Report On

THE ROLE OF LOGISTICS MANAGEMENT INFORMATION SYSTEM (LMIS) IN THE HEALTH COMMODITY SUPPLY CHAIN MANAGEMENT IN BANGLADESH AT LOWER HEALTH CARE LEVEL (COMMUNITY BASED CLINIC AND UPZILLA HOSPITAL)

Submitted By

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An internship report submitted to the BRAC Institute of Governance and Development (BIGD) in partial fulfillment of the requirements for the degree

of

Masters in Procurement and Supply Chain Management.

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Declaration

It is hereby declared that the Research Monograph titled *The Role of logistics Management Information System (LMIS) in the health commodity supply chain management in Bangladesh at lower health care level (Community based clinic and Upzilla Hospital).* Its written and submitted by me as the pre-requisite for the completion of Masters n Procurement and Supply Management (MPSM) 20218-2021 BRAC Institute of Governance and Development, BRAC University. It 1s completely my own work and does not contain any statement which may attack or target any particular group of the society. The internship report submitted is my/our own original work while completing degree at BRAC University. The report does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing. The report does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.

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Subject: The Role of Logistics Management Information System (LMIS) in the Health Commodity Supply Chain Management in Bangladesh at Lower Health Care Level (Community Based Clinic and Upzilla Hospital).

Dear Sir / Madam,

This is my pleasure to display my entry level position provide details regarding' Recruitment and Selection Procedure of Community based clinic and Upzilla Hospital, which I was appointed by your direction.

I have attempted my best to finish the report with the essential data and recommended proposition in a significant compact and comprehensive manner as possible.

I trust that the report will meet the desires.

Sincerely yours,

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Non-Disclosure Agreement

This agreement is made and entered into by and between Community clinic and Upzilla Hospital and the undersigned student at BRAC University of Md Abdul Hakim ID 18282021.

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The Author

Executive Summary

Bangladesh is currently implementing its Seventh Five-Year Plan (7FYP) for the period 2016-2020. To ensure its progress, the Government of Bangladesh adopted a number of policies, acts, rules, etc. Recently, a number of acts have either been passed or amended to strengthen the capacity and quality of the health services of the country. In order to achieve these goals, there should be adequate supply of logistics which are needed for efficient and effective service delivery. There should also be proper management of logistics in order to achieve these goals. Logistics bridges the physical and temporal gaps in a global supply chain. Efficient logistics makes a global economy possible, lowering the cost of living for the people of the world. The major disadvantage of push-based model were unnecessary stocking goods, expired, breaking cool chain, wastage of product, increased dead stock. The major advantage of pull based model were less wastage, proper utilized of product, quality immunization, decreased the dead stock and fulfilled the requirement of community. Both methods have some challenges though cent percent of the respondent suggested about implementation of pull based model in community level. As a contribution to strengthening the supply chain management in developing countries, this thesis provides research that can be used to define informational needs in different supply chain contexts. These informational needs can be used as a guide for how to improve information systems for logistic management, to promote the role of these informational needs in the supply chain management.

Keywords: Logistics Management Information System (LMIS), Health Commodity, Supply Chain Management, Health Care

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Abbreviations

API	Application Programming Interface
ARV	Antiretroviral
CSCMP	Council of Supply Chain Management Professionals
CHCP	Community Health Care Provider
CCIT	Cool Chain Inventory Tool
DGHS	Director General of Health Services
DHIS2	District Health Information System 2
DHMT	District Health Management Team
DMO	District Medical Officer
DVDMT	District Vaccination Data Management Tool
EDCL	Essential Drugs Company Limited
eLMIS	electronic Logistic Management Information System
GDP	Gross Domestic Product
HLL	HLL Life Care Limited
HIS	Health Information System
HISP	Health Information System Program
HMIS	Health Management Information System
HMN	Health Metrics Network
ILS Gateway	Integrated Logistic System Gateway
IS	Information System
IT	Information Technology
IVD	Immunisation and Vaccine Development
JSI	John Snow Inc.
LMIS	Logistic Management Information System

LTL	Less Then Truckload
MDGs	Millennium Development Goals
MOHSW	Ministry of Health and Social Welfare
MoH	Ministry of Health
CMSD	Central Medical Store Department
NCRD	Norwegian Centre for Research Data
NGO	Non-Governmental Organization
OI	Opportunistic Infections
RHMT	Regional Health Management Team
RMO	Regional Medical Officer
R&R	Report and Requisition
SC	Supply Chain
SCC	Supply Chain Competitiveness
SCM	Supply Chain Management
SDP	Services Delivery Point
SMER	Statically Mutually Exclusive Roles
SMT	Stock Management Tool
SMP	Systematic Multiprocessing
TBA	Traditional Birth Attendant
TL	Truck Load
VIMS	Vaccine Information Management System
VMI	Vendor-Managed Inventory
WHO	World Health Organization
USAID	United States Agency for International Development

CHAPTER 1

INTRODUCTION

1.1 Back ground of the study

Over the last 49 years since Independence, Bangladesh has made a lot of strides in the Health Sector. Health infrastructure has been proliferated remarkably. Medical colleges, medical universities, private medical colleges, private clinics, private hospitals, district hospitals, rural health centers, and community clinics are being increased in numbers and improved in quality with modern facilities. There have been significant gains in terms of polio and small pox eradication. Extensive vaccination and case isolation have resulted in diminishing the prevalence of diphtheria and tetanus. Progress in immunization (valid vaccination coverage) is excellent in Bangladesh. With improvement of overall hygiene and sanitation standard, there's a discernible reduction in cholera, typhoid, and dysenteries. A great number of satellite clinics for tuberculosis now offer free treatment with contribution from NGOs. HIV/AIDS are at a low level of prevalence. Kala-azar and malaria has been significantly curved down. Malaria and tuberculosis-related death rates are currently very low in Bangladesh. Maternal mortality and neonatal mortality rate have also been reduced. Bangladesh is currently implementing its Seventh Five-year Plan (7FYP) for the period 2016-2020. To ensure its progress, the Government of Bangladesh adopted a number of policies, acts, rules, etc. Recently, a number of acts (relating to communicable diseases, mental health, organ transplantation, community clinic, etc.) have either been passed or amended to strengthen the capacity and quality of the health services of the country.

In order to realize these goals, there should be adequate supply of logistics which are needed for efficient and effective service delivery. There should even be proper

management of logistics so as to realize these goals. Logistics bridges the physical and temporal gaps in a global supply chain. Efficient logistics makes a worldwide economy possible, lowering the value of living for the people of the planet. In the name of efficiency, information technology has been adopted to support logistics for several years. Optimization of the information flow to leverage the effectiveness and efficiency of the whole logistic system is one of the most important areas during which the logistic providers are competing with one another (Hai & Yirong (2002) [1]. The importance of logistics is predicted to increase. Because the power to manage procurement, production, and transportation by firms so as to satisfy customer demands will increase and the use of Logistics Management Information Systems (LMIS) for the management of fast and accurate information flows will become essential in future business environments (Yoon *et al*., 2008 [2]). Health care organizations in all countries were looking for ways to improve operational efficiencies and reduced costs without affecting patient care services (Msimangira, 2010 [3]). Thus, the importance of health logistics cannot be over emphasized. Silve (2009) [4] and Mumford (2006) [5] in their work quoted WHO's report as "they can prevent or treat most illnesses by using known and inexpensive techniques, the problem lies elsewhere: it consists in providing personnel, medicines, vaccines and knowledge to those in need, at the acceptable time, insufficient quantity, reliable and sustainable manner, and at a price acceptable". Health logistics cannot be narrowed to only the function which deals with the utilization of physical resources; it encompasses the efficient coordination and control of the flow of all operations that include personnel, clients, facilities, information and other resources.

Total number of hospitals under the DGHS is 739 are contributing greatly to the

healthcare in Bangladesh. The government hospitals of secondary and tertiary levels, hospitals at the upazila and union levels, registered private hospitals and clinics, and registered private diagnostic centers are dedicated to providing healthcare to the people. Effective and efficient logistics management plays a key role in organizations and therefore the economy. Because logistics plays key roles in every economy, the availability chain partners must coordinate all activities in logistics management to make sure efficiency. Sangeeta and Nadeem (2004) [6] refer to logistics have the specific functions that need to be carried out by each of the supply chain partners such as selecting products, forecasting demand, ordering and procuring, warehousing and storing, managing inventory, transporting from one level to subsequent until the commodities reach the clients and managing data within the process.

In health logistics system, the availability of supply chain partners are the manufacturers who are the pharmaceutical companies which supply raw materials, the procurement agents such us the ministries of health, health administrative units, United Nations agencies and others. Distributors were composed of the transporters, the central, the regional and therefore the district medical stores. Financiers were donors or funding agencies. Service providers also constitute NGOs and Service Delivery Points (SDPs) such as hospitals, health centers and pharmacies. The coordination of those activities by the availability chain partners plays significant roles in organizations and therefore the economy as an entire. The importance of strategic logistics management within the Health Service system cannot be over emphasized. Poulin (2007) [7] argued that logistics accounts for a sizeable portion of operating budget of a hospital. Studies have shown that from 30% to 46% of hospital expenses were

invested in various logistical activities which almost half the prices related to supply chain processes could be eliminated through the utilization of best practices.

1.2 Objective of the study

The main objective of the study was to observe health commodity supply chain needs and consideration for LMIS

1.3 Logistic Management Information System (LMIS)

Logistic Management Information System (LMIS) is a system of records and reports, whether paper-based or electronically, that is being used to collect, organize, and present logistic data gathered from all levels of a health system. It is used to aggregate, analyze, validate, and display data that can be used to make logistic decisions and manage the health commodity supply chain (hereby addressed as supply chain) and improve customer service (USAID | DELIVER PROJECT, Task Order 1, 2011) [79]. An LMIS collects data about health products; stock available, losses, adjustments, consumption, demand, issues, shipment, status, and knowledge about the cost of commodities managed in the system (Abdullah *et al.*, 2014) [8]. The information that is being used to improve management decisions can, for instance, be information about the number of health commodities consumed which ultimately would contribute to improve forecasting procedures. In a supply chain of health commodities, the LMIS is working as a linkage between the health system levels. It is important that each of the levels of the supply chain understand how they link to the other levels in the system.

Each activity in the chain are all steps in an interconnected process (John Snow, Inc., 2012) [9].

Managers gathered information in the beginning of cycle, about each activity within the system and analyzed that information to form decisions and coordinate for future actions. For example, information about product consumption and inventory levels must be gathered to make sure that a manager knows what proportion of a product to acquire. Word “logistics” added by Logisticians to management information system (MIS) to create logistics management information system (LMIS). Logisticians want to clear it that the gathering of knowledge for managing a logistics system may be a separate activity from the gathering of knowledge for other information systems, including health management information systems (HMISs) (USAID | DELIVER PROJECT) [77] [78]. An LMIS collected data about commodities, this information is usually used for activities, like filling routine supply orders for health facilities. An HMIS collects information on the entire number of patients seen or diagnosed; data from an HMIS isn't used as often as LMIS data- i.e., annually and it is used for various purposes- i.e., for evaluating program impact. Logisticians emphasized the utilization of logistics data for creating decisions about activities within the logistics cycle.

Over time, the profession of supply chain management has evolved to satisfy the changing needs of the worldwide supply chain. According to the Council of Supply Chain Management Professionals (CSCMP) “Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement and all logistics management activities. Importantly, it also includes coordination and

collaboration with channel partners, which may be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies." The CSCMP also defines logistics management as "The part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of products, services and related information between the purpose of origin and therefore the point of consumption so as to meet customers' requirement. Logistics management is an integrating function, which coordinated and optimized all logistics activities, also as integrates logistics activities with other functions including marketing, sales manufacturing, finance, and information technology." (CSCMP 2011) [10]. Logistics were considered alternatively as activities because the operational component substantial of supply chain management, including quantification, procurement, inventory management, transportation and fleet management, and data collection and reporting. Supply chain management includes the logistics activities plus the coordination and collaboration of staff, levels, and functions. In a nutshell, the supply chain included global manufacturers and provide and demand dynamics, but logistics tends to focus more on specific tasks within a specific program health system.

Logistics management information system included a number of activities that support all activity of the health commodity supply chain management. Over the years, logisticians have developed a model to illustrate the relationship between the activities in a logistics system and they call it the heart of logistics.

Serving Customers

Everyone who works in logistics must remember that they select, procure, store, or distribute products to satisfy customer needs. Storekeepers do not store drugs only for the aim of storing but also, they store products to make sure that commodity security exists for each customer to get and use the health commodities when they need them. In addition, to serving the requirements of the top customer the customer seeking health services everyone with in the process is additionally serving the requirements of more immediate customers. Storekeepers provided customer service once they issued medicines to the clinic and therefore the central medical stores provide customer service once they issue commodities to the district. The logistics system ensures customer service by fulfilling the six rights. Each activity within the logistics cycle,

therefore, contributes to excellent customer service and to making sure commodity security.

Product Selection

Products selection is the basic of health programs in any health logistics system. A national formulary and therapeutics committee, pharmaceutical board, board of physicians, other government-appointed group could also be liable for product selection are main activity in any health logistics system. Most countries have developed essential medicine lists patterned on the planet Health Organization (WHO) Model List. Products were selected to be used it will be impact the logistics system, therefore the logistics requirements must be considered during the merchandise selection.

Quantification

The specified quantity and price of every product must be determined after selection of a products. Quantification is that the process of estimating the number and price of the products required for a selected health program or service. After that, an uninterrupted supply for the program will be ensured that determining when the products should be procured and distributed. The suggested reading list at the top of the handbook will be carefully read for sources of additional information about quantification of health commodities.

Procurement

Quantities of products must be procured after a supply plan has been developed as a

part of the quantification process. Health systems or programs can procure from international, regional, or local sources of supply; or they will use a purchase agent for this logistics activity. Procurement should follow a group of specific procedures that ensure an open and transparent process that supports the six rights in all stage of procurement.

Inventory Management

Inventory management is an important factor for logistic management. After procured some goods it will received by the health system or program. After that it must be transported to the service delivery level where the client will receive the products. During this process, the products must be stored carefully until they are sent to subsequent lower level, or until the customer needs them. Almost all businesses maintain store a quantity of stock for future customer needs.

1.4 Scope

The theme for this thesis is to research the supply chain in developing countries to strengthen the management of health commodity procurement. The role of financial information for procurement within supply chain management is chosen as a topic to address areas where the LMIS in the Bangladesh supply chain can be improved. Looking at the role of data for procurement at the lower health care units, and therefore the use of LMIS at this level, it can contribute to worry the importance of including the lower health care levels to use LMIS within the decision-making processes. Research from other developing countries, such as in Nigeria, has stated that the lack of information systems at middle, and lower levels of supply chain management are drastically affecting the effectiveness of the management (Mohammed *et al.*, 2007 [11]).

Health Information Systems in Developing Countries

The collection of components for improving the service delivery and health outcomes. However, it is important to recognize what role the technology can play. The technologies are introduced to collect, report, and analyse health data to take better, and informed decisions. In public health, decision-makers are dependent on the timely availability to sound data that are presented, communicated, and disseminated to them which changes their understanding of health issues and needs of cosumers (AbouZahr & Boerma, 2005 [12], Health Metrics Network, 2008 [13]). Information must therefore flow to where it is needed for action (Mumford, 2006 [14]). Better information contributes to make better decisions, which makes the decision-makers knowledgeable about all possible choices (Braa & Sahay, 2012 [15]). Information may be used in a variety of ways within a dynamic social context (Braa & Sahay, 2012 [15]). To make informed decisions, relevant information must be collected; many HIS of today are collecting a substantial amount of data, where more data are reported than would be regarded as needed (Braa & Sahay, 2012 [15]). However, the main goal is to report enough sound data so that HIS are able to generate, analyse, and disseminate this data to support the decision-making processes (AbouZahr & Boerma, 2005 [12]). Many HIS in developing countries tend to be 40 "data-rich" but "information poor" (Health Metrics Network, 2008 [13]). This is often a consequence of the belief that raw data can be used directly to make decisions without making it accessible for users to generate information for decision making process. High quality data stored in a well structures repository is of little value if it cannot be accessed by users to generate information for decision-making (Health Metrics Network, 2008 [13]). Therefore, a well-developed and

structured technology was necessary for users to access for decision making and generate information for decision making.

The Health Commodity Supply Chain

Per Village Reach's study from 2012, existing systems for health commodity distribution is struggling with meeting the demand of medical supplies. As the anticipated future are requiring more medical supplies, improving these systems is important to improve the supply chain in public health (VillageReach, 2012 [16]). A typical distribution model for medical supplies in developing countries were characterized by a structure where the distribution is organized by one source to many locations. Strengthening the supply chain often comes from the top of the chain, where the commodities are in 'bulks' at a limited number of locations where few personnel are involved. Inventory is broken into smaller parts for necessary for further, it goes down the supply chain, and managed by more personnel at several locations (VillageReach, 2012 [16]).

Distribution Models for Health Commodities

There are several ways of distributing health commodities in a supply chain. The choice of distribution is usually determined by Ministries of Health, and is often context-dependent. There may be several distribution models practiced at the same time within a health structure or system.

The Pull-Based Model

One common distribution model is the pull-based model. According to Management Sciences for Health (2012 [17]) a pull-based distribution model is in which each facility "determines the medicines quantities to be requisitioned from the procurement unit or warehouse.". The process in the model is that the consumers, such as health centres, dispensaries, and facilities, are ordering the health commodities themselves based on needs. The order is sent from the facility, electronically or on paper, to the suppliers. In some situations, the order is bypassing a district office for further control before it is being sent to the suppliers. The order is proceeded by the supplier, and in most cases, delivered by them to their respective recipient. In a pull-based model, each level of the health system determines what types and quantities are that are needed. They are then placing orders to the supply source. The system is also referred to as an independent demand or a requisition system (Management Sciences for Health, 2012 [18]). When following a pull-based model, the managers of facilities are supposed to work out their own demands estimates and buffer stocks.

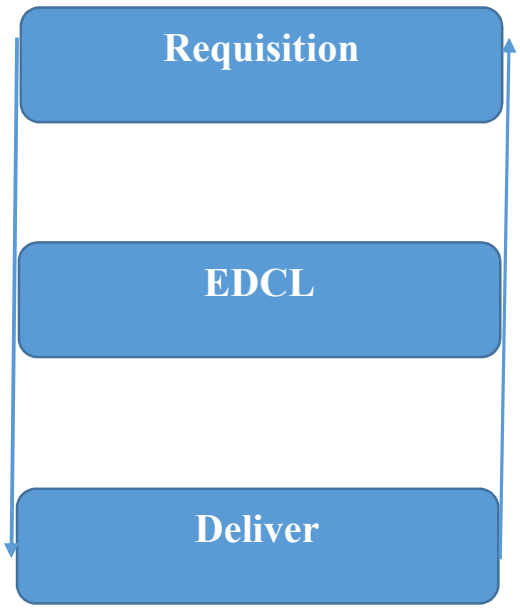


Figure 1. Pull based order for medicines

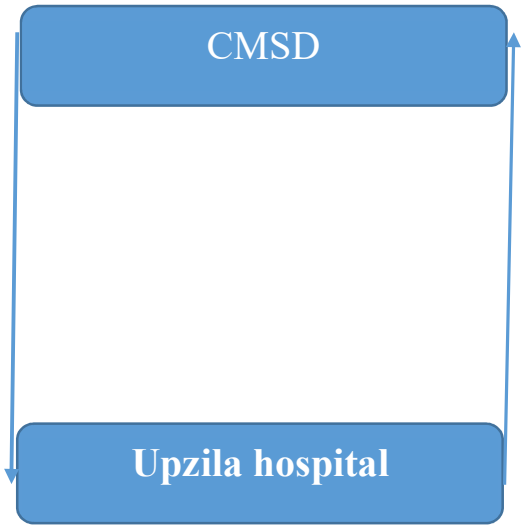


Figure 2. Pull based order for instrument

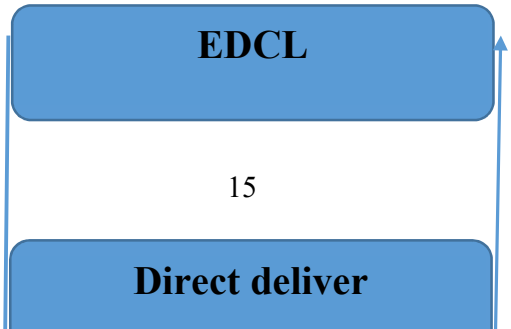
Figure 2 show the overall processes in a pull-based model. The flow of the orders is going upstream, and the supplies downstream. The orders are managed electronically from the district level and up, and either electronically or by paper from the facility-level. Distributing commodities in a pull-based model is, according to (Management Sciences for Health, 2012 [18]) favourable when; i) The lower staff are competent in managing inventory and estimating needs, ii) When there are sufficient supplies at the supply sources, iii) A large range of products is being handled, iv) Field staff members are regularly supervised, and performance is monitored and v) Good data are available to decision makers. The overall processes in the pullbased distribution model. Otherwise, if accurate information about needs exists or cannot be obtained, other distribution models should be considered.

The Push-Based Model

The push-based system is a distribution model where commodities are pushed to facilities on pre-determined terms. The terms are set by the higher levels of a health systems, such as an organization (usually a governmental organization, hereby referred to as supply sources).

The Management Sciences for Health (2012) [18] was described the push-based distribution model in which the procurement unit or warehouse determines what medicine quantities to be issued to the facilities. The supply sources determine the type and quantities of medicines to distribute to the lower levels. A plan for delivery is made in the beginning of a planning period that is usually a year time period. The supplies are then delivered according to plan throughout the year (Management Sciences for Health, 2012 [18]). The system is also referred to allocation or ration system (Management Sciences for Health, 2012 [18]). The push-based model should be useful in situations for disaster relief and when the pipelines for supplies does not function throughout the levels of the health system. In some situation, countries are practicing both a push-based and a pull-based model, where primary health commodities are issued routinely, while district and regional hospitals are managing their own needs (Management Sciences for Health, 2012) [18]. Changing from a push-based model to a pull-based model seems to be ideal, but is not always an easy task. It often requires complex changes in inventory management, warehouse operations, and distribution (Management Sciences for Health, 2012) [18]. Figure 1 the pull-based model. Figure 2: The overall processes in the push based distribution model, A typical push-based model, and the most known example in health commodity supply, is the ration kit system (Management Sciences for Health, 2012 [18]). The pharmaceutical kits contain selected medicines and medical supplies, also referred to as tracer products (Management Sciences for Health, 2012 [17]). The purpose of the kits, the quantity, and the range varies according to the situation (Management Sciences for Health, 2012 [17]). Issuing kits are usually done in emergency situations, for example in a disease outbreak, but also in some situations for regular supply. However, the kit system has led to poor inventory control systems, and additional medicine orders that are issued may not be based on real consumption data, but on educated guesses and estimates (Management Sciences for Health, 2012 [17]). Differing in distribution

between districts in Kenya has therefore lead to overstock at some facilities, that should in theory be redistributed to other facilities that experience stock-outs. Weak infrastructure and transportation challenges made the redistribution difficult (Management Sciences for Health, 2012 [17]). The kit systems still have some potential advantages; simplified budgeting (pre-determined kits with standard costs), procurement, storage and supply management, scheduled delivery intervals leading to more secure delivery to rural facilities etc. (Management Sciences for Health, 2012 [17]). As pharmaceutical supply conditions are improving, shifting from a push-based model to other, more flexible, distribution models may be possible. However, shifting to another more flexible distribution model requires that financial and managerial capacities exist to maintain sufficient flow of health commodities to fill the individual orders (Management Sciences for Health, 2012 [17]). A shift in distribution model also requires a reliable and complete information system. The information system should at a minimum monitor the number of patients treated, medicine consumption and morbidity patterns. This data that can help to determine whether there is sufficient management capacity to change to a pull-based model, or if a more advances push-based model should be considered (Management Sciences for Health 2012 [17]). A more advanced push-based model, the informed push model, are described in the next sub-section. According to (Management Sciences for Health, 2012 [18]) a push-based system is favorable when i) Lower level staff at health facilities etc. are not competent in inventory management ii) Where accurate information about needs does not exists, and cannot be obtained iii) When demand is exceeding supply, making rationing necessary iv) A limited number of products are being handled v) When disaster relief are necessary or when the situation calls for an immediate short term supply through pre-packed kits.



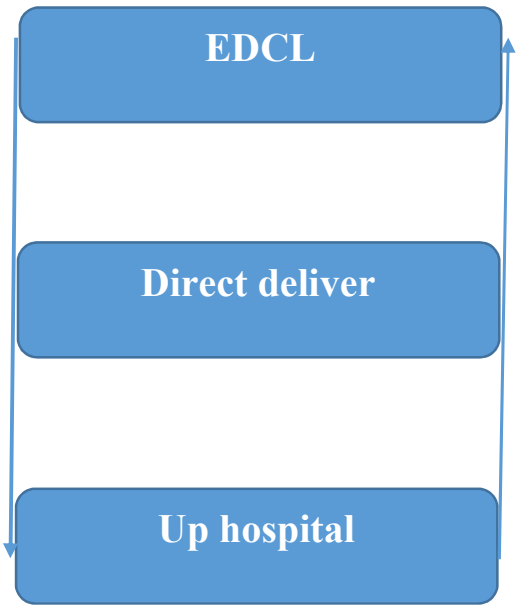


Figure 4. Pushed based deliver to community clinic

1.5 Research question

- What consideration for the logistics management information system should be made to promote the role of logistics management information system in health commodity supply chain management?
- What are the challenges with this existing situation and the opportunities for improvement in the logistics of health commodity supply chain management of Bangladesh (Community based clinic and Upzila Hospital level)?

CHAPTER 2

REVIEW OF LITERATURE

In this section, several research streams are reviewed in order to highlight the existing research gap. While there is growing interest in the benefits of effective logistics management system, organizations are often unsure of how to achieve it. Furthermore, some new research exists specifically in the area of integrated logistics management system.

2.1 Logistics Management

CSCMP, 2010 [19] conducted a survey to examining aspects of logistics management of organization, evaluating its existing performance and implement developed logistics management system for effectiveness. For fulfillment of the main purpose, it is important to have a clear idea definition of the meaning of logistics. The definition of logistics according to Council of Supply Chain Management Professionals (CSCMP) as the process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods including services, and related information from the point of origin to the point of consumption for conforming to customer requirements. This definition included inbound, outbound, internal and external movements.

Logistics is one of the most important component of supply chain management. The Council of Supply Chain Management Professionals defines logistics management as that part of Supply Chain Management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements.

The importance of integrating the logistics processes of all supply chain partners to better serve the needs of ultimate customers is described by Stank *et al.* (2001) [20].

Rodrigues et al. identified logistics as one of the largest costs involved in international trade by their research (Rodrigue et al. 2006 [21]). Logistics has evolved through several stages. The integrated logistics management concept of the 1980s added inbound logistics to physical distribution in response to transportation deregulation and increasing globalization (Kent & Flint 1997 [22]). The 1950s and 1960s witnessed the looks of the systems concept that integrated various outbound logistics functions into physical distribution. Physical distribution seeks the lowest total systems costs via functional cost tradeoffs (Brewer & Rosenzweig, 1961 [23] and Lekashman & Stolle, 1965 [24]). The influence of Porter's value chain model extended logistics management to envision efficiency and effectiveness of the total system of interrelated companies from original vendors to final consumers, a concept that became known in the 1990s as supply chain management.

Logistics management is defined as creating economic time and place value by procuring, moving and positioning inventory for a business (Bowersox *et al.* 2007 [25], Christopher, 2005) [26]. According to Stock & Lambert (2001) [27] there are thirteen key logistics activities that are involved in the flow of products, from point of origin to point of consumption. They observed that each one these activities affect the logistics process albeit not all companies consider every activity to be a neighborhood of their logistics. The logistics key activities included customer service, demand forecasting, inventory management, logistics communications, material handling, order processing, packaging,

parts and repair support, plant and warehouse site selection, procurement, reverse logistics, traffic and transportation, warehousing and storage.

Aronsson et al. (2000) [28] described that the customer service can be divided into several customer service elements. All together the described elements cover the whole concept of customer service. Aronsson (2000) [29] described a structure, originated from Persson & Virum (2001) [30] which consists of seven different customer service elements. These elements are customer order, time interval, delivery reliability, delivery dependability, stock availability, flexibility, information and customization. However, apart from Persson & Virum they do not include customization or information in their model. Instead the model only consists of 5 customer service elements; customer order time interval, delivery reliability, delivery dependability, stock availability and adaptability. Jonsson & Mattsson (2006) [31] described a similar structure with similar definitions of the elements.

2.2 Effective Logistics Management

The efficient application of logistics has long been viewed as a big enabler for firms seeking to realize competitive superiority (Stank and Lackey Jr, 2008) [32]. For example, Langley and Holcomb (1997) [33] assume that logistics is capable of creating customer value by enhancing efficiency, effectiveness and differentiation. Novack and Simco (1992) [34] argue that logistics contributes to the creation of 4 sorts of value: form, time, place and possession utilities. The scope of the logistics process - “between the point of origin and the point of consumption” -is thus conceptualized as covering a firm’s suppliers and its customers (Min & Mentzer, 2004) [35]. Specifically, the logistics activities involved from

suppliers towards customers is named “forward logistics” while logistics flows within the other way constitute the notion of “reverse logistics”.

Such a broad span of logistics is related to the very fact that logistics is liable for meeting requirements and desires not only of the firm’s customers (external customers) but also of other functional departments within the firm (internal customers) (Morash and Clinton, 1997) [36]. To improve a company’s logistics, like the other area, it's important to be ready to evaluate its performance. Many companies have realized that provide chains got to be assessed to become efficient and effective.

Without measures and metrics it's highly difficult to make a transparent direction for improvement in order that a corporation are able to do its goals. Effective performance measures and metrics are also necessary to test and evaluate different strategies (Gunasekaran, and Tirtiroglu, 2001) [37]. To be ready to understand the way to evaluate logistics performance subsequent step is to seem deeper into the goals of logistics. This research first discusses logistics’ goals and then focuses on two aspects of the goals. The first one is customer service and secondly the total costs, more carefully given that this aspect is not taken into consideration the model that seems most appropriate is that the logistics pipe by Aronsson and Brodin (2006) [38]. The reason for this is that it emphasizes the flow of material and throughput times in the specific parts of the logistics system. Therefore, the logistics pipe is chosen as a general representation of a logistics system during this thesis. Below the various functions laid out in the model, procurement, operations and distribution, are discussed briefly.

Aronsson and Brodin (2006) [38] divide the total costs into four main categories, carrying costs, holding costs, transportation costs and administration costs. To this they also add other logistics cost, for instance information costs, packaging costs and material costs. The procurement concerns order entry and delivery of fabric needed within the operations. An important part of the procurement is searching for, selecting and contracting of suppliers. In general the word operations ask a process of making goods and services by combining material, work and real capital. This definition gives that the term “operations” differs widely. In some organizations it can be the production of a product and in other organizations it might just be the storage of goods (Jonsson *et al.* 2006) [39]. The responsibility of the distribution division is to provide the purchasers with products from the finished goods inventory. Thereafter the customer can either consume the merchandise or add value thereto before selling it to a different customer. The goal of distribution is to form the finished products available to the customer at a coffee cost and with a high customer service level. In logistics the aim is to succeed in as low total costs as possible while at an equivalent time offering the specified level of customer service. This points out that focus shouldn't get on achieving the very best customer service possible but rather on offering the purchasers the service level they demand. Total cost is an important concept in logistics. It implies that focus shall get on all the prices over the entire company, not just on a selected department. To be able to understand what drives the total cost it can be divided into a number of cost items that sum up to the total cost for a company’s logistics. This can be through with help from different total cost models. These models are mainly wont to simulate how the entire cost are going to be suffering from a particular decision. Lambert & Stock categorize the total costs into five different cost elements, inventory carrying

costs, transportation costs, lot quantity costs, warehousing costs and order processing and information costs.

2.3 Six Important Factors for Effective Logistics Management and Network Optimization

The following are the six important factors for effective logistics management and Network Optimization:

1. Proper Planning

The first step to accomplishing a task is planning. Now, planning encapsulates various factors. It involves procuring the products, storage facilities, and delivery of products to the precise location. Apart from these, the opposite parameters are – time, transportation, and therefore the costs. A supply chain operative should be ready to devise the flow chart for the entire operation. The purpose of designing is to achieve maximum add the smallest amount possible time. At an equivalent time, the design should aim at maximizing the profits.

Proper planning may be a wise plan, but an experienced manager are going to be ready to steel oneself against the unforeseen circumstances as well. These situations can be related to

1. The products (Inbound & Outbound)

2. Unavailability of the transportation & cost analysis (LTL or TL)

3. Any internal issue in the organization

2. Adopting Automation

In the age of automation, technology plays a serious role in increasing the efficiency of an organization. Automation features a vital role within the business process optimization. There is valuable software which will be deployed within the logistics process. For example, business process software is often integrated that gives timely updates regarding the movement of goods. The operator and therefore the client will get details regarding:

1. The goods that are dispatched from the supplier
2. Procurement of the goods at the warehouse and
3. Lastly Delivery of the goods at the destination

This saves a substantial amount of working time because manual interference is eliminated. Moreover, accurate tracking help in improving overall process management. Similarly, the account details and employee details are often managed using specific software developed for these tasks. Therefore, the logistics firm should embrace the technology for increasing productivity.

3. Value Relations

The team is an important aspect of a corporation that's liable for the expansion. Whether

it's the delivery guy or the warehouse manager, everyone should be perfect in their respective field of labor. For this, a well plan that would like to take a position in proper training of the workers. Regular training workshops keep the workers updated with the newest trends within the logistics industry. This helps in increased efficiency and satisfaction of the clients. Logistics manager with impeccable interpersonal skills is crucial for the organization. There are times when the items don't work consistent with the plan. In this situation, rather than panicking, it needs a reliable one that can be mapped out the problems with utmost efficiency. Moreover, the manager should have authoritative contacts within the industry. This can be beneficial in tapping the business opportunities.

4. Warehouse Management

Effective logistics management is incomplete without proper warehouse management. Warehouse operations are considerably hooked in to the sort of products. For example materials which might be rusty easily, should be stored in moisture free environment. Similarly, the specifications vary according to the products. The logistics department should aim at developing the warehouse inventory so that there is minimum wastage of goods. Moreover, maximization of the storage capacity of the warehouse is another key factor. Usage of vertical storage columns is recommended. Effective implementation of the software for sequencing the merchandise s is important because there should be no delay while locating the product when the order is placed. The warehouse staff should be well-trained for the warehouse operations.

5. Efficient Transportation

Transportation department are often analyzed to decrease the expenses of the logistics department and at the same time, it's often revamped for faster delivery of the products. Following factors should be considered for efficient transportation. 1. Determination of the best delivery route. It should opt for the shortest yet safest route. This is beneficial for saving money also as time.

6. Measure and Improvise

Logistics network optimization is incomplete without integrating measurement, analysis, and feedbacks. When new strategies are deployed within the system, the output must be measured. This is important because it intimates the success or failure of the strategy. Measurement tools and software should be integrated that easily determines and classifies the knowledge as per the need. Future planning is heavily hooked in to the measured information. Analyze the metrics related to different operations. Generous feedbacks help in improvising. The ideas and suggestions of the workers should be recorded periodically. This ensures generation of a pool of ideas and at the same time, it reveals any flaws in the system. If a company wish to trump over its competitors, it should adapt the latest technology and innovative approach. The aim of effective logistics management is to enhance the efficiency.

Trkman *et al.* (2010) [40] within their research article SC investigate the connection between analytical capabilities in the plan, source, make and deliver area of the availability chain. They have applied structural equation modeling and collected samples of 310 companies from different industries from the USA, Europe, Canada, Brazil and China. They strongly recommended reinforcing of the importance of a

company's use of its databases, explicative and predictive models and fact-based management to drive its decisions and actions. The analytical capabilities can better guide the exclusively human decisions and supply automated decisions in some tasks in organizations. The marketing and logistics collaboration doesn't have an immediate impact on firm performance but increases firm performance through the mediation of firm-wide cross-functional integration.

Schwarz and Zhao (2010) [41] have pointed out in their article entitled impact of information sharing on US pharmaceutical manufacturing leads to a distributed SC. The change essentially forced pharmaceutical distributors to maintain lower inventories. SC theory and practice in other industries suggest that by improving decision making and implementation, companies can operate with substantially lower inventories. This happened in pharmaceutical distribution when a securities and exchange commission investigation led manufacturers to force distributors to figure with less inventory.

Stoerkel and Heck (2011) [42] trends and practical examples of SCM have pointed out that the companies have started to integrate certain functions into the organizations internally. Secondly, they proceeded to integrate the different levels of the particular SC. The main goal was to increase visibility throughout the SC. In the case of Nokia the change from logistics to SC was very beneficial and represented one of the key success factors in the battlefield of telecommunications. The lack of communication and common goals between the business partners in a particular SC is one of the biggest barriers against the efficient operational performance. Verma and Seth (2011) [43] framework for Supply Chain Competitiveness (SCC) a few benefits it helps in understanding the activities, roles and responsibilities of suppliers,

manufacturers and distributors for achieving SCC. It provides directions for future studies for the SC competitiveness. Conceptual framework can be used as a guiding tool to understand SCC and further improvements. It can be used for managing SC according to the needs of organizations.

Miguel (2011) [44] in his article entitled, identified the impact of the SCM as a multidimensional construct information sharing, long-term relationship, co-operation and process integration on different competitive priorities like cost, flexibility, quality and time.

Methvin and Campbell (2011) [45] in their conference proceedings care providers and details with the present and future considerations related to key processes, technology and metrics as more providers recognize the strategic imperative associated with progressive SCM. They envision significant growth of information, technology, credentials and overall development of the field in line with other industries. They pointed out that gained SC efficiencies represent sizeable savings for the US healthcare system going forward.

Behzad *et al.* (2011) [46] observed modelling healthcare internal service SC for the analysis of medication delivery errors and amplification effects suggested the reduction of medication delivery errors of the hospital and that by hiring employees with more average experiences can reduce medication delivery errors. Decreasing the fractional rate of attrition, which suggests having experienced employees for a

extended time within the pharmacy, can reduce medication delivery errors. There is a trade-off between the productivity of the workers and drugs delivery errors. Increasing the productivity could increase the errors. The task of assembling the medications needs accuracy. Therefore, the manager should try to not allow the productivity to extend quite a particular level.

According to Arawati (2011) [47] in the SCM, supply chain flexibility the associations and effects of the four SCM modeling. The results of the study assist in the understanding of how SCM determinants influence supply chain flexibility and business performance. The result indicates that manufacturing companies should emphasize greater attention to the technology and innovation and lean production aspects of the SCM processes and a greater degree of management support for SCM implementations. By strengthening SCM, improved performance will be likely to occur. The findings of this study suggest that SCM would be able to support and accommodate the supply chain flexibility as well as increases the level of business performance. SCM increase the SC flexibility by improving product flexibility, volume flexibility and launch flexibility. This subsequently would lead to better business performance.

Rajamohan and Rigin (2011) [48] in their research paper entitled practices supported the industry to deliver the products everywhere India to satisfy the requirements of consumers at the proper time also to extend the margin through effective implementation of SCM.

Naude and Weiss (2011) [49] SCM ACMs and the problems they experience with the supply side, internal operations and distribution side of their SCs. The study found that the foremost significant problems facing ACMs are internal process problems. The most

significant problems are those concerning demand management and extend across the entire supply chain, from the customer side where customer demand drives the availability chain, internally in ACMs, to the availability side of the availability chain. It is quite clear that automotive SCs experience the bullwhip effect. According to SCM summit (2012) [50] focuses that SC brain is for the high level executive concerned with managing risk, aligning the supply chain with corporate planning, achieving competitive advantage, balancing customer demands with the necessity to regulate cost, and improving rock bottom line. The experienced staff and lots of well respected content partners offer executive decision makers a synthesis of the many minds, singularly focused and delivered within the medium. Rajamohan and Rigin (2010) [51] pointed out in their research article competitive that due to the advantage industries sometimes offer promotional discounts to attract new customers, increase sales volume or reduce inventories, such promotions require planning to ensure that the industry select the level of discounts that best encourages volumes and resulting profit levels that most approximately meet the firms specific competitive objective.

Rigin (2010) [52] viewed that innovative practices in HLL are increasing their turnover and level of production. Forecasting is an important technique in HLL to predict the future production and sales activities. The primary production planning and control department is effectively forecasting future production planning activities in HLL Life care.

Verma and Seth (2011) [53] in their article entitled “A conceptual framework for supply chain competitiveness” indicated that the framework would be highly beneficial to the

organizations in leveraging the efficiency of SCM and to achieve SC competitiveness. The roles and responsibilities of suppliers, manufacturers and distributors are used for achieving SC competitiveness. It provides directions for future studies for the SC competitiveness. It was often used as a guiding tool to know SCC and further improvements. It can be used for managing SC according to the needs of organizations. Looking at the outcomes from SCC, it is one of the most important aspects of business success.

Miguel and Brito (2011) [54] explored the impact of the SCM as a multidimensional construct such as information sharing, long-term relationship, cooperation and process integration on different competitive priorities like cost, flexibility, quality and time. The empirical results provided evidence of a positive impact of SCM on operational performance, supporting previous empirical research and contributing to generalize. Methvin and Campbell (2011) [55] in their conference preceding entitled "Healthcare provider SCM" highlight the significance of SCM for healthcare providers and detail present and future considerations related to key processes, technology and metrics. As per their note more providers recognize the strategic imperative related to progressive SCM, their envision significant growth of data , technology, credentials and overall development of the sector in line with other industries. They concluded that gained SC efficiencies represent sizeable savings for the US healthcare system going forward.

Basu *et al.* (2011) [56] in their research work point out that the risk factors in SC in context to Indian manufacturing organizations, all risks cannot be avoided. Risk mitigation planning provides a corporation with a more mature deciding process in facing unexpected losses being caused by unexpected events. Existence of the

availability chain are often seen in both service industries also as in manufacturing industries and therefore the complexity variation occurs from industries to industries and from firm to firm. Beside other issues organizations must consider the general costs including cost of space, expenses associated with doing businesses outside the country. With this the socioeconomic, political and cultural dimensions can be considered as important issues in order to manage the SC risks. Rajamohan and Rigin (2012) [57] identified basic 13 elements which are important to implement effective SCM in HLL Life care. They have pointed out that SCM approaches used to efficiently integrate suppliers, manufactures, warehouse and customers.

Dheeraj and Vishal (2012) [58] have suggested a few ideas in their research work and said that, cost and complexity are perceived as the biggest barriers to implementing green SCM, which highlights the necessity for cost effective and straightforward to implement solutions. Brand building is one among the highest incentives for green SCM, highlighting the importance of public perception of how companies operate. Recycling of raw materials and component parts are the very best green manufacturing and production focused initiatives adoption of green practices is highest in those areas of the supply chain where there's an immediate reference to cost savings and efficiency. Most of the Indian manufacturing small and medium enterprises like cutting and hand tools and auto parts and spare parts and industrial equipments and machinery manufacturer and various other products manufacturers are seem to be quite advanced within the implementation of green warehousing and distribution initiatives, presumably because these initiatives often also mean added efficiency.

Wolf *et al.* (2012) [59] have organized the program in supply chain risk management they have suggested that SC risk has grown from multiple factors such as, dependencies on foreign technology, infrastructure vulnerabilities, inadequate procurement practices, and deficient standards. It is necessary to converge efforts on managing risk as against eliminating risk. SC risk cannot be delegated to a single sector to resolve. It has to be recognized as a global issue requiring a multi-cultural, multi-disciplinary approach to include standards, engineering, technology, legal and procurement specialists all with the similar intent. Awareness of supply chain risks throughout a systems life-cycle is an all important objective for mitigating compromised components. People at all levels within an organizations hierarchy should recognize SC risk.

Shieh (2010) [60] in his research article proposed that SCM and the organizational innovation are able to help maximize Organizational value and competence in the market. The corporations practicing SCM must set up an organizational structure with innovation to face the internal and external challenges for advancing competence. The acquirement of competence of an innovative organization relies largely on the development of creativeness of all staff. Therefore, such an organization should emphasize that each member or team must be able to set into action independently the operational strategies, take responsibility for management, and link together to form the intact value chain. Rapid changes of the environment under competition require a corporation to show its ability of quick response.

Sheih (2010) [61] have conducted survey of 98 different companies. This survey is able

to provide a fairly accurate overview of the status of SCM in perspective of level of information sharing with customers, degree of investment in SC automation tools, mode of SC communication used, and benefits of using bar coding technology. The study depicts that SC strategy of most companies is focused on improving information sharing with immediate customers related to market development and delivering products on time. However, competitive advantage can be obtained through use of automation tools of SC like electronic data exchange and using internet based communication technique and for enhancing the data security, bar coding technology is additionally employed by the Indian manufacturing firms. The overall results are encouraging with 26 percent response rate, in Indian scenario and underline the need for more such studies of Indian firms.

Katariya and Chavan (2012) [62] in their research work commanded that the customer satisfaction is the final result of effective and efficient SCM of any organization. With reference to this study the SCM is related to quality, quantity, price and service. This is required for customer satisfaction and a sound economy. Hence, SCM is the universal tool for attaining a sounder position in the global market during the current crisis period. Effective and efficient SCM represents an opportunity to add value and decrease costs in the U.S. health care system. To accomplish this end, it is necessary for top-level executives and SC managers to reform and transform their approach to the SC. Each hospital or system must determine what value can be achieved through the SC and the structure itself to meet its goals.

Wang and Darshan (2012) [63] indicated that the following beneifits namely improved the customer satisfaction, building long term relationship with customers, fully

information sharing and integration, increased productivity, capacity and quality, improved strategic and tactical focus.

Khan et al. (2009) [64] used to identify the critical distribution practices of agile SC provide a comprehensive framework, that can be used to improve the responsiveness of SC. This paper indicates to developing and validating the SCM deliver and agility constructs of SCM practices and by exhibiting its value in improving organizational performance. This paper directed to evaluate the effectiveness of their distribution practices across the SC and take corrective actions wherever needed.

Eltantawy *et al.* (2009) [65] conducted a research to determine the impact of SMER and strategic supply management skills on SM perceived reputation and performance. This study highlights the fact that strategic supply managemnt skills had a significant positive direct and indirect, through SM perceived reputation, impact on SMP. Nevertheless, the direct path from strategic skills to moral responsibility was not supported. Without the supportive business environment, top management support and its ethically conscientious philosophy, skills are unlikely to translate into SMER.

Singh and Damien (2009) [66] investigated a model of collaboration based on the notion of firms having strong working relationships with their suppliers and customers. They have prepared a simple but effective model for how firms could realistically and meaningfully pursue collaborative relationships with multiple trading partners beyond a one to one dyadic focus. This model does not require large investments of resources, development of special infrastructure, creation of new entities, dramatic re-alignment of how business is done so on. This study indicates that collaborative arrangements with

trading partners are important drivers of improved firm performance. The effect of customer relationship with performance is greater than supplier involvement. The supply side activities also account for a big proportion of the variance in performance metrics.

Sun et al. (2009) [67] pointed out their thoughts through their research that supply chain management strategy is widely believed to be able to improve supply chain management performance. According to one of the famous frame workers of supply chain management Lee proposed an environmental uncertainty framework to devise the right supply chain strategy. To examine how the alignment between supply chain strategy and environmental uncertainty impacts perceived supply chain management performance. The study suggested an alignment between environmental uncertainties and supply chain strategies would positively impact on supply chain management performance. This implies that aligning supply chain strategies with environmental uncertainties within a supply chain is more important than based simply on examining the connection between supply chain strategy and supply chain management performance. The authors suggested to form a supply chain strategy without considering the alignment between supply chain strategies and environmental uncertainties. The findings of the study indicated that the imitating competitor supply chain strategy can be less advantageous to a firm than expected without considering the similarities in firm environmental uncertainty.

Shub and Stonebraker (2009) [68] showed that the soft human and organization variables have a more enduring effect. Thus, in the long run, there must be reasonable fit across most or all of the hard and soft variables that sustain the performance of

integrated supply chain. This has been generally demonstrated in the case of JIT, an early phase of supply chain integration. They strongly indicates that it posits a relationship between the welldefined structure, culture, and empowerment variables and SC integration and performance. In the aggregate, these variables constitute a major component of the senior management and leadership strategy of an organization. According to their suggestions, supply chain integration has become the basis for competitive edge in many industries during the later years of the twentieth century and the emerging twenty-first century. Ultimately, the best-managed supply chain is determining how to manage and apply a myriad of nebulously defined soft contributors to that success.

Nagy (2011) [69] conducted a survey and point out that supply chain management tools are to improve the efficiency of information sharing between supply chain participants and to smooth material flow carried out by the parties in collaboration. Cost management and performance assessment tools aim to explore the costs and profit realized by the co-operating companies as well as the entire supply chain. All the tools adapted either at a company or on supply chain level, strive to enhance the overall performance of the supply chain. The performance of a supply chain can be assessed by the value created for the end consumer and by the profit the partners realize. However, companies and supply chain adopt tools to manage the different flows, the way they face and handle risks coming either from the system or from the surrounding environment has a key influence on the performance achieved.

Balasubramaniam and Somu (2011) [70] highlighted in their survey that supply chain is a very complex network connecting various suppliers, customers, manufacturers and

enterprises. Typically, it generates issues which require conflict resolution and consensual decision-making. DSS is one such IT tool that addresses these problems and provides solutions for semistructured business problems. DSS has been integrated into many activities and business processes of the availability chain like logistics management, inventory management, sales and distribution planning, materials and production planning. Various DSS implementations and deployments in supply chain management tasks like transportation planning, manpower planning, customer engagement, production support etc. are studied. However, considering the potential benefits, existing implementations are not wide spread because of several problems like complexity, resistance to change by user, customization needs, diverse platforms and so on. Recently, distributed software agents and web services integrated with DSS approaches are proposed to overcome this problem. More deployments of IT-enabled supply chains using DSS by enterprises are needed.

Rajamohan and Rigin (2011) [71] stated that the information technology is playing a vital role to the effective practice of supply chain management. The information technology factors should be identified by the company to build the effective logistics and supply chain management activities. The reduction of data in the effective manner helps to increase the effectiveness of the supply chain management activities.

Rejman *et al.* (2012) [72] pointed out many advantages that the implementation of MIS developed for purchasing processes They have listed the achievements in the following areas like economical, functional and rational management of the records about the

quantity, quality and level of stocks of input materials or parts, input prices and supply conditions in the market. Monitoring of fabric and financial flows in real time. Reduction of the info acquisition time interval and buying processes. Increasing the number of output information due to the rapid and multiplicative intersection of the collected data about the materials or parts in the process of development, technological characteristics, requests, data about the required materials or parts for purchasing, current stock of finished products and input materials, materials or parts in transport and so on. MIS increasing the number of processed data, increasing the quality of information, eliminating human errors in data processing, online communication with suppliers and customers. Integration into existing company website, online registration of knowledge on customer satisfaction, also as information on complaints.

Nikakhtar and Jianzheng (2012) [73] suggested that the effective supply chain is benefiting from electronic tools for further co-ordination and integration of the supply chain. Furthermore, in order to find an effective supply chain management, it is necessary to recognize major performance of effective IT. One of the basic tools for this goal is the role and inevitable position of e-commerce in the supply chain. By applying e-commerce tools subject of electronic supply chain, it is possible to have a complete image of ecommerce and IT in supply chain management. What is so much important in electronic supply chain is the integration of supply chain systems as mentioned in this paper. The organizations which have an interest in priority in market and today active business environment should enjoy their priority than competitors by the utilization of upgraded knowledge and their facilities in e-commerce and especially performing of modern supply chain systems and updating of companies and organizations and their powerful man power.

Wagner *et al.* (2012) [74] studied and link between supply chain investigated and quantified the impact of supply chain fit on the financial performance of the firm. To achieve a supply chain fit, firms must consider three basic steps first, they need to understand the demand and supply uncertainty of their products and associated customer needs. Second, they have to know the characteristics and capabilities of their supply chain, that is, the position along the efficiency responsiveness continuum. Third, they need to ensure that the degree of supply chain responsiveness in supply chain design characteristics and capabilities is consistent with the production high responsiveness for a supply chain facing high implied uncertainty, and efficiency for a supply chain facing low implied uncertainty.

CHAPTER 3

METHODOLOGY

In any scientific research methodology plays an important role. Research methodology is a systematic way to solve any research problem. Appropriate methodology enables the researcher to collect valid and reliable information and to analyze the information properly in order to achieve a correct conclusion. The methods and procedures followed in this study have been described in this chapter.

3.1 Locale of the Study

The study was conducted in Trishal upazila of Mymensigh district which consists of thirteen unions. Out of these sixteen unions, one community clinic and one upazila hospital were selected for the study locale. A map showing Trishal upazila and Mymensingh district has been presented in figures 1, 2.

3.2 Study Area

3.2.1 Rationale for selecting the research areas

Mymensingh district is selected purposively as the district is near to capital of Bangladesh. There are thirteen upazilas in Mymensingh district, among which Trishal upazila was selected purposively because of near to Dhaka and good communication.

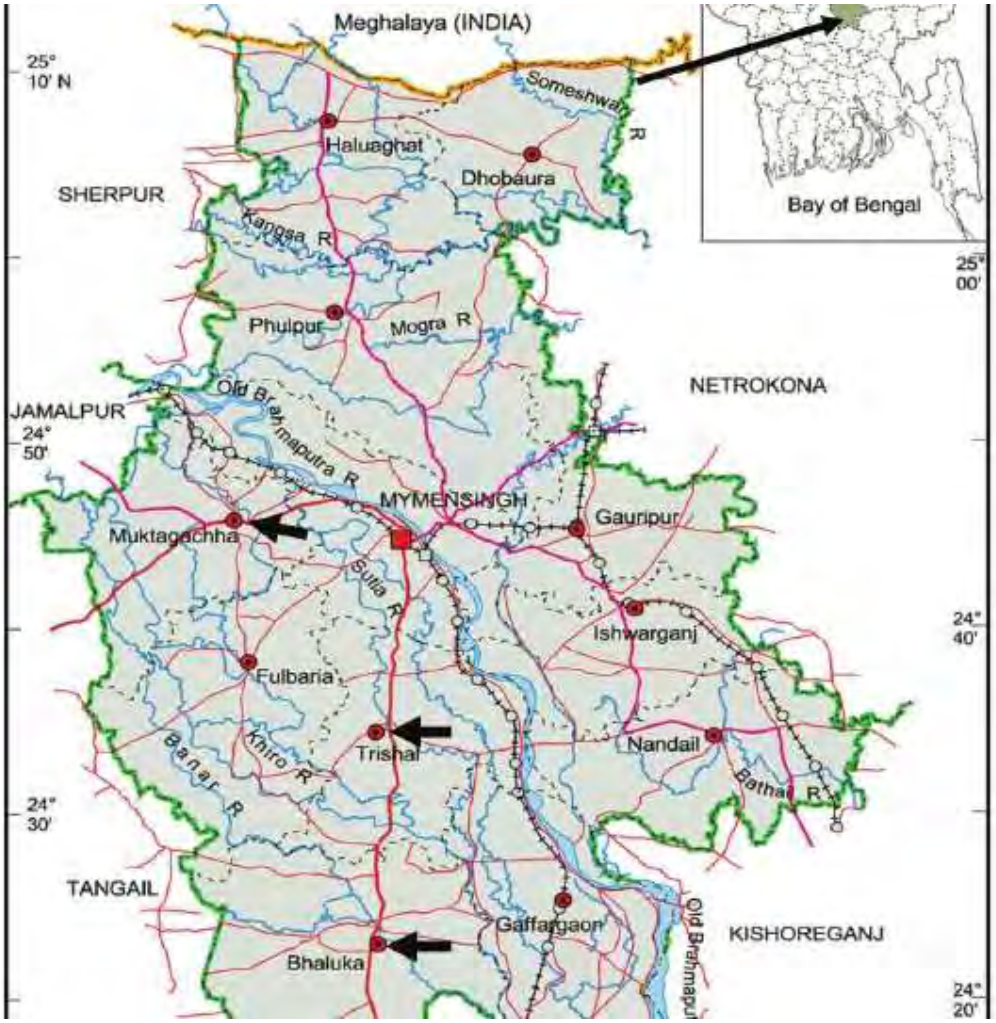


Figure 5. A Map of Mymensingh District Showing locale of the study

Figure 6. A Map of Trishal Upazila showing locale of the study

3.2.2 Basic features of the Bangladesh and study area

Bangladesh has a population of about 163 million, and is the eighth most populous country in the world. The annual population growth rate of Bangladesh is 1.37%. The male and female ratio of our country is 104.9 and 100.0. Most of the people are living in the rural area and this is about 74%. The crude birth rate of Bangladesh is 19.2 per 1000 population and the crude death rate is 5.5 per 1,000 population. The net reproduction rate (NRR) of our country per fertile woman (15-49 year) is 1.03. The average life-expectancy at birth is 69.0 years and the life-expectancy 67.9 for male and 70.3 for female. An effectively performing health system is essential for improving the population's health status, providing safe guard against health-related financial threat and enhancing the health sector's responsiveness to customer's needs. Health sector reform is not only a health related issue but also a development issue as health care systems account for 9% of global production and a significant portion of global empowerment.

The total area of Trishal Upazila is 338.98 square kilometer. The upazila is located in between 24°28' and 24°41' north latitudes and in between 90°18' and 90°32' east longitudes. Total number of population is 372498 which male 190428 and female 182070. Average literacy rate was 40.2% which is male 42.1% and rest part is female. Sanitation 22.97% (rural 20.18% and urban 46.05%) of dwelling households of the upazila use sanitary latrines and 44.79% (rural 46.36% and urban 31.74%) of dwelling households use non-sanitary latrines; 32.24% of households do not have latrine facilities. Number of health centre viz. hospital is 2, upazila health complex is 1, family welfare centre is 2, satellite clinic is 4, union community clinic is 12 and veterinary hospital is 1.

3.2.3 Sample and Sampling Design of the Study

Mymensingh district was purposively selected for the study and among the thirteen upazilas of Mymensingh district, Trishal upazila was selected purposively on the basis of prior to the research objectives. There were three categories respondent used in this study. 1st category CHCP and the number of CHCP 10, 2nd category was Doctor and the number were 5 and 3rd one is Store keeper and the number was 4. So, the total number of respondents was 19.

3.4 Research Instrument

For conducting a study every research method has their own instruments of data collection. Data need to be consciously identified, carefully selected, methodologically collected and accuracy and precision are obviously important quality in research measurement. In this study face to face interview method was used. This survey method can be useful for descriptive, explanatory and exploratory purposes. This method is probably the best method in social research as it easy to collect empirical data with limited time and money. In order to collect relevant data, a pre tested structured interview schedule was carefully prepared keeping the objectives of the study in mind. The questions and statements contained in the schedule were simple, direct and easily understandable by the respondents. The schedule contained both closed form and open form questions.

The draft interview schedule was prepared in English and was pre-tested with two respondent. This pre-test facilitated the researcher to examine the suitability of different

questions and statements in general. On the basis of pretest result corrections, modifications and adjustments were done in the interview schedule. English version of the interview schedule may be seen at Appendix-A.

3.5 Methods and Procedure of Data Collection

3.5.1 Survey

The survey was conducted in September and October 2020. Data were collected by the researcher himself from 21 respondent through interview schedule. The researcher first established rapport with the respondents and clearly explained the objectives. As a result, the respondents furnished proper response to the questions without any hesitation. The questions were clarified whenever any respondent had difficulties in understanding. Excellent cooperation was received from the respondents and other people of the study area.

3.6 Processing of the Data

In order to develop conceptual basis of study, the researcher collected information from different relevant sources, such as books, journals, theses, abstracts, reports and websites. The researcher also collected documents from various organizations like Upazila Officer for this purpose.

3.7 Validity, Reliability and Ethical measures

3.7.1 Reliability and validity

Reliability deals with indicators dependability. Reliability means that the information provided by indicators does not vary as a result of characteristics of the indicator, instrument or measurement device itself (Neuman and Lawrence, 1997) [75]. Validity using terminology from statistics discipline refers to the truthfulness of the findings. To put it in other words validity is the conditions of having really measured what one wanted to measure reliability and validity are central issues in all scientific measurement. Both concern how concrete measures or indicators are developed for constructs. Reliability and validity are salient in social research because constructs in social theory are often ambiguous, diffuse and indirectly observable. Perfect reliability and validity are virtually impossible to achieve (Neuman and Lawrence, 1997) [75]. Researchers want to maximize the reliability and validity of indicators. Reliability tells us about an indicators dependability and consistency. Validity tells us whether an indicator actually captures the meaning of the construct during which we have an interest. In this research, researchers try to maintain the indicators dependability and consistency and capture the meanings in which researcher are interested. In this way apart from gathering data to other process reliability and validity are tried to maintain strictly.

3.7.2 Ethical consideration

Ethics begins and ends with researcher. A researcher personal moral code is the strongest defense against unethical behaviors (Neuman and Lawrence, 1997) [75]. Before, during and after conducting a study, a researcher has opportunities to and will

reflect on research actions and consult his or her conscience. Ethical research depends on the integrity of the individual researcher and his or her values. “If values are to taken seriously, they can’t be expressed and laid aside but must instead be guides to actions for the sociologist. They determine who are going to be investigated for what purpose and in whose service” (Sagarin, 1973) [76]. In the present study the ethical standard was strictly followed in every stage of research.

3.8 Data collection

Data were collected by means of interviewing the selected sampled respondent. The researcher himself collected data for this study. But to familiarize researcher with the selected respondent and establishing report during conducting the interview, the researcher had to seek help from local officials of the study area.

3.9 Data processing and analysis

To facilitate tabulation, the collected data were properly transferred from interview schedule to a master sheet. Qualitative data were converted into quantitative forms by means of suitable scoring whenever necessary. Tabulation and cross tabulation was done by the researcher and data analysis was done with the help of MS Excel.

CHAPTER 4

RESULT AND DISCUSSION

4.1.1 Finding of CHCP

The researcher interview five CHCP about push and pull based model. Out of ten respondent 8 (80%) was male and 2 (20%) female. The Age of the respondent 26 to 30 years of old.

Table 1. Push Based Model of CHCP

Question	Possible Answer	Respondent (%)	Rank Order
i. Do you agree with pushed based mode?	i) No	100%	
	ii) Yes	0%	
ii. What are the impact of push based model on storage	i) Unnecessary goods keep in stock	100%	1
	ii) Possibility to damage	90%	2
	iii) Possibility to expired	90%	3
iii. What are the impact of push based model on cool chain (immunization progrmme)	i) Challenge to keep and maintain of cool chain	100%	1
	ii) Break cool chain	100%	2
	iii) Quality damage	90%	3
iv. Causes of health commodities wastage / expired /storage space /damage	i) Increased wastage	100%	1
	ii) Not cover storage capacity	90%	2
	iii) Unplanned storage	90%	3
v. Causes of stock out / dead stock	i) Expired	100%	1
	ii) Not follow demand	90%	2
	iii) Increased dead stock	80%	3
vi. Do you think any LMIS gap?	i) Yes	0%	
	ii) No	100%	

vii. What are the challenge?	i) More storage	100%	1
	ii) Expired	100%	2
	iii) Requirement not fulfill	80%	3
viii. Opportunity to improved	i) Supply as per requirement	100%	1
	ii) Implement pull based order	90%	2
	iii) Follow up and training	90%	3

The push based model have eight question out of eight 2 questions were closed from and 6 questions were open from. Cent percent of the respondent replied the disagreement of push based model. The possible reason of this agreement was the more disadvantage of this model. “What are the impact of push based model on storage?” asked this question and replied possible 3 answers. The 1st possible disadvantage they replied the “Unnecessary goods keep in stock” 2nd “Possibility to damage” and 3rd one was “Possibility to expired”. Possible reason that in this model some medicine or goods that was send from the central store to the community level. So, some unnecessary goods were kept in stock that was obviously either damaged or possibility to expired the date. Ultimately the impact of push based model was not good.

“What are the impact of push based model on cool chain (immunization progrmme)?” asked this question and replied possible 3 answers. The 1st possible disadvantage they replied the “Challenge to keep and maintain of cool chain” 2nd “Break cool chain” and 3rd one was “Quality damaged”. In this model some vaccine that was send from the central store to the community level without concern the community level. There was a challenge to keep in

store and maintain of cool chain because the categories of vaccine and number of vaccines is not appropriated as the requirement of community level. Sometimes break the cool chain of vaccine ultimately the quality of vaccine was deteriorated. Ultimately the impact of push based model was not good.

“Causes of health commodities (wastage/ expired /storage space/damage)?” asked this question and replied possible 3 answers. The 1st possible answer they replied the “Increased wastage” 2nd “Not cover storage capacity” and 3rd one was “Unplanned storage”. In this model some goods that was send from the central store to the community level without concern the community level. The extra goods needs more storage and there was always problem in storage capacity. So, unplanned storage of goods was common practices in community level. Ultimately the impact of push based model for this reason increased the wastage of products .

“Causes of stock out / dead stock” asked this question and replied possible 3 answers. The 1st possible answer they replied the “Expired” 2nd “Not follow demand” and 3rd one was “Increased dead stock”. In push model some goods that was send from the central store to the community level without concern the community level. The extra goods needs more storage and there was always problem in storage capacity. For this reason the goods or medicine expired as previously not follow the demand of community level. Ultimately the impact of push based model for this reason increased the dead stock.

Cent percent of the respondent replied yes with the question “Do you think any LMIS gap?”. The possible reason of this agreement was the more advantage of this model. “What are the challenge?” asked this question and replied possible 3 answers. The 1st possible answer they replied the “More storage” 2nd “Expired” and 3rd one was “Requirement not fulfill”. Some medicine or goods that was send from the central store to the community level without

concerning the community level. So, they respondent replied 1st challenges about the storage capacity of community level. We know about the situation that in community level the total area of the office is not sufficient. So, the respondent truly said about the storage capacity. After that they replied about the expired period as the goods or medicine is send or allotted without concern the community. So, this good or medicine is not need the community level and ultimately expired. Lastly, their was a crises in demand and supply and ultimately the demand of local community was not fulfilled.

"Opportunity to improved" asked this question and replied the respondent possible 3 suggestion. The 1st possible disadvantage they replied the "Supply as per requirement" 2nd "Implement pull based order" and 3rd one was "Follow up and training". In this model some vaccine that was send from the central store to the community level without concern the community level. Some medicine or goods that was send from the central store to the community level without concerning the community level. So, they respondent 1st suggestion about the supply as per requirement of community level. By implementation of this suggestion might be fulfilled the demand of local community. The truly suggested about the pulled based order implementation. It will be the best solution for paused based problem. Lastly, the respondent suggested about the follow up that is monitoring and proper training. The training and monitoring is ongoing process and very much important.

Pull Based Model

The findings of pull based model given bellow in Table 2.

Table 2. Pull Based Model CHCP

Question	Possible Answer	Respondent (%)	Rank order
i. Do you agree with pulled based mode?	i) No	0%	
	ii) Yes	100%	
ii. What are the impact of pull based model on storage?	i) Less wastage	100%	1
	ii) Proper utilized	100%	2
	iii) Requirement fulfill	90%	3
iii. What are the impact of pull based model on cool chain (immunization progrmme)?	i) Ensure quality during Transport	100%	1
	ii) Ensure quality during storage	100%	2
	iii) Proper utilized	90%	3
iv. Causes of health commodities wastage / expired /storage space /damage	i) Good storage	100%	1
	ii) Possibility to lees wastage	100%	2
	iii) Reduced expired	90%	3
v. Causes of stock out / dead stock	i) Possibility to less stock out	100%	1
	ii) Reduced dead stock	90%	2
	iii) Reduced buffer stock	90%	3
vi. Do you think any LMIS gap?	i) No	0%	
	ii) Yes	100%	
vii. What are the challenge?	i) Communication	100%	1
	ii) Training up	90%	2
	iii) Stock out of pick hour	90%	3
viii. Opportunity to improved	i) Proper steps	100%	1
	ii) Training up	90%	2

	iii) Implementation up to community level	90%	3

The push based model have eight question out of eight 2 questions were closed from and 6 questions were open from. Cent percent of the respondent replied the agreement of pull based model. The possible reason of this agreement was the more advantage of this model. "What are the impact of pull based model on storage?" asked this question and replied possible 3 answers. The 1st possible advantage they replied the "Less wastage" 2nd "Proper utilized" and 3rd one was "Requirement fulfill". In this pull based model some medicine or goods that was supplied from the central store to the community level on the basis of requirement of community level. So, goods were kept in well stock that was obviously utilized in proper way and ultimately the requirement of the community was fulfilled. Tthe impact of pull based model was good.

"What are the impact of pull based model on cool chain (immunization progrmme)?" asked this question and replied possible 3 answers. The 1st possible advantage of this pull based model they replied the "Ensure quality during Transport" 2nd and "Ensure quality during storage" and 3rd one was "Proper utilized". In this model, there was less or no possibility to beak the cool chain during transport and storage. So, the quality of vaccine was ensured during transport and storage. In this model vaccine that was send from the central store to the community level as per the requirement the community level and ultimate the utilization was maximum.

"Causes of health commodities (wastage/ expired /storage space/damage)?" asked this question and replied possible 3 answers. The 1st possible answer they replied the "Good storage" 2nd "Possibility to lees wastage" and 3rd one was "Reduced expired". In this model

all goods that was allotted from the central store to the community level for their own demand. So, planned storage of goods was practices in community level. For this reason, possibility less was wastage of medicine and goods. Ultimately, the impact of pull based model reduced expired products.

"Causes of stock out / dead stock" asked this question and replied possible 3 answers. The 1st possible answer they replied the "Possibility to less stock out" 2nd "Reduced dead stock" and 3rd one was "Reduced buffer stock". In pull model goods and medicine that was send from the central store to the community level for their own demand. For this reason, the goods or medicine possibility to less stock out. Ultimately the impact of pull based model reduced the dead stock and ultimately reduced the buffer stock.

Cent percent of the respondent replied yes with the question "Do you think any LMIS gap?". The possible reason of this agreement was the more advantage of this model. "What are the challenge?" asked this question and replied possible 3 answers. The 1st possible answer they replied the "Communication" 2nd "Training up" and 3rd one was "Stock out of pick hour". Medicine or goods that was sent from the central store to the community level for their own requirement. Though in pull model has many advantages but it has some challenge. First challenge was communication. Sometimes miss communication conducted lack of training as a result medicine and goods not get proper time. Lastly, sometimes this crises resulted medicine and goods stock out pick time.

"Opportunity to improved" asked this question and replied the respondent possible 3 suggestion. The 1st possible disadvantage they replied the "Proper steps" 2nd "Training up" and 3rd one was "Implementation up to community level". In pull model, some medicine or goods supply from the central store to the community level as their requirement. This model has many advantages but have some area that needs to improvement. So, they respondent

suggestion about the proper training need to follow the proper steps. Lastly, the respondent suggested about implementation of this model in community level.

4.1.2 Finding of Doctors

The researcher interview five CHCP about push and pull based model. Out of five respondents 4 (80%) was male and 1 (20%) female. The Age of the respondent 27 to 32 years of old.

Table 3. Push Based Model of Doctors

Question	Possible Answer	Respondent (%)	Rank Order
i. Do you agree with pushed based mode?	i) No	100%	
	ii) Yes	0%	
ii. What are the impact of push based model on storage?	i) Unnecessary goods keep in stock	100%	1
	ii) Possibility to damage	100%	2
	iii) Possibility to expired	100%	3
iii. What are the impact of push based model on cool chain (immunization progrmme)	i) Challenge to keep and maintain of cool chain	100%	1
	ii) Break cool chain	100%	2
	iii) Quality damage	80%	3
iv. Causes of health commodities wastage / expired /storage space /damage	i) Increased wastage	100%	1
	ii) Not cover storage capacity	100%	2
	iii) Unplanned storage	80%	3
v. Causes of stock out / dead stock	i) Expired	100%	1
	ii) Not follow demand	100%	2
	iii) Increased dead stock	80%	3
vi. Do you think any LMIS gap?	i) Yes	0%	
	ii) No	100%	
vii. What are the challenge?	i) More storage	100%	1

	ii) Expired	100%	2
	iii) Requirement not fulfill	80%	3
viii. Opportunity to improved	i) Supply as per requirement	80%	1
	ii) Implement pull based order	80%	2
	iii) Follow up and training	80%	3

The push based model have eight question out of eight 2 questions were closed from and 6 questions were open from. Cent percent of the respondent replied the disagreement of push based model. The possible reason of this agreement was the more disadvantage of this model. “What are the impact of push based model on storage?” asked this question and replied possible 3 answers. The 1st possible disadvantage they replied the “Unnecessary goods keep in stock” 2nd “Possibility to damage” and 3rd one was “Possibility to expired”. Possible reason that in this model some medicine or goods that was send from the central store to the community level. So, some unnecessary goods were kept in stock that was obviously either damaged or possibility to expired the date. Ultimately the impact of push based model was not good.

“What are the impact of push based model on cool chain (immunization progrmme)?” asked this question and replied possible 3 answers. The 1st possible disadvantage they replied the “Challenge to keep and maintain of cool chain” 2nd “Break cool chain” and 3rd one was “Quality damaged”. In this model some vaccine that was send from the central store to the community level without concern the community level. There was a challenge to keep in

store and maintain of cool chain because the categories of vaccine and number of vaccines is not appropriated as the requirement of community level. Sometimes break the cool chain of vaccine ultimately the quality of vaccine was deteriorated. Ultimately the impact of push based model was not good.

“Causes of health commodities (wastage/ expired /storage space/damage)?” asked this question and replied possible 3 answers. The 1st possible answer they replied the “Increased wastage” 2nd “Not cover storage capacity” and 3rd one was “Unplanned storage”. In this model some goods that was send from the central store to the community level without concern the community level. The extra goods needs more storage and there was always problem in storage capacity. So, unplanned storage of goods was common practices in community level. Ultimately the impact of push based model for this reason increased the wastage of products .

“Causes of stock out / dead stock” asked this question and replied possible 3 answers. The 1st possible answer they replied the “Expired” 2nd “Not follow demand” and 3rd one was “Increased dead stock”. In push model some goods that was send from the central store to the community level without concern the community level. The extra goods needs more storage and there was always problem in storage capacity. For this reason the goods or medicine expired as previously not follow the demand of community level. Ultimately the impact of push based model for this reason increased the dead stock.

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concerning the community level. So, they respondent replied 1st challenges about the storage capacity of community level. We know about the situation that in community level the total area of the office is not sufficient. So, the respondent truly said about the storage capacity. After that they replied about the expired period as the goods or medicine is send or allotted without concern the community. So, this good or medicine is not need the community level and ultimately expired. Lastly, their was a crises in demand and supply and ultimately the demand of local community was not fulfilled.

"Opportunity to improved" asked this question and replied the respondent possible 3 suggestion. The 1st possible disadvantage they replied the "Supply as per requirement" 2nd "Implement pull based order" and 3rd one was "Follow up and training". In this model some vaccine that was send from the central store to the community level without concern the community level. Some medicine or goods that was send from the central store to the community level without concerning the community level. So, they respondent 1st suggestion about the supply as per requirement of community level. By implementation of this suggestion might be fulfilled the demand of local community. The truly suggested about the pulled based order implementation. It will be the best solution for paused based problem. Lastly, the respondent suggested about the follow up that is monitoring and proper training. The training and monitoring is ongoing process and very much important.

Pull Based Model

The findings of pull based model given bellow in Table 4.

Table 4. Pull Based Model of Doctors

Question	Possible Answer	Respondent (%)	Rank order
i. Do you agree with pulled based mode?	i) No	0%	
	ii) Yes	100%	
	i) Less wastage	100%	1

ii. What are the impact of pull based model on storage?	ii) Proper utilized	80%	2
	iii) Requirement fulfill	80%	3
iii. What are the impact of pull based model on cool chain (immunization progrmme)?	i) Ensure quality during Transport	100%	1
	ii) Ensure quality during storage	80%	2
	iii) Proper utilized	80%	3
iv. Causes of health commodities wastage / expired /storage space /damage	i) Good storage	100%	1
	ii) Possibility to lees wastage	80%	2
	iii) Reduced expired	80%	3
v. Causes of stock out / dead stock	i) Possibility to less stock out	100%	1
	ii) Reduced dead stock	100%	2
	iii) Reduced buffer stock	80%	3
vi. Do you think any LMIS gap?	i) No	0%	
	ii) Yes	100%	
vii. What are the challenge?	i) Communication	80%	1
	ii) Training up	80%	2
	iii) Stock out of pick hour	80%	3
viii. Opportunity to improved	i) Proper steps	100%	1
	ii) Training up	100%	2
	iii) Implementation up to community level	80%	3

The push based model have eight question out of eight 2 questions were closed from and 6 questions were open from. Cent percent of the respondent replied the agreement of pull based model. The possible reason of this agreement was the more advantage of this model. “What are the impact of pull based model on storage?” asked this question and replied possible 3 answers. The 1st possible advantage they replied the “Less wastage” 2nd “Proper

utilized" and 3rd one was "Requirement fulfill". In this pull based model some medicine or goods that was supplied from the central store to the community level on the basis of requirement of community level. So, goods were kept in well stock that was obviously utilized in proper way and ultimately the requirement of the community was fulfilled. Tthe impact of pull based model was good.

"What are the impact of pull based model on cool chain (immunization progrmme)?" asked this question and replied possible 3 answers. The 1st possible advantage of this pull based model they replied the "Ensure quality during Transport" 2nd and "Ensure quality during storage" and 3rd one was "Proper utilized". In this model, there was less or no possibility to beak the cool chain during transport and storage. So, the quality of vaccine was ensured during transport and storage. In this model vaccine that was send from the central store to the community level as per the requirement the community level and ultimate the utilization was maximum.

"Causes of health commodities (wastage/ expired /storage space/damage)?" asked this question and replied possible 3 answers. The 1st possible answer they replied the "Good storage" 2nd "Possibility to lees wastage" and 3rd one was "Reduced expired". In this model all goods that was allotted from the central store to the community level for their own demand. So, planned storage of goods was practices in community level. For this reason, possibility less was wastage of medicine and goods. Ultimately, the impact of pull based model reduced expired products.

"Causes of stock out / dead stock" asked this question and replied possible 3 answers. The 1st possible answer they replied the "Possibility to less stock out" 2nd "Reduced dead stock" and 3rd one was "Reduced buffer stock". In pull model goods and medicine that was send from the central store to the community level for their own demand. For this reason, the

goods or medicine possibility to less stock out. Ultimately the impact of pull based model reduced the dead stock and ultimately reduced the buffer stock.

Cent percent of the respondent replied yes with the question “Do you think any LMIS gap?”. The possible reason of this agreement was the more advantage of this model. “What are the challenge?” asked this question and replied possible 3 answers. The 1st possible answer they replied the “Communication” 2nd “Training up” and 3rd one was “Stock out of pick hour”. Medicine or goods that was sent from the central store to the community level for their own requirement. Though in pull model has many advantages but it has some challenge. First challenge was communication. Sometimes miss communication conducted lack of training as a result medicine and goods not get proper time. Lastly, sometimes this crises resulted medicine and goods stock out pick time.

“Opportunity to improved” asked this question and replied the respondent possible 3 suggestion. The 1st possible disadvantage they replied the “Proper steps” 2nd “Training up” and 3rd one was “Implementation up to community level”. In pull model, some medicine or goods supply from the central store to the community level as their requirement. This model has many advantages but have some area that needs to improvement. So, they respondent suggestion about the proper training need to follow the proper steps. Lastly, the respondent suggested about implementation of this model in community level.

4.1.3 Finding of Store Keeper

The researcher interview five CHCP about push and pull based model. Out of Four respondents 4 (100%) was male. The Age of the respondent 34 to 42 years of old.

Table 5. Push Based Model of Store Keeper

Question	Possible Answer	Respondent (%)	Rank Order
i. Do you agree with pushed based mode?	i) No	100%	
	ii) Yes	0%	
ii. What are the impact of push based model on storage?	i) Unnecessary goods keep in stock	100%	1
	ii) Possibility to damage	75%	2
	iii) Possibility to expired	75%	3
iii. What are the impact of push based model on cool chain (immunization progrmme)	i) Challenge to keep and maintain of cool chain	100%	1
	ii) Break cool chain	75%	2
	iii) Quality damage	75%	3
iv. Causes of health commodities wastage / expired /storage space /damage	i) Increased wastage	75%	1
	ii) Not cover storage capacity	75%	2
	iii) Unplanned storage	75%	3
v. Causes of stock out / dead stock	i) Expired	75%	1
	ii) Not follow demand	75%	2
	iii) Increased dead stock	75%	3
vi. Do you think any LMIS gap?	i) No	0%	
	ii) Yes	100%	
vii. What are the challenge?	i) More storage	100%	1
	ii) Expired	75%	2
	iii) Requirement not fulfill	75%	3
viii. Opportunity to improved	i) Supply as per requirement	75%	1

	ii) Implement pull based order	75%	2
	iii) Follow up and training	75%	3

The push based model have eight question out of eight 2 questions were closed from and 6 questions were open from. Cent percent of the respondent replied the disagreement of push based model. The possible reason of this agreement was the more disadvantage of this model. “What are the impact of push based model on storage?” asked this question and replied possible 3 answers. The 1st possible disadvantage they replied the “Unnecessary goods keep in stock” 2nd “Possibility to damage” and 3rd one was “Possibility to expired”. Possible reason that in this model some medicine or goods that was send from the central store to the community level. So, some unnecessary goods were kept in stock that was obviously either damaged or possibility to expired the date. Ultimately the impact of push based model was not good.

“What are the impact of push based model on cool chain (immunization progrmme)?” asked this question and replied possible 3 answers. The 1st possible disadvantage they replied the “Challenge to keep and maintain of cool chain” 2nd “Break cool chain” and 3rd one was “Quality damaged”. In this model some vaccine that was send from the central store to the community level without concern the community level. There was a challenge to keep in store and maintain of cool chain because the categories of vaccine and number of vaccines is not appropriated as the requirement of community level. Sometimes break the cool chain of vaccine ultimately the quality of vaccine was deteriorated. Ultimately the impact of push based model was not good.

"Causes of health commodities (wastage/ expired /storage space/damage)?" asked this question and replied possible 3 answers. The 1st possible answer they replied the "Increased wastage" 2nd "Not cover storage capacity" and 3rd one was "Unplanned storage". In this model some goods that was send from the central store to the community level without concern the community level. The extra goods need more storage and there was always problem in storage capacity. So, unplanned storage of goods was common practices in community level. Ultimately the impact of push based model for this reason increased the wastage of products.

"Causes of stock out / dead stock" asked this question and replied possible 3 answers. The 1st possible answer they replied the "Expired" 2nd "Not follow demand" and 3rd one was "Increased dead stock". In push model some goods that was send from the central store to the community level without concern the community level. The extra goods needs more storage and there was always problem in storage capacity. For this reason the goods or medicine expired as previously not follow the demand of community level. Ultimately the impact of push based model for this reason increased the dead stock.

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without concern the community. So, this good or medicine is not need the community level and ultimately expired. Lastly, their was a crises in demand and supply and ultimately the demand of local community was not fulfilled.

"Opportunity to improved" asked this question and replied the respondent possible 3 suggestion. The 1st possible disadvantage they replied the "Supply as per requirement" 2nd "Implement pull based order" and 3rd one was "Follow up and training". In this model some vaccine that was send from the central store to the community level without concern the community level. Some medicine or goods that was send from the central store to the community level without concerning the community level. So, they respondent 1st suggestion about the supply as per requirement of community level. By implementation of this suggestion might be fulfilled the demand of local community. The truly suggested about the pulled based order implementation. It will be the best solution for paused based problem. Lastly, the respondent suggested about the follow up that is monitoring and proper training. The training and monitoring is ongoing process and very much important.

Pull Based Model

The findings of pull based model given bellow in Table 6.

Table 6. Pull Based Model of Store Keeper

Question	Possible Answer	Respondent (%)	Rank order
i. Do you agree with pulled based mode?	i) No	0%	
	ii) Yes	100%	
ii. What are the impact of pull based model on storage?	i) Less wastage	100%	1
	ii) Proper utilized	75%	2
	iii) Requirement fulfill	75%	3
iii. What are the impact of pull based model on cool	i) Ensure quality during Transport	100%	1

chain (immunization progrmme)?	ii) Ensure quality during storage	75%	2
	iii) Proper utilized	75%	3
iv. Causes of health commodities wastage / expired /storage space /damage	i) Good storage	100%	1
	ii) Possibility to lees wastage	100%	2
	iii) Reduced expired	100%	3
v. Causes of stock out / dead stock	i) Possibility to less stock out	100%	1
	ii) Reduced dead stock	75%	2
	iii) Reduced buffer stock	75%	3
vi. Do you think any LMIS gap?	i) No	0%	
	ii) Yes	100%	
vii. What are the challenge?	i) Communication	100%	1
	ii) Training up	100%	2
	iii) Stock out of pick hour	100%	3
viii. Opportunity to improved	i) Proper steps	100%	1
	ii) Training up	75%	2
	iii) Implementation up to community level	75%	3

The push based model have eight question out of eight 2 questions were closed from and 6 questions were open from. Cent percent of the respondent replied the agreement of pull based model. The possible reason of this agreement was the more advantage of this model. “What are the impact of pull based model on storage?” asked this question and replied possible 3 answers. The 1st possible advantage they replied the “Less wastage” 2nd “Proper utilized” and 3rd one was “Requirement fulfill”. In this pull based model some medicine or goods that was supplied from the central store to the community level on the basis of requirement of community level. So, goods were kept in well stock that was obviously utilized in proper way and ultimately the requirement of the community was fulfilled. Tthe impact of pull based model was good.

"What are the impact of pull based model on cool chain (immunization progrmme)?" asked this question and replied possible 3 answers. The 1st possible advantage of this pull based model they replied the "Ensure quality during Transport" 2nd and "Ensure quality during storage" and 3rd one was "Proper utilized". In this model, there was less or no possibility to beak the cool chain during transport and storage. So, the quality of vaccine was ensured during transport and storage. In this model vaccine that was send from the central store to the community level as per the requirement the community level and ultimate the utilization was maximum.

"Causes of health commodities (wastage/ expired /storage space/damage)?" asked this question and replied possible 3 answers. The 1st possible answer they replied the "Good storage" 2nd "Possibility to lees wastage" and 3rd one was "Reduced expired". In this model all goods that was allotted from the central store to the community level for their own demand. So, planned storage of goods was practices in community level. For this reason, possibility less was wastage of medicine and goods. Ultimately, the impact of pull based model reduced expired products.

"Causes of stock out / dead stock" asked this question and replied possible 3 answers. The 1st possible answer they replied the "Possibility to less stock out" 2nd "Reduced dead stock" and 3rd one was "Reduced buffer stock". In pull model goods and medicine that was send from the central store to the community level for their own demand. For this reason, the goods or medicine possibility to less stock out. Ultimately the impact of pull based model reduced the dead stock and ultimately reduced the buffer stock.

Cent percent of the respondent replied yes with the question "Do you think any LMIS gap?". The possible reason of this agreement was the more advantage of this model. "What are the

challenges?" asked this question and replied possible 3 answers. The 1st possible answer they replied the "Communication" 2nd "Training up" and 3rd one was "Stock out of pick hour". Medicine or goods that was sent from the central store to the community level for their own requirement. Though in pull model has many advantages but it has some challenge. First challenge was communication. Sometimes miss communication conducted lack of training as a result medicine and goods not get proper time. Lastly, sometimes this crises resulted medicine and goods stock out pick time.

"Opportunity to improved" asked this question and replied the respondent possible 3 suggestion. The 1st possible disadvantage they replied the "Proper steps" 2nd "Training up" and 3rd one was "Implementation up to community level". In pull model, some medicine or goods supply from the central store to the community level as their requirement. This model has many advantages but have some area that needs to improvement. So, they respondent suggestion about the proper training need to follow the proper steps. Lastly, the respondent suggested about implementation of this model in community level.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATION

The major finding of push-based model were described below:

i) Total 19 respondents from 3 categories100% agree the disadvantage of push-based methods and advantages the pull-based method.

ii) Some unnecessary medicine and goods were kept in stock that was obviously either damaged or possibility to expire the date was the main impact in the push-based method.

iii) Breaking the cool chain of vaccine, ultimately the quality of vaccine was deteriorated is another disadvantage of push-based method.

iv) Unplanned storage of extra goods was increased the wastage of product and expired the products date as well as increased the dead stock.

v) Cent percent of the respondent agreed the LMIS gap and about challenges replied storage capacity, products expired and about local requirement.

vi) The respondent suggested about the pull-based order implementation and follow up training and monitoring.

The major finding of pull based model were described below:

i) Cent percent of the respondent the agree the advantages the pull-based model.

ii) Less wastage and proper utilized of product and fulfilled the requirement is the major impact of pull based model.

iii) For ensuring quality of vaccine during transport and storage ultimately improve the immunization program is the impact of immunization program.

iv) Planned storage of goods, less wastage of goods and reduced expired was another advantage of pull model.

v) Ultimately the impact of pull based model reduced the dead stock and ultimately reduced the buffer stock.

vi) Cent percent of the respondent agree the LMIS gap.

vii) Communication gap, Training and stock out goods of pick hour is the major challenge for pull based model.

viii) They respondent suggested about the proper training need to follow the proper steps.

ix) Finally, the respondent suggested about implementation of this model in community level.

Conclusion

The following conclusion was made about the findings

The major disadvantages of push-based model were unnecessary stocking goods, expired, breaking cool chin, wastage of product, increased dead stock. The major advantage of pull based model were less wastage, proper utilized of product, quality immunization, decreased the dead stock and fulfilled the requirement of community. Both methods have some challenges though cent percent of the respondent suggested about implementation of this model in community level.

Recommendation

The following recommendation was made about the findings

- Decentralized and Implementation of Logistics Management Information System among the channel.
- Proper training should be given before implementation of pull based model in community level.
- Proper follow up or monitoring will be done after implemented pull based model.

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Appendix A.

Department of, BRAC University

An interview schedule for a research study entitled

"**The Role of Logistics Management Information System (LMIS) in the Health Commodity Supply Chain Management in Bangladesh at Lower Health Care Level (Community and Up Hospital)"**

Serial No. :

Name of the respondent:

Father's/Husband's name:

Village :

Union :

Upazila & District :

Please provide information on the following aspects:

1. **Age**

What is your present age? _____ years

2. **Push based model**

	Push based model	Remarks
1	Do you agree with pushed based mode ? YES/ NO	
i		
ii		
iii		
2	What are the impact of push based model on storage	
i		
ii		
iii		

3	What are the impact of push based model on cool chain (Immunization progrmme)	
i		
ii		
iii		
4	Causes of health commodities wastage / expired /storage space /damage	
i		
ii		
iii		
5	Causes of stock out / dead stock	
i		
ii		
iii		
6	do you think any LMIS gap ? YES/NO	
i		
ii		
iii		
7	what are the challenge	
i		
ii		
iii		
8	Opportunity to improved	
i		
ii		
iii		
	Name :	
	Position:	

3. Pull based model

	Pull based model	Remarks	
1	Do you agree with pull based mode ? YES/ NO		
i			
ii			
iii			
2	What are the impact of push based model on storage		
i			
ii			
iii			
3	What are the impact of push based model on cool chain (immunisation progrmme)		
i			
ii			
iii			
4	Causes of health commodities wastage / expired /storage space /damage		
i			
ii			
iii			
5	Causes of stock out / dead stock		
i			
ii			
iii			
6	do you think any LMIS gap ?YES/NO		
i			
ii			
iii			
7	what are the challenge		
i			
ii			
iii			
8	Opportunity to improved		
i			
ii			
iii			
	Name :		
	Position:		