what are the biggest challenges for stakeholders? Please mention 3 main challenges and explain why?

RQ2: Sub01: (There are well-established integrated E-SCM systems to conduct a feasibility analysis on for implementation).

1. Is there any specific procedure for analyzing the feasibility of implementing an integrated E-SCM system in pharmaceutical industries? If yes, please explain. If No, whether do not you think, there should have some procedures to analyze the feasibility of implementing an integrated E-SCM system in pharmaceutical industries?

RQ02: Sub02: (There are well-established criteria for assessing the effectiveness of the integrated E-SCM system)

1. Are there a specific basis or yardsticks for evaluating the productivity of the integrated E-SCM system? If Yes, please mention it. If Not, don’t you think whether there should have some yardsticks to evaluate the productivity of the integrated e-SCM?

RQ02: Sub03: (There are well-established criteria for evaluating the efficiency of the current supply chain management system).

1. Are there a specific basis or yardsticks for evaluating the efficiency of the current system? If Yes, please mention the basis for evaluation. If Not, don’t you think should have some specific basis or yardsticks for evaluating the efficiency of the current system?

2. Is there any commitment from your side for your clients? Please explain.

RQ3: Sub01: (The stakeholders in the manual supply chain system are identifiable)

1. How would you describe Stakeholders in the current supply chain system? Do you have stakeholders? How do you differentiate them? Please explain.

RQ03: Sub02: (The stakeholders do encounter challenges within the current supply chain system).

1. What kind of problems are you facing in the current supply chain system with your stakeholders?

2. How do you solve those problems?

3. If integrated E-SCM is being introduced, do you think some aspects should still be kept as it is in the current supply chain system? Please explain.

RQ03: Sub03: (The roles of stakeholders are greatly influenced by the integrated E-SCM system in pharmaceutical industries).

1. Do you think that your role in the current system will be greatly enhanced if an integrated E-SCM system is being introduced? Please explain.

2. Which part of the supply chain system do you believe the introduction of the E-SCM system will be effected the most?

3. Would you welcome the changes that the effect will bring into the current system? Please explain.

Appendix 3 - Thematic Map

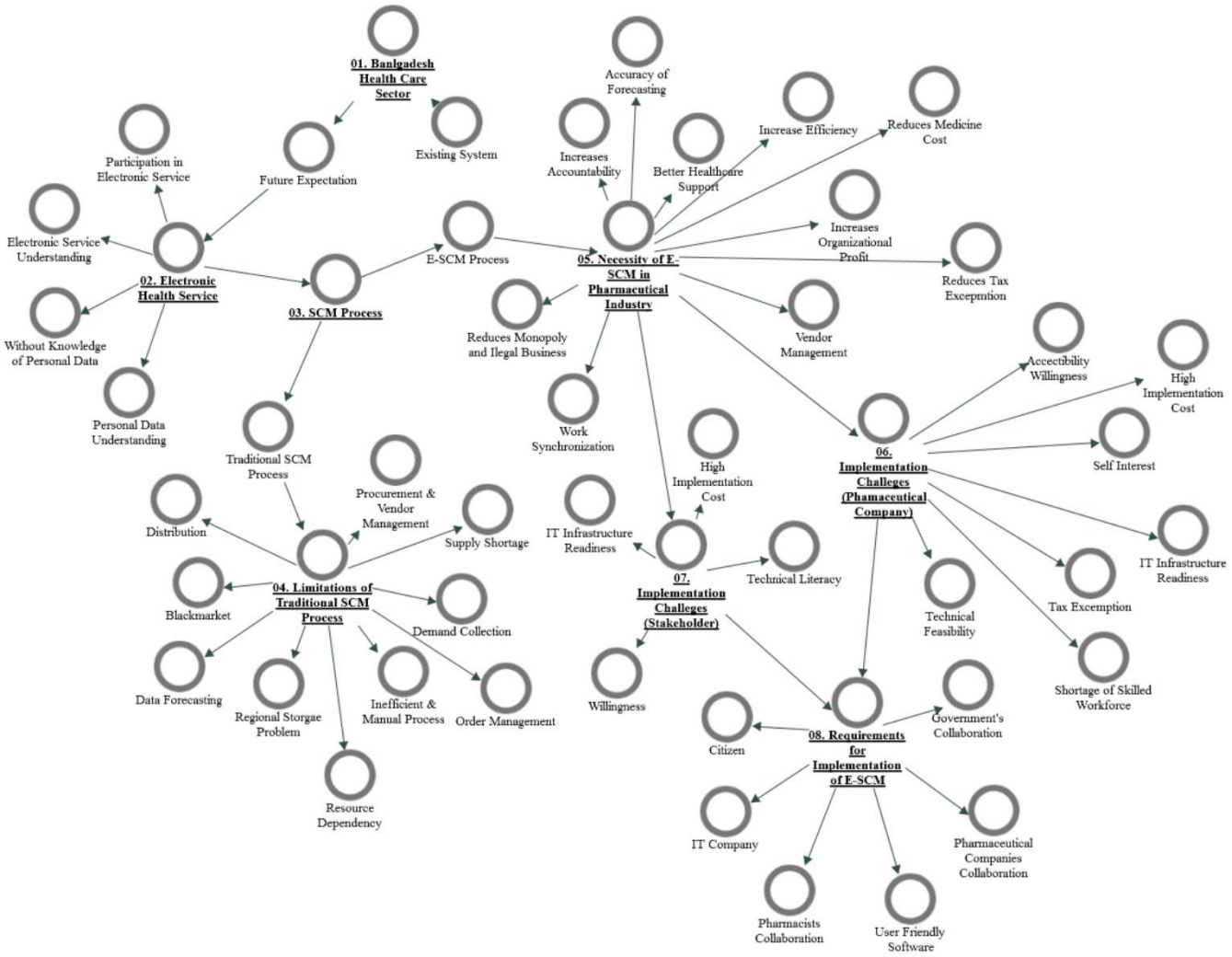

Figure 4: Thematic Map, Source: author

Appendix 4 – Interview Files

https://drive.google.com/drive/folders/10YjPR4SlcA4sAonGsOnOGZCKfENPPsIw?usp=sharing