Urban Logistics Planning: A Case of Porbandar City

Thesis submitted in

Partial Fulfillment for

The Award of the Degree of

Master of Urban and Regional Planning

By

Harshilkumar Umeshbhai Tanna

Second Semester, MURP II – 2020-21

Primary Guide: Dr. Bhawana Vasudeva

Secondary Guide: Ms. Khyati Rathod

Master of Urban and Regional Planning (MURP) Program

Department of Architecture

Faculty of Technology and Engineering

The Maharaja Sayajirao University of Baroda

D. N. Hall, Pratap Gunj, Vadodara, Gujarat, India

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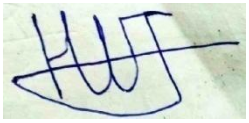
CERTIFICATE

Urban Logistics Planning: A Case of Porbandar City

The contents presented in this Thesis represent my original work and it has not been submitted for the award of any other Degree or Diploma anywhere else.



Harshilkumar Umeshbhai Tanna

This Thesis is submitted in partial fulfillment of the requirements for the
Degree of Master of Urban and Regional Planning
at the Department of Architecture
Faculty of Technology and Engineering
The Maharaja Sayajirao University, Vadodara, Gujarat, India
The present work has been carried out under our supervision and
guidance and it meets the standard for awarding the above stated degree.

Primary Guide:
Dr. Bhawana Vasudeva

Secondary Guide:
Ms. Khyati Rathod

Head of the Department, (Dr. Bhawana Vasudeva)
Department of Architecture

Dean, (Prof. C. N. Murthy)
Director of the Master's Programs,
Faculty of Technology & Engineering, The Maharaja Sayajirao University

“The Growth Story of India shall be written on the canvas of planned urban development and the script writers shall be the town and country planners!”

ABSTRACT

The concept behind Urban Logistics Planning is an holistic approach. It runs on a strategy of movements of urban goods/freights ensuring efficient and sustainable logistics operations within urban area boundary. This concept is gaining so much popularity in urban fringes due to rise in the long term models such as of E-commerce, food deliveries, online Pharma stores, current Covid-19 pandemic vaccine distributions, etc. are putting up the pressure on logistics services. Also the efficient logistics planning, sustainability, electric vehicle last mile deliveries and reverse logistics are becoming the additive part in this chain of services. All these factors are boosting the structures such as of warehouses and distribution centres at various unplanned locations creating the logistics sprawl. This is all due to absence of Logistics Policy in India. This from an urban planning point of view needs to be addressed as early as possible before it gets out of control and started spreading haphazardly creating problems for future development. Also there is major contribution of private sector in this field of logistics which needs to be taken care of while creating any such policies.

After reviewing all these scenarios, study aims at developing a framework layout for urban logistics planning. The study identifies the 2 most essential supply chains in current pandemic situation, first being the groceries items and second being the pharmaceuticals. A detailed study regarding current working network and physical infrastructural facilities requirements is done for these two supply chains by taking a case of Porbandar city. Research also analyzes the phases and parameters for creating the efficient urban logistics network planning, irrespective of any particular study area. Data collection methodology used for research work is qualitative (various literatures, case studies, policy documents and focused group interviews) as well as quantitative (maps and charts generations) in nature.

The research work findings are related to the location of current warehouse facilities availability in groceries and pharmaceutical cargo generated per person per day in the city. The gaps were identified broadly in 4 different tracks relating to distribution facilities, logistics space, data bank creation and increase use of new fuel vehicles for last mile deliveries.

Logistics industry sector is giving a promising rise and for that a strong Logistics Master Plan or its inclusion in city Development Plan is must needed in future. So for that this research can be used as a map ahead to proceed with planning urban logistics in the city and to create a similar document for other supply chain running within the city.

DEDICATION

This thesis is dedicated to,

My beloved country, India.
My hometown city, Porbandar.
People's who lost their lives in these Covid-19 pandemic and all the front-line workers.

My parents "Jasuben Tanna and Umeshbhai Tanna", elder brother "Keval Tanna" and my dear family members who have been moral support system in my achievements and journey and believing in my values and also helping me in all other things great and small.

All my friends who have been the throughout guides for my development in the path and creating the memories for life long.

My guides for the thesis work, Dr. Bhawana Vasudeva and Ms. Khyati Rathod for their encouragement, active guidance and providing a pillar support that helped me to bring out the best work that I would like to convey through my research.

And the almighty, supreme God for all the blessings and keeping me safe and healthy.

Thank You! for being a part of my journey that I aspire to achieve.
God bless you.

ACKNOWLEDGEMENT

It is my pleasure to record thanks and gratitude to the contributions provided by my guide Dr. Bhawana Vasudeva, Ms. Khyati Rathod and all the faculty members from Department of Architecture, Faculty of Technology and Engineering, The Maharaja Sayajirao University of Baroda whose generous help and support enabled me to complete my thesis project of "Urban Logistics Planning: A Case of Porbandar City" within stimulated time period.

My special thanks to all the panel members for their critics and reviews which help me to improve my thesis work.

Further I am thankful to all the persons (Dr. Pankaj Prajapati, Gopaldas Shah, Kajal Thakkar, Sarah Zia, Ajay Jain) who had given me their valuable time and provided suggestions for my thesis work.

I am thankful to Porbandar-Chhaya Nagarpalika for providing me with the data I required for my thesis work.

Lastly, I would like to thanks my dear friends, field experts and people whom I surveyed, my dear family members and to all those who have helped me throughout my final semester in some way or the other are credited for their respective support and contributions for making my thesis work complete and possible in such a pandemic situations.

This thesis would not have been completed without all of you. Thank you for your belief in me and my work.

- **Harshil Tanna**

(M.U.R.P. II – 2021)

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF MAPS

LIST OF TABLES

ABBREVIATIONS

In order of appearance

NGO	:	Non Governmental Organization
TP	:	Town Planning
ULP	:	Urban Logistics Plan
CBD	:	Central Business District
TPS	:	Town Planning Scheme
DP	:	Development Plan
GTPUD	:	Gujarat Town Planning and Urban Development
UFT	:	Urban Freight Transportation
SC	:	Supply Chain
UK	:	United Kingdom
SULP	:	Sustainable Urban Logistics Plan
SUMP	:	Sustainable Urban Mobility Plan
SUTP	:	Sustainable Urban Transport Plan
LAZ	:	Limited Accessibility Zone
GIS	:	Geographic Information System
SWLS	:	Supermap-based Web Logistic System
B2B	:	Business-to-Business
O-D	:	Origin-Destination
GDP	:	Gross Domestic Product
MoCI	:	Ministry of Commerce and Industry
LPI	:	Logistics Performance Index
PL	:	Party Logistics
IR	:	Indian Railway
ntkm	:	net ton kilometers
D2D	:	Door-to-Door
NMDP	:	National Maritime Development Programme
PPP	:	Public-Private Partnership

CAGR	:	Compound Annual Growth Rate
MT	:	Metric Tonnes
ASSOCHAM	:	The Associated Chambers of Commerce of India
DLDSL	:	DMICDC Logistics Data Services
IoT	:	Internet of Things
GoI	:	Government of India
LP	:	Liladhar Pasoo
PIB	:	Press Information Bureau
ITS	:	Information Technology Services
UDC	:	Urban Distribution Center
UCC	:	Urban Consolidation Center
NITI	:	National Institution for Transforming India
EU-USA	:	European Union - United States of America
OSM	:	Open Street Map
DHDP	:	District Human Development Plan
M+OG	:	Main + Out Growth
CT	:	Census Town
NH/SH	:	National/State Highway
AAI	:	Airport Authority of India
GMB	:	Gujarat Maritime Board
CEZs	:	Coastal Economic Zones
DMIC	:	Delhi-Mumbai Industrial Corridor
MVA	:	Megavolt Amperes
MLD	:	Million liters per day
URDPFI	:	Urban and Regional Development Plan Formulation and Implementation
AI	:	Artificial Intelligence
EV’s	:	Electric Vehicle’s
MC	:	Municipal Corporation
INR	:	Indian National Rupees

CHAPTER 1 – INTRODUCTION

The growth of city planning over the periods and centuries can be understood by any individual or by a group of people or working Non Governmental Organizations (NGO's) or by any professionals and non-professional of all ages irrespective of any religion or caste or literacy or illiteracy. The growth can be seen in all direction from high quality infrastructure to exploring space and Earth objects and so much more as far as science and human being gets evolutes, the growth of city or town or urban space or region continues.

There was a time when city use to be built or constructed nearby any river flow or having sea face, but after ages of evolution the growth of city used to be more diverse and scenarist with artificial man-made beauties all over the landscape view using immense concrete and steel materials. Also with the addition of new technologies and improvement in the design and planning from hand drawings to software based system and generating the eye-catching maps, the pattern of the city gets evolved from low rise mud and bricks house to high rise glass and steel structures. With such evolution and uncontrolled growth of city or town the mankind used to start developing the city or town growth by implementing the Regional Plan, Master Plan, Development Plan, Town Planning (T.P.) Schemes, Local Area Plan and many such types of plans were introduced with a vision of minimum 5 years to maximum of 30 years to develop a city as per planning laws and regulations so that the further growth of any city or town took place in an controlled manner.

Now looking upon at another part i.e. logistics. It refers to overall process of managing how resources are acquired, stored, and transported to their final destination. (Source: Investopedia Definition) It is the branch that has shown the tremendous growth in the recent years after the service sector of delivering products to the end consumer had been evolved with the advancement in technologies such as tracking the parcel of consumer,

keeping records of data's, online payment system etc. E-commerce businesses, food deliveries, cargo and freight delivery etc. type of business model had been grown over the year with providing employment opportunities at different levels and sectors in the city. Due to this it has putted up urban planning in more complex situation than in early times.

As this logistics sector is increasing at a rapid pace and the future expectations are also high and positive for business like E-commerce and multi-modal logistics, as a city planner it is important to understand the problems faced by such business activities and to solve it by providing useful infrastructural facilities in this sector while preparing city Development/Master Plan or by providing separate plan under the name of Urban Logistics Plan (ULP) for any city.

1.1 HISTORY OF URBAN PLANNING

Source: (Town Planning History)

India's history in the field of town/city/urban planning takes us back to the golden era of the Indus or Harappa Valley civilization (2600 to 1700 B.C.) which was very rich in terms of security, administration, planning, water supply, sewerage management etc. that was done without any such use of technologies or any digital advancement which we used to see those in modern day society. During Solanki Dynasty and Mughal Dynasty i.e. in the period from 5th century to 19th century town used to be built by creating the zones for different activities of the town i.e. sectoral development and also there was development in transportation that anyone can get direct access into the town centre from all the directions. From there we had taken the concept of centric planning or Central Business District (C.B.D.) for important activities and the transport network spreaded in each direction e.g. the city of Chennai, Tamilnadu is based on such concept. Also during this period we had seen that there were provisions' of Defensive Planning by guarding the city with high walls all around the town. Many such planning's done in ancient

centuries can be understood through some instincts found at various identified archaeological sites.

During British period, the organized efforts for the Town Planning started which provided legal support and guidelines for preparing planning proposals. India's first on paper policy for town planning came into existence in 1915 when Bombay Town Planning Act, 1915 came into power and formation of Town Planning schemes in city area gets started. After the formulation of this act, the very 1st Town Planning Scheme (TPS) of Gujarat (and also the 1st in India) was published in 1917 at Jamalpur area, Ahmedabad City and gets its passing in the year 1925. Then after few years of the formation of the Bombay Town Planning Act the very first project of formation of Development Plan (DP) gets started in the year 1954.

There was division of 2 states i.e. Gujarat and Maharashtra being done in 1960. This formation of different state establishes the rise of separate town planning act in the state of Gujarat. Then after various evolutions in the act and many changes in the criteria's where done and finally in the year 1976 Gujarat published it's very first own town planning act which is known as Gujarat Town Planning and Urban Development Act, 1976. (GTPUD Act)

After the formation of act there were many project proposed and the work for DP for macro level & TPS for micro level get started at a very rapid pace in the state in the field of town planning and urban development.

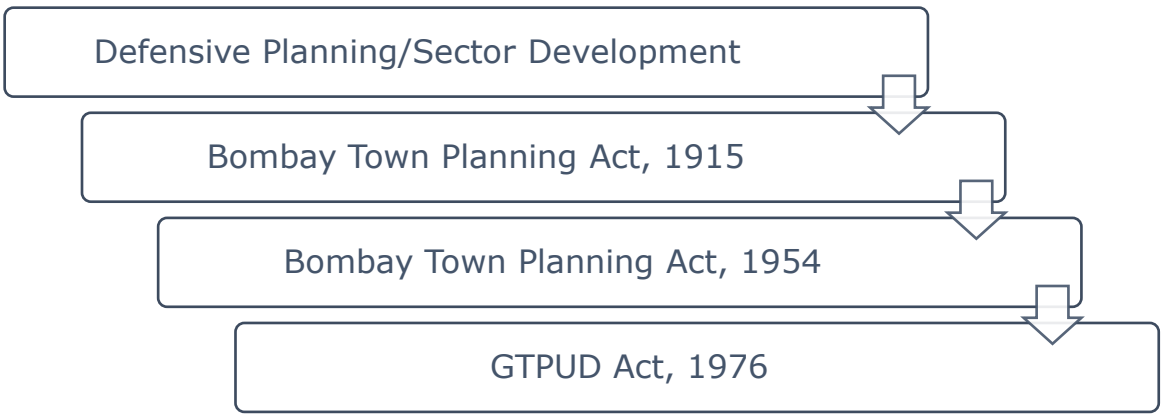


Figure 1.1: Levels of Planning Acts

At current the urban planning in the state is a two level process. At macro level, the urban planning is conducted in the form of city development plan, or simply a development plan for the entire city area or the development area. The second level i.e. micro level urban planning is done, in the form of a Town Planning Scheme, which is prepared for smaller areas of the city, keeping in view the needs of such smaller area.

The process of the TPS gets work out under 3 stages: a) Draft Scheme b) Preliminary Scheme and c) Final Scheme.

In this era of rapid urbanization, with a large number of problems within urban areas, planning for future urban development is very essential. The general confusion of haphazard and non-conforming land use patterns, lack of adequate and efficient services / facilities and overall deteriorating environment demand for a systematic approach in the planning and development of urban areas.

1.2 URBAN LOGISTICS: CONCEPT

Urban Freight Transportation (UFT) is increasing day-by-day in the cities. UFT involves a vast range of additional processes:

- handling and storage of goods,
- inventory management,
- waste and returns, as well as
- Home delivery.

While many of these processes, or parts of them, are undertaken outside of urban areas, they continue to have an impact on urban operations. UFT is a for-profit activity, predominantly controlled and operated by private interests. UFT makes goods available to customers located in urban areas.

UFT has a number of negative effects in terms of safety, congestion, and air and noise pollution. For instance, in Europe, UFT is responsible for 25% of urban transport related CO2 emissions and 30-50% of other transport related pollutants. In addition, a growing urban population,

combined with other trends, such as e-commerce and home deliveries development, together with an ageing population, will lead to an increase in demands for goods and services, with a consequent increase of UFT demand.

1.2.1 Planning for Freight Traffic

Source: (National Urban Transport Policy, 2014)

Freight traffic is often forgotten in urban transport planning for a city. As a largely private sector activity it is difficult to control, and many of the decisions that affect goods vehicles are made by the industry itself. There needs to be a much greater focus on planning for movement of goods, since it is almost universally recognized that transport of goods is important and will grow with economic growth. Goods movement should be planned in a manner that it does not affect passenger movement.

As economic activities in cities expand and city population grows, a substantial amount of freight traffic would be generated. The timely and smooth movement of such freight is crucial to the well-being of the people and the viability of the economic activities they undertake. However, with limited capacity of the urban transport infrastructure, it is essential that freight traffic and passenger traffic are so staggered as to make optimum use of the urban transport infrastructure. It is a time honored and tested practice to use off-peak passenger travel times to move freight. Many cities have earmarked late night hours for the movement of freight and restricted the entry of heavy vehicles into cities during day time. Further, several cities have by-passes that enable through traffic to go around the city and not add to city traffic.

These practices are sound and would be encouraged in all cities. For this purpose, cities would be encouraged to build by-passes, through innovative and viable public – private partnerships. Similarly, facilities for the parking of freight vehicles outside city limits, such as truck terminals,

would also be encouraged through public-private partnerships. Therefore movement of freight traffic should be a part of urban transport planning exercise and it needs to be inter-linked.

Below figure 1.2 shows the flowchart in which the process of joining logistics and urban planning has been shown along with the issues and type of study needed for the same.

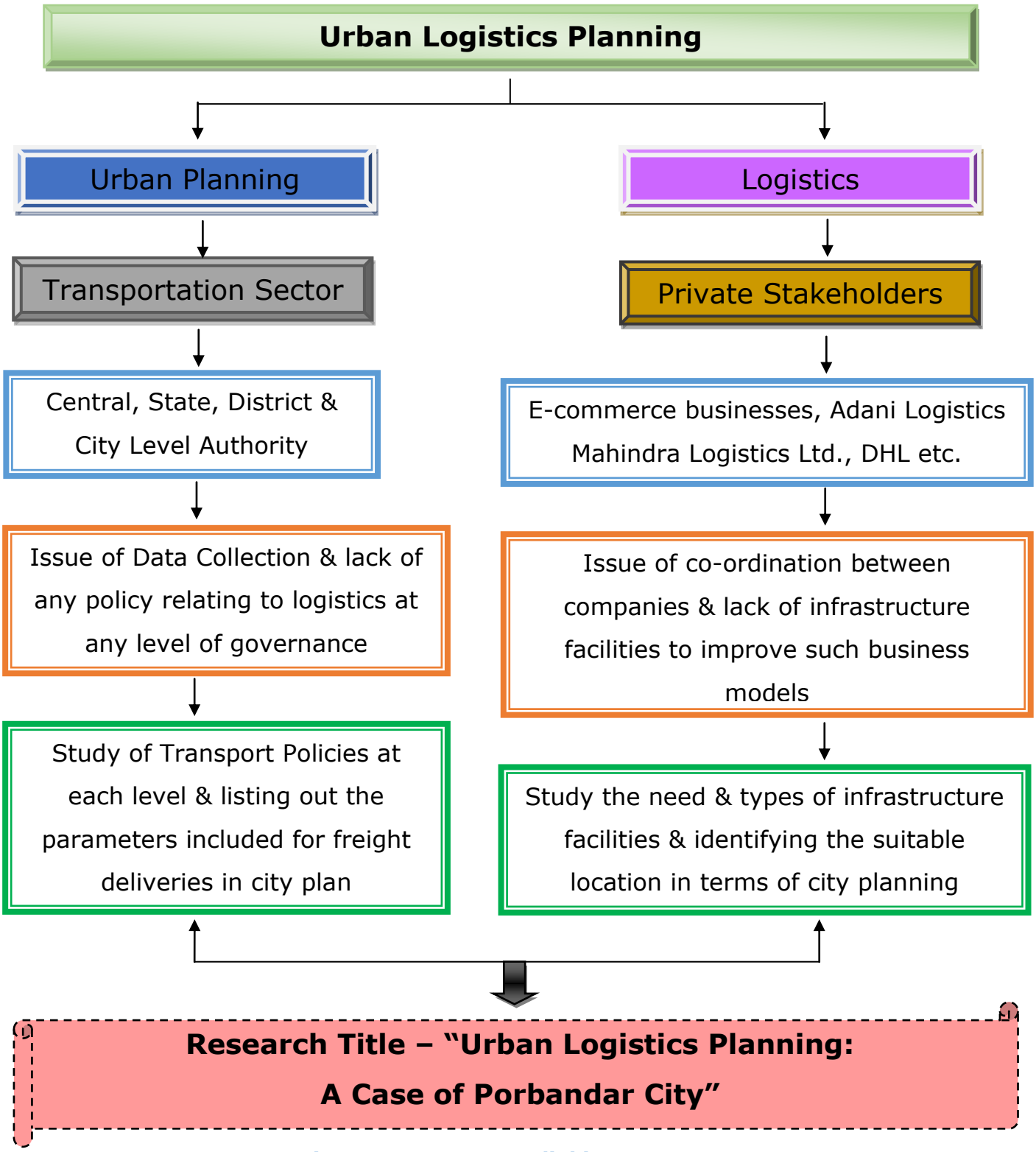


Figure 1.2: ULP Inter-linking Process

1.3 THESIS FRAMEWORK

1.3.1 Research Area

- Domain–Transport Planning
- Sub-domain–Urban Logistics Planning

1.3.2 Research Problem Identification

- Considering the long term model of E-commerce and Multi modal Logistics, the current supply chain network, infrastructure facilities and data collection in this sector is quite unorganized and unplanned.
- Private sector's in this field does not share sufficient data about infrastructural details or parameters for framing up policies.

1.3.3 Purpose of the study

- As it can be identified from different literatures that there is increasing trend in logistics sector and similar business models are rising. It parallel raises concern about:
  - Post pandemic scenario,
  - Wastage of Product, (as a part of Reverse Logistics)
  - Different transport mode connectivity
  - Urban Distribution/Consolidation centers or Warehousing or Logistics Space/Park
  - Data Localization
  - Climate Change factor
  - Efficiency of current working supply chain
- Therefore it is an prior requirement to prepare an organize planning approach for such growing sector, before it gets out of control and started growing haphazardly creating problems for future development.

1.3.4 Research Questions

- What are the phases, structure and parameters for preparing effective grocery and pharmaceutical supply chain w.r.t. urban logistics planning?

1.3.5 Aim

- To develop a framework layout for urban logistics planning.

1.3.6 Objectives

1) To identify network of grocery and pharmaceutical supply chain in Porbandar city.
2) To identify the physical infrastructure facilities requirements for grocery and pharmaceutical supply chain.
3) To analyze parameters for efficient logistics network planning.

1.3.7 Study Area

- Porbandar City, Gujarat, India.
- It is located at Latitude-21.6, Longitude-69.6.

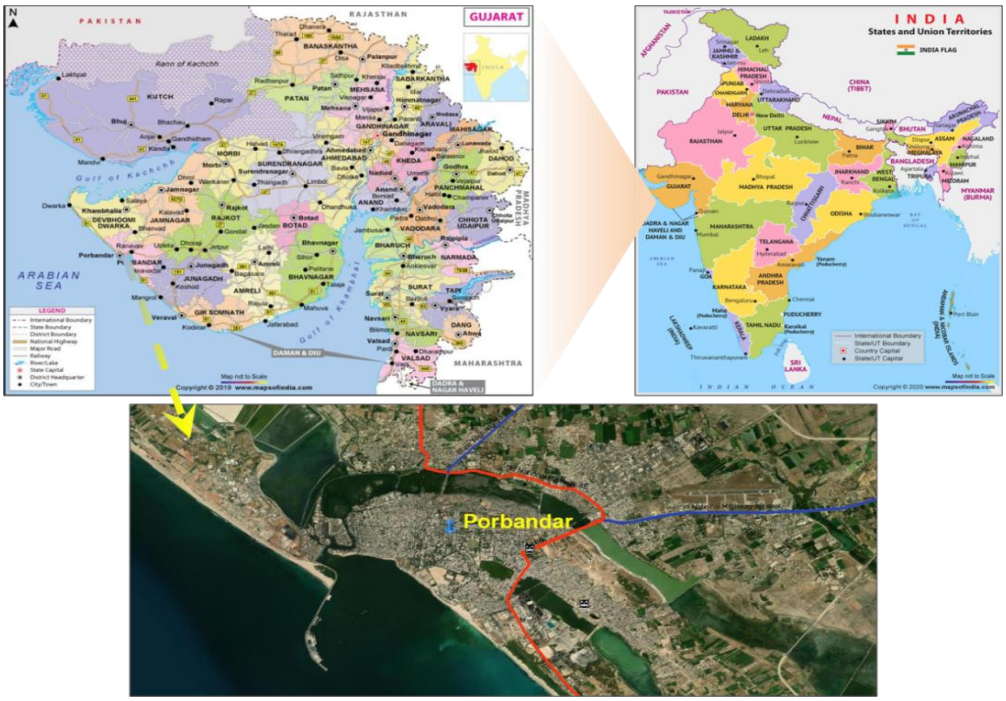


Figure 1.3: Study Area Location

Source: (Maps of India)

1.3.8 Scope of work

- Proper Logistics network in city planning can benefit end user with right product in right time at right place.
- Interdependencies between producers and consumers can be marginalized by knowing network of distribution.
- City Infrastructure proposals (e.g. distribution facilities) can be further improvised.
- Logistics policy framework can be generated for grocery and pharmaceutical supply chain.

1.3.9 Limitations of work

- Lack of data of airport and railway transport freight or logistics movements.
- Research is solely done for Porbandar city.
- Research is conducted for logistics relating to grocery and pharmaceutical sector only.

1.3.10 Assumptions

- Frequencies of cargo (per day) are assumed as true – provided in field survey.
- Percentage of Pharmaceutical cargo products are assumed as true – provided in field survey.

1.3.11 Outlines of the Chapters

- Chapter no. 2 is about various literatures that had been reviewed in this research thesis work.
- Chapter no. 3 is the main part which is going to provide the conceptual framework of the thesis work and what is the methodology adopted for the research work.
- Chapter no. 4 provides the total data collection, data analysis and findings from the study and
- Last i.e. Chapter no. 5 is about the Recommendations, Conclusion from the research and what future research could be done in this field.

CHAPTER 2 – LITERATURE REVIEW

2.1 RESEARCH PAPERS

The concept of ULP is not very much famous in India due to the vast and old retail segment which is fragmented in mostly all the villages and corners of the country. Now as the technology is rising and supporting the new E-commerce market that has been raised at a very rapid pace in last few years, it has been seen that there is occurring the needs for warehousing, efficient supply chain (S.C.), waste management, advancement in technology for data collection and product shipment and other infrastructures in which the field of logistics is concerned. So to identify all these, firstly it is required to find how foreign countries had deal with ULP and to understand the working process and the rise and falls in this sector.

2.1.1 Foreign Literatures

(Fossheim & Andersen, 2017)

- The paper talks about the understanding of common practices carried out in urban logistics planning in Scandinavian and UK countries. Also the guidelines of SULP, SUMP and SUTP plans are studied based on their usage. It was found that the urban freight plans are more used in UK (England, Wales, Northern Ireland & Scotland) as compared to Scandinavian countries (Denmark, Norway & Sweden). A collaborative and sustainable planning approach was used and integrating it with regional planning was done in UK countries while studying the logistics operations. Thus the importance of framing logistics plan for any city/region would benefit the country with better services and a sustainable business flow.

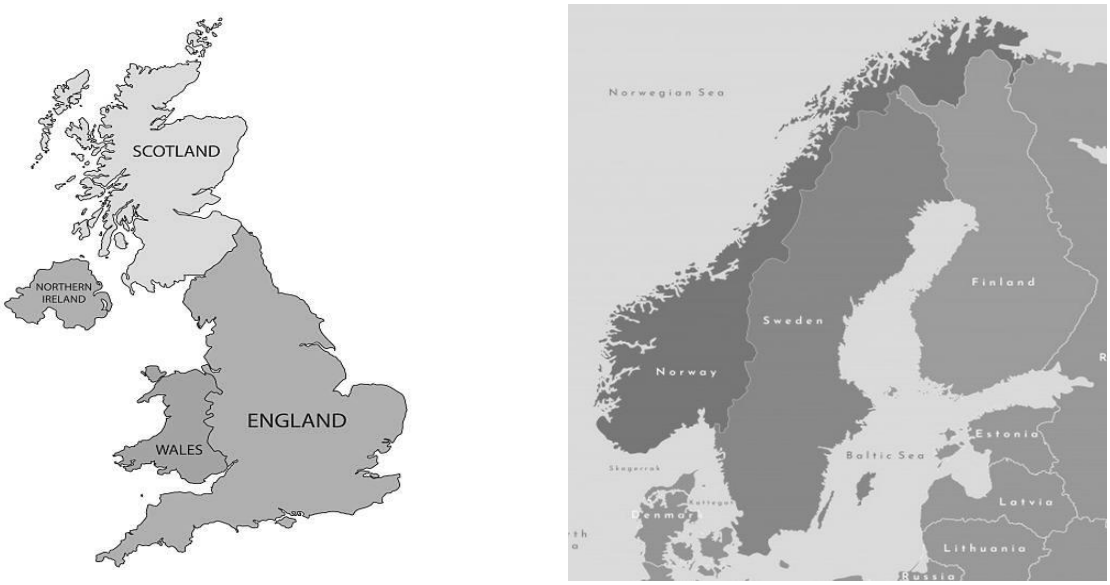


Figure 2.1: Map of UK and Scandinavian Countries

Source: (freepik.com and vector4free.com)

- SUTP is 'an integrated approach with the goal of overcoming deficits in the coordination and cooperation across administrative borders, as well as between authorities in national hierarchies'.
- SUMP is a 'strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. It builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles'.
- SULP is a holistic planning strategy for urban freight that ensures efficient and sustainable logistics operations within urban areas.
- Sustainable development, is defined according to the Brundtland Report by the three components: economic growth, environmental protection to meet the needs of future generations and social equity to accommodate future generations. Only two plans, those of Dundee and London, are labeled as Sustainable Urban Logistics Plans or plans for sustainable urban freight transport.

(Matusiewicz, 2019)

- The paper primly focuses on 2 goals, first being identifying the conditions for deliveries in Limited Accessibility Zone (LAZ) based on

interviews and second being identifying the guidelines for creating the new transport policy which in line with sustainable urban logistics. Desk research method was used to define the road map for SULP in which the data and information is analyzed and verified using earlier European projects. Paper includes SULP tool along with current practice by Gdansk and the comparison of 3 different types of plans i.e. traditional transport planning, SUMP and SULP. It also includes stages of organizing the work in SULP. On concluding note the author based on the survey result, suggest the SULP functioning in urban sub-zones which benefits all the stakeholders' participation.

(Raimbault, 2019)

- The research paper talks about the interrelation of urban and regional governance with the inland ports. The paper is based upon the qualitative methodology i.e. policy document and semi-structured interviews. Current working of inland port, diverse logistics spaces, transport infrastructure and land use planning should interconnected studied is suggested in the paper. Inland port infrastructures are identified as the strategic assets and aiming to increase port regionalization. Author in conclusion suggests the inclusion of inland port spaces and institutions i.e. co-evolution of the different modes of governance of logistics dynamics in urban regions i.e. here with the Paris metropolitan logistics policies and strategies.

(Muñuzuri, Cortés, Guadix, & Onieva, 2011)

- Most of European cities have radial structure, with very high concentration of shopping areas, restaurants and other social attraction poles in the city center. This generates asymmetric flows of people going to work, shop, eat or visit tourist attractions, with similar flows of associated goods.
- Urban freight policies in Spain are not often the result of detailed analyses and evaluations. Often, cities do not share information,

knowledge or cooperation, and there is a significant lack of national or regional bodies dealing with city logistics.

- Nevertheless, there is but one aspect where city center residents and workers, local authorities, freight carriers and receivers agree: the need to improve the efficiency of the freight delivery system in Spanish cities, especially in those areas with narrow streets, high commercial density and tourist attractiveness.
- Investment and implementation do not make any sense when local administrations try to keep everyone quiet by doing nothing while simultaneously promoting politically popular sustainability and congestion policies in the media.
- The strong political costs and negative reactions inherent in Spanish culture put strong pressure on local authorities when it comes to enforcing certain policies, and the situation remains unchanged.

(Guan & Lin, 2008)

- To improve the efficiency and high quality service of the logistic companies, a GIS-based logistics information system is designed and implemented by this paper.
- The modern logistics enter a new stage of the physical distribution organization informationization which takes the network and electronic commerce as representatives, including that some high and new technologies like database system, electronic ordering system, electronic data exchange apply massively in physical distribution domain.
- The traditional physical distribution management system lacks the informationization, the computerization, the visualization, and lacks the effective management to each link, leading that we carry on the effective communication with difficulties among the physical distribution activities, and so increase the redundant cost, and reduce the working efficiency.

- Framework of Supermap-based Web Logistic System (SWLS)

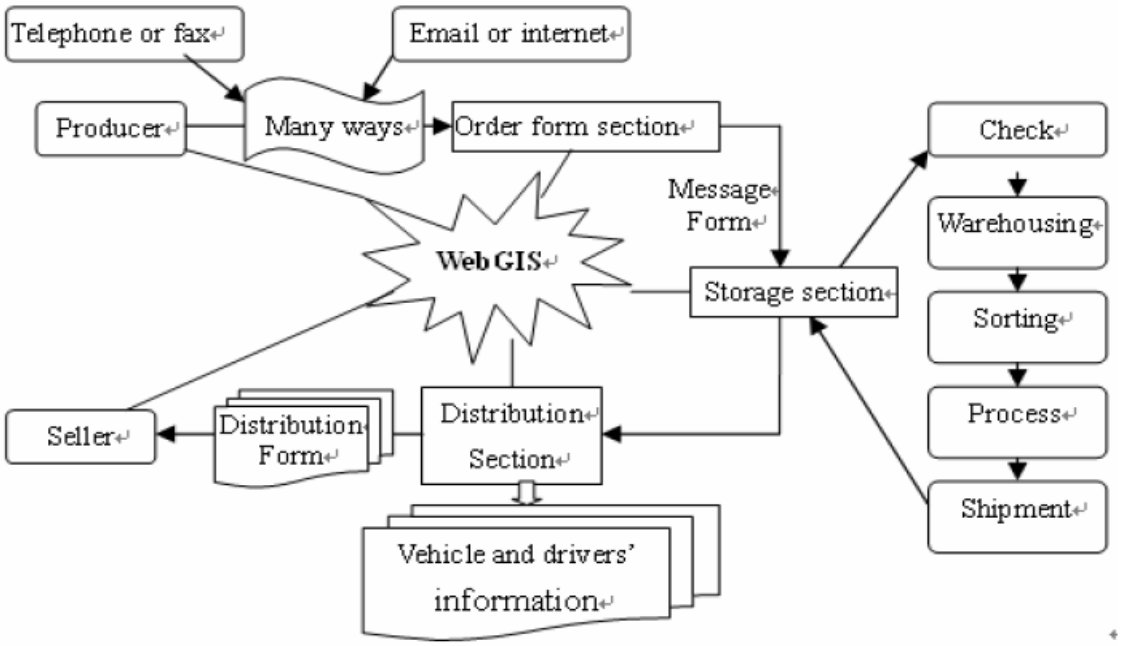


Figure 2.2: Framework for SWLS

Source: (Guan & Lin, 2008)

(Muñuzuri, Cortés, Onieva, & Guadix, 2009)

- The paper presents a case study of Seville, Spain in which a modeling approach consisting of a demand model followed by an entropy maximization procedure to estimate an origin-destination matrix for urban freight transport vehicles, both for business to business and home deliveries, during the morning peak hour.

- Data Collection and Analysis:

  - The estimation of delivery vehicle flows was carried during peak hour between 8:30 a.m. and 9:30 a.m. in the city of Seville, Spain.
  - In this case study the analysis was divided into the five activity sectors (in the zoning of the Seville metropolitan area in 181 zones) identified by the Local Tax Agency of Seville according to the specific business practices:

1) transformation of mineral nonmetallic products and chemicals (construction, pharmacies, glass products, paints, washing products, etc.);
2) transformation of metals (machinery, computers, electric equipment, vehicles, etc.);
3) other industries (textile products, shoes, furniture, paper products, financial institutions, etc.);
4) non-fresh food products, beverages, and tobacco; and
5) fresh food products (fruit, vegetables, meat, and fish).

- Four in-depth surveys were also carried out in different areas of the city, including the city center and its surroundings.
- A total number of 290 retailers belonging to the five sectors were interviewed, thus obtaining data related to the average number of deliveries received daily by each type of retailer, the usual time of arrival of deliveries, the type of company making the delivery, and the type of vehicle used.

- Results and Validation:

  - The demand model was formulated for each one of the five B2B sectors considered and for overall home deliveries. The results obtained were the six O-D matrices for freight transport in the city.
  - O-D matrix had been prepared considering the results of origin in row lines & destination in the form of column lines in OD matrix.
  - Results were shown on map and its validation with the tables providing the data for the map generated.

2.1.2 Urban Logistics Scenario in Indian Context

As per S. Ramachandran et. al. (2015), current transport usage in freight cargo deliveries in India is mostly done by road as a major transport mode as it can provide the last mile connectivity in several areas where

other transport mode cannot be extended for last mile connectivity. It can be supported by following figure:

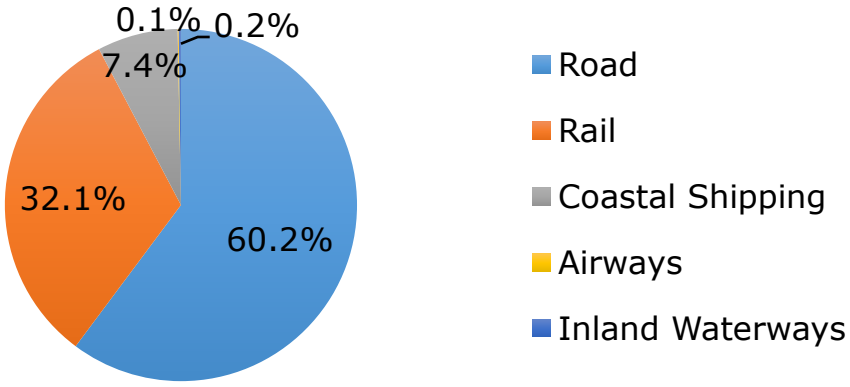


Figure 2.3: Total Freight Transport Modal Mix

(Source: S. Ramachandran et. al. (2015))

Looking at the overall logistics cost of India, it mostly gets vary from company to company and from industry to industry. When considering it across the economy as a whole, the total cost of logistics is expressed in a percentage of gross domestic product (GDP). The annual logistics cost in India is estimated to be 13 percent of the total GDP. It can be further sub-divided in the following segment as seen in the figure:

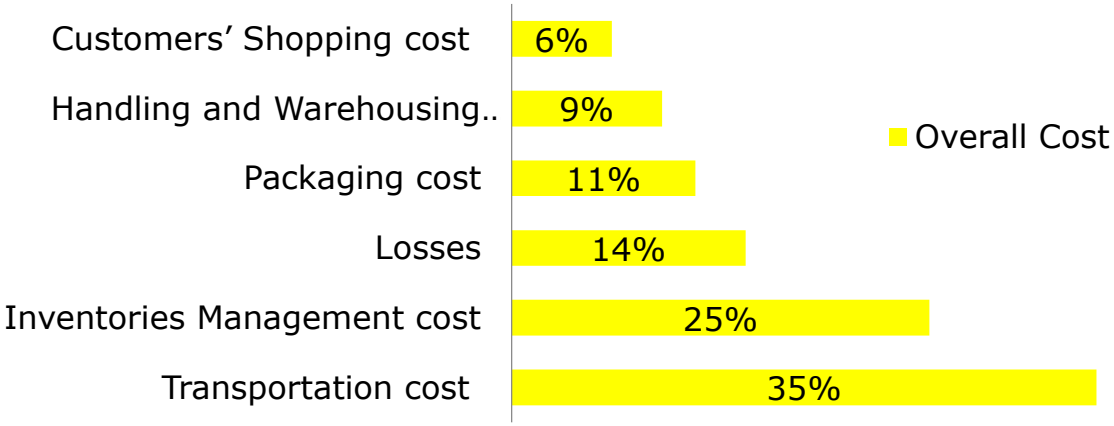


Figure 2.4: Elements of Logistics Cost

(Source: S. Ramachandran et. al. (2015))

The market usage of logistics sector is very wise and mostly used by every sector and industries. The following figure shows the market usage of logistics in India:

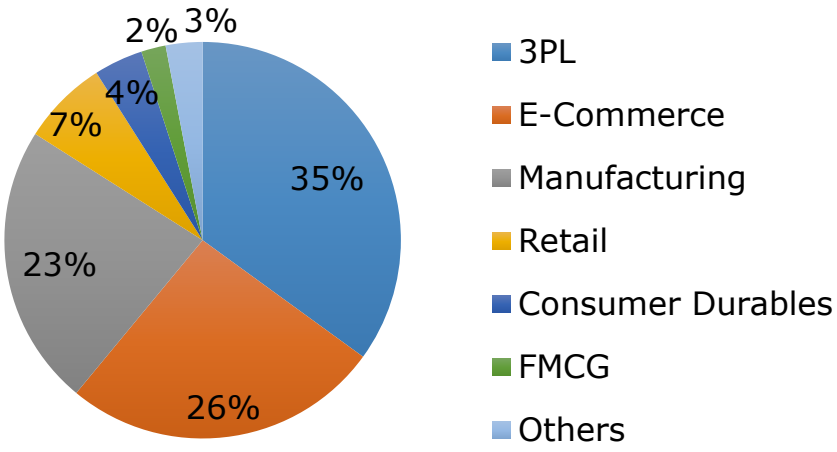


Figure 2.5: Sector wise Market Usage in Logistics

Source: (Warehousing Industry, 2021)

Warehousing Industry scenario in India - A warehouse is a fundamental part of business infrastructure and is one of the key enablers in the supply chain. Majority of the warehousing activities in India is largely undertaken by the unorganized segment (figure 2.6). However, there has been a rapid growth in the transactions by organized players in the recent past in an industry which is largely unorganized.

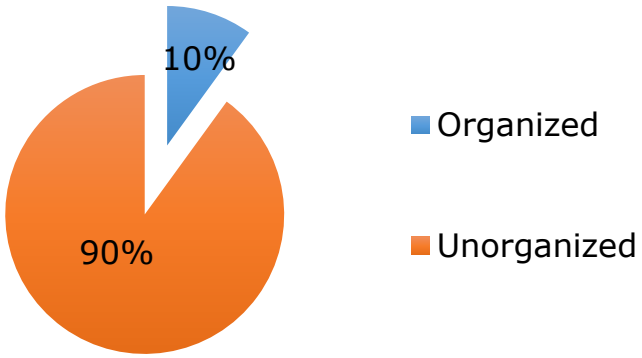


Figure 2.6: Warehousing Industry – India

Source: (Warehousing Industry, 2021)

(Niphadkar, Oberoi, Davda, Bansal, & Sejal, 2020)

- The draft of National Logistics Policy was published by the Ministry of Commerce and Industry (MoCI) on 05th February 2019, to seek suggestions from various stakeholders which can be examined and reviewed before finalizing the Policy.

- Aim: To reduce the logistics cost from 14% to less than 10% by 2022 and to promote smooth movement of goods across the country.

- Challenges: The challenges faced by the industry are multi-fold, and include insufficient transport network, unregulated growth of information technology, underdeveloped warehousing facilities.

Figure 2.7: Key Areas of India's NLP

- Key Points:
  - National Logistics Policy is brought out to address the various challenges bedeviling the smooth cargo movement and imposing additional cost to importers and exporters.
  - India’s logistics sector has been fragmented and unorganized despite its economic growth.
  - The Policy will facilitate in creating a point of reference for all matters relating to logistics and trade which will also function as an information and knowledge sharing platform.
  - The Policy at the same time will also provide impetus to trade, and focus on economic growth which will lead in competitiveness of imports and export and double the employment in logistics sector by generating additional 10-15 million jobs and target on improving skills in the sector and encourage gender diversity.

- Efficient and practical implementation of the Policy would help provide an impulse to consistent trade border facilitation, and improve India's ranking in the Logistics Performance Index (LPI) and boost investments.

- Solution: Logistics Policy includes improvement in road network, rail corridors and modern cargo facilities. The warehousing facility is required for changing the dynamics of the manufacturing, modern sales and distribution. Due to this policy, the warehousing sector will develop in India by improving the storage facilities across country and also promote cross regional trade on e-commerce platforms by smooth flow of goods. The logistics plan can prove to be a crucial element in bridging the gap between producers and consumers.

(Sangam & Shee, 2017)

- In this research paper, it is argued that the risk of blindness when outsourcing (i.e. movement of goods from outside supplier) can be mitigated through effective governance.
- Governance can be defined as a mechanism where partners cope with uncertainty by minimizing complexity, simplifying routines and sharing information through their knowledge structures. Or
- Governance is a set of management system, guidelines, protocols, relationships and governing structures that provide the framework to achieving targeted strategic goals.
- Governance can help both parties in a business relationship ensuring the end customer receives value-added services. Effective governance mechanisms are likely to get organizational success. Without adequate governance structures, any project runs into the risk of conflicts and inconsistencies, which may prevent the project from reaching its goal.
- It talks about the efforts made by Indian government for showing growth in logistics by the recent completion of the various highway

road projects which are an improved backbone for national transport to carry about 60% of India's total freight volume.

- Also it put up the point of growth in India's GDP and that had made a strong economic progress and has prompted remarkable growth in logistics outsourcing, and due to that more 3PL service providers are cashing in potential opportunities partly due to increasing awareness and various government support and initiatives in this sector.
- Research is concluded on these 3 parameters of governance. (shown in below figure 2.8)

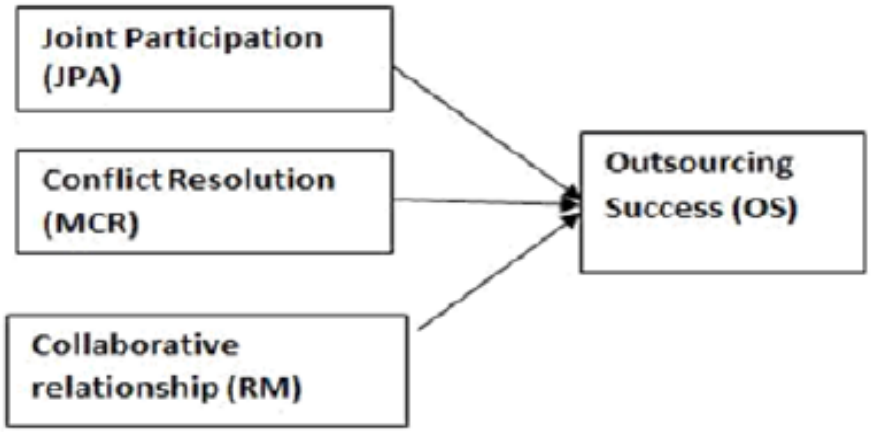


Figure 2.8: Governance Research Framework

Source: (Sangam & Shee, 2017)

(Chandra & Jain, 2009)

- Indian Railway (IR) charges 56 paise per net ton km (ntkm) in 2005.
- Multimodal Transportation of Goods Act of 1993. (Door-to-Door (D2D) service using multiple modes) (According to this Act multi-modal 52 transportation can only be carried out by a company registered as a multi-modal transport operator. The Act was introduced to expedite exports by assuring exporters a sense of security in transporting their goods.)
- Under National Maritime Development Programme (NMDP), govt. if encouraging Public-Private Partnership (PPP) in building and maintenance of ports.

(Das, 2020)

- The Indian government always has an objective to encourage growth of exports.
- Below figure shows the percentage of companies in India outsourcing different types of logistics operations:

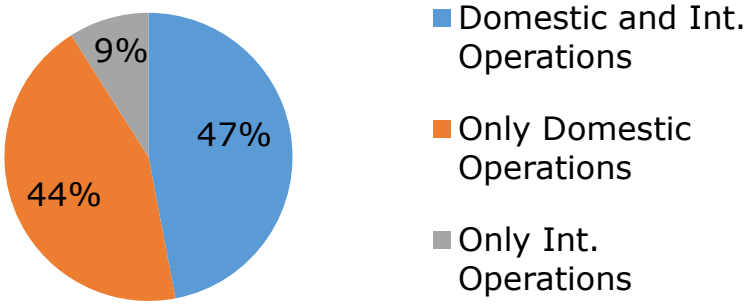


Figure 2.9: Percentage of Companies – Outsourcing

Source: (Das, 2020)

- In developing countries like India an efficient logistics infrastructure can reduce cost of transportation which in turn can contribute directly to global competitiveness of the country. Efficient logistics industry acts as an economic catalyst by opening up new market opportunities, moving products and services with speed and efficiency. Logistics is the key foundation upon which other economic sectors depend and consumer demands are met.

2.2 ARTICLES, INTERVIEWS AND REPORTS

2.2.1 Types of Logistics

Source: (What is the difference between 1PL, 2PL, 3PL, 4PL, and 5PL?, 2019)

Also known as a massive chain network, logistics is a detailed organization responsible for carrying out various delivery and shipment related operations. Whenever a product from an online store gets booked these logistics are the ones, that takes care of the shipment and makes sure that one can get the right product in hand. The rise of e-commerce has made a significant contribution in a world as well as

Indian economy and so did the logistics sector. Without logistics, a concept of e-commerce could have never been possible to be implemented. Below are different types of logistics available like 1PL, 2PL, 3PL, 4PL & 5PL and how they are unique in their own way.

Figure 2.10: Levels in Logistics Operations

Source: (What is the difference between 1PL, 2PL, 3PL, 4PL, and 5PL?, 2019)

1PL: 1st Party Logistics

It is referred to a firm or individual, that has their own cargo, freight and can transport goods and merchandise from one point to another point. They are the specifically the consigner of different goods and products and organizes the transport of products to their respective destinations. It mainly consists of two parties that get benefit from the transaction, the manufacturer or the supplier and the person buying it. There are no other middlemen involved in the whole process.

2PL: Second Party Logistics

It generally involves transport of goods from a particular transport area of the supply chain like rail, road, sea or air. They are the asset-based carriers and includes transport using ships of own lease and airlines that they are contracted with. They are mainly used for international transportation of heavy and wholesale goods and also for trading purpose.

3PL: 3rd Party Logistics

It is a supply chain that primarily concerns the transportation and delivery of different products but also includes various types of additional services as well. The functions of 3PL include warehousing, terminal operations, customs brokerage, supply chain management and many more. It also includes logistics IT software products and analysis services, for tracking and tracing the delivery status of different products. These 3rd party logistics delivers all the above-mentioned services and are specialized in domestic and offshore warehousing and also manages supply chains.

4PL: 4th Party Logistics

Among the 1PL 2PL 3Pl 4PL and 5PL, the 4th party logistics is a new concept into the market, and it involves employing an overseer for managing an entire supply chain of a company. These logistics are often called Lead Logistics provider and they are often treated as a consulting company for many supply chains. They act as a head administrator and takes care of every aspect of these supply chain companies.

With increased efficiency 4PL is becoming the next big thing in the logistics sector. These are providing a single invoice solution and streamlines logistic work like no other.

5PL: 5th Party Logistics

A fifth party logistics provider is also known as a logistics aggregator. They will aggregate the demands of the 3PL and others into bulk volume for getting better rates with different types of airlines and shipping companies. This type of logistics is not asset based. It usually works seamlessly across all disciplines.

2.2.2 News Articles

- Adani-Flipkart Warehouse Deal – The Hindu article
  - Article wrote about the new commercial partnership done for logistics and data center related business and also describes the rising demand for logistics infrastructure in urban planning.

- Why warehouses/fulfillment centers needed by E-commerce platforms?
  - E-commerce market will rise to $200 billion by 2026.
  - Strengthening supply chain infrastructure.
  - For making their service better.
  - For making deliveries faster on Times.
- Flipkart with Haryana Government has partnered 140 acres of land for Warehousing facilities.

- Commerce Ministry, Urban Affairs Ministry to work on Logistics Planning in Cities – Money Control article
  - 50 cities are being selected for logistics planning and an initiative for consultative and collaborative framework to be generated in the country.

- Covid-19 ups demand for efficient last mile delivery and intra-city logistics – IIFL News Service article
  - Covid-19 accelerated the shift towards digitization on online services in India. It is estimated that 20% of small businesses offer online services, leaving a large and infinite possibilities for growth in logistics sector.

- Covid-19 vaccine distribution to give cold chain logistics sector a boost – The Economic Times article
  - As per a report by Research and Markets, the Indian cold chain market was worth Rs 1,121 billion in 2018 and is further projected to reach Rs 2,618 billion by 2024, growing at a CAGR of 14.8% during 2019-2024.

- Demand for warehousing to remain strong in 2021 – Financial Express article
  - As per Savills India, 3 million sq. ft. of warehousing space was absorbed in 2020 by logistics players in tier II cities. Industrial and warehousing space absorption is expected to grow 83% by end of

the year to 47.7 million sq. ft. in 2021, driven by robust growth in e-commerce and manufacturing, and it expects to gain momentum as demand for cold chain, pharmaceutical warehouses as well as growth in e-commerce and organized retail are likely to drive logistics infrastructure in urban planning in upcoming years.

- Growth and Innovation in the Logistics Sector – The Economic Times article
  - Increasing investments and trade point towards a healthy outlook for the Indian freight sector. Port capacity is expected to grow at a CAGR of 5% to 6% by 2022, thereby, adding a capacity of 275 to 325 MT. Indian Railways aims to increase its freight traffic from 1.1 billion tons in 2017 to 3.3 billion tons in 2030. Freight traffic on airports in India has the potential to reach 17 million tons by FY 2040.
  - The National Logistics Policy that would be released by the GoI would provide an impetus to trade, enhance export competitiveness, and improve India's ranking in the LPI.

2.2.3 Interviews

- Interview Rajya Sabha TV by Kriti Mishra – Interview was conducted on India's Draft National Logistics Policy from the 3 different stakeholders and suggestions provided were of Effective and Efficient Logistics ecosystem that can be a key contributor to the robust economic growth in the country.

  Ajay Dua - Former Secretary, MoCI
  - Why Logistics?
  - E-commerce and Multi Modal Logistics is a way forward in future.

  SK Jindal, Chairman, Investment and Capital Markets, ASSOCHAM

- Importance of Logistics in business is very important but we were not focusing on it and now we have focus on it and we can do a lot in it, we have tremendous amount of potential.
- Logistics is required whatever you do.
- It is the backbone of businesses.
- There is tremendous potential through start-ups.

Sachin Haritash, Director, Chetak Cargo Pvt. Ltd.

- It will help in reducing the inefficient supply chain with benefits of cost reduction and help new players to enter into the logistics market.

- Logistics Data Bank Interview CNBC **(www.ldb.co.in)** – They discussed about the logistics data bank that is created using digitized assets of app and web based services, E-way portal and real time tracking data in it.

  1) Piyush Sinha, Director, DMICDC Logistics Data Services (DLDSL)

  - App and Web based services that contain the IoT data of ongoing container information with the unique identity number, location, timings, report and route map real time data in it.
  - It is linked with E-way bill portal of Government of India. (GoI)
  - This would benefit the receiver to make on time delivery of the items that he/she might be receiving.

  2) Varun Gada, National Head, Liladhar Pasoo (LP)

  - Smart Warehousing with multi use & digitized.
  - Offering end to end logistics services.
  - Currently having a sum of 1.2 million square feet of space in India at 10 locations.

  3) Rajesh Gandhi, Chairman, Kompress India

  - Works in Storage sector in Logistics.

- Commerce Ministry's Logistics Division unveils plans for 'Freight Smart Cities' – PIB Delhi
  - Logistics Division of MoCI had discussed the plan for "Freight Smart Cities" – to improve the efficiency of urban freight and to reduce the logistics costs.
  - For this the Logistics Division had created a roadmap for improvement in freight movement in Indian cities where comes the concept of 'Freight Smart Cities'.
  - Under this initiative, city-level logistics committees would be formed and they will have related govt. departments and agencies at the local and state levels.
  - Development it to be done in following areas:
    - Peri-urban freight centres,
    - Night-time deliveries,
    - Developing truck routes,
    - Using ITS and modern technologies,
    - Promoting electrification for urban freight and
    - Parcel delivery terminals (like UDC/UDD)

A list of 75 cities is provided having more than 1 million population, which is to be finalized in consultation with State governments.

2.2.4 Reports

- India Logistics Report, MoCI, January 2021
  Source: (TRANSFORMING THE LOGISTICS SECTOR IN INDIA, 2021)

- Indian Government is planning for Logistics in 2 ways:
  - Supply–side Logistics (Unified Policy and Regulatory, Interconnected Infrastructure, Complete Digital Transformation, Holistic Skilling Ecosystem)
  - Demand-side Logistics (Optimal synergetic use specific to sectors, Better logistics for international trade, Support – Resilience, Sustainability, Innovation)

- Govt. is also planning for a unified legal framework for "One Nation-One Contract" paradigm (single bill of lading/freight across modes) supporting "One Nation-One Market".
- Provisions of the law will enable the assignment of a unique Logistics Account Number replacing unwieldy registration systems and encourage excellence certification in the currently fragmented market of logistics service providers. It will also promote common terminology, transparency in charges and better mechanisms for industry lead conciliation and dispute settlement.
- Logistics Division lending a supply chain approaches to looking at and addressing the problems.
- Integration of Multi-mode transport with warehousing location – it gives better efficiency and reduces logistics costs.

- Warehousing Industry Report, CARE Ratings, April 2021
  Source: (Warehousing Industry, 2021)

- Warehouses can be categorized as per Type (General, Specialty, Refrigerated), by Ownership (Public, Private, Bonded), by Sector (Industrial v/s Agricultural), by Usage Pattern (Single v/s Co-warehousing), by Infrastructure (Single Storey v/s Multi-Storey) or by End User Industry. (Automotive, Food and Beverage, Chemical, Consumer Goods and Retail, Textile, Pharmaceutical, Others)

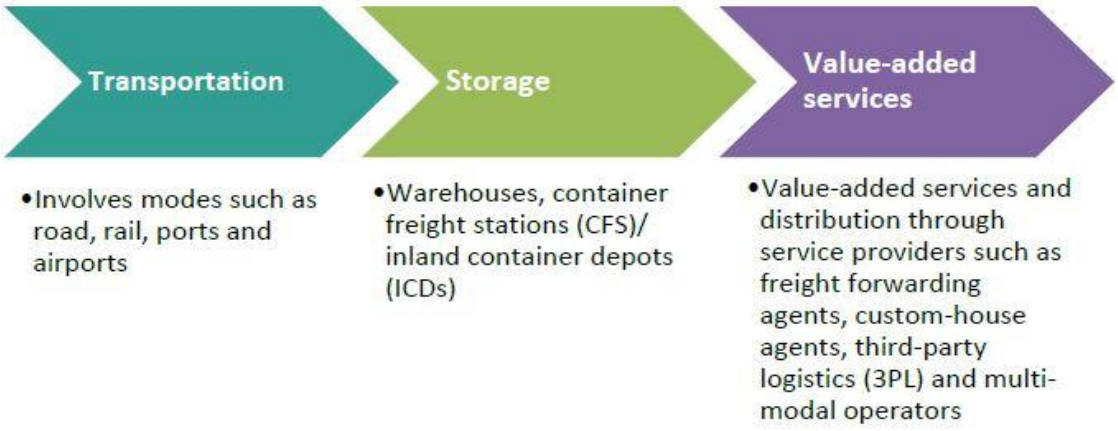


Figure 2.11: Logistics Value Chain

Source: (Warehousing Industry, 2021)

- Warehouses were broadly classified into public-private, bonded, government and co-operative warehouses.

- Goods on the Move Report, NITI Aayog and Rocky Mountain Institute, September 2018
  Source: (Goods on the Move: Efficiency & Sustainability in Indian Logistics, 2018)

Importance of Logistics for Development

Improving efficiency of the logistics sector is of high importance for the country's economy as it boosts economic growth, grows exports through global supply chains and generates employment. While India's passenger and freight mobility sectors are becoming more efficient and the logistics is sector is growing at CAGR of 10.5% in India and is further expected to rise with the Covid-19 vaccine distribution.

Logistical inefficiencies lead to reduced employment opportunities, perpetuate a poverty cycle for rural populations, make roads and highways unsafe, and contribute to pollution. Conversely, enhancing the efficiency of logistics can create high quality economic growth and employment opportunities, improve safety and public health, and support India's successful fulfillment of international commitments towards climate change.

The GoI has launched several initiatives like the "Make in India" in 2014, "Startup India" in 2016, "Atmanirbhar Bharat" in 2020 etc. with an aim to support the manufacturing sector of the Indian economy and elevate its contribution to GDP from the current 17% up to 25%. Efficient logistics are a cornerstone for the continuation of India's economic development over the coming decades. The robust growth in manufacturing envisioned through the "Make in India" initiative will demand high levels of logistical efficiency, which means that goods must not only be produced, they must also be efficiently transported to markets at reasonable prices.

World Bank research in Latin America showed that reducing the share of logistics costs in the final price of goods by 14% can increase demand for those goods by 8–18% and increase employment in that sector by 2.5%–16%. Such an impact is particularly important for micro small and medium enterprises, which employ over 110 million Indian citizens. Specifically for agricultural products, another critical sector of the Indian economy, the same reduction in logistics costs to 14% of final prices increased demand by 12% and increased agricultural employment by 6%—boosting both rural incomes and nutrition and food security for the entire country. Logistics efficiency can also benefit farmers through reduction in loss and wastage of produce during transportation to markets.

Currently, India loses 40% of agricultural production to wastage in the supply chain. Reducing that wastage could both provide an income boost to farmers and also lower overall prices for produce, creating better access to high quality food for Indian citizens.

Employment in the Indian logistics industry, particularly as a truck driver, is a hard life. Truck drivers typically spend long periods away from home and family; more than 25% of drivers return to their home base only after eight days, reducing quality of life and leading to poor outcomes in both physical and psychological health. Around 50% of the truck drivers face driving-related health issues. In 2017 approximately 67% of truck drivers did not have any medical check-up. Truck drivers are also poorly paid, earning only half as much as cab drivers. Furthermore, poor logistics practices often lead to unsafe practices such as overloading of trucks, which compromise road safety both for truck drivers and those with whom they share the road—over 20% of the 1.4 lakh fatalities in 2014 were truck drivers. This combination of factors—low pay, high risk and low quality of life is driving a decline in the number of truck drivers. From 900 truck drivers per 1000 trucks in 2002 the number fell to 600 truck drivers per 1000 trucks in 2017. Resolving key issues in logistics can enhance

safety and health and reduce the overall requirement for truck drivers while providing higher quality employment opportunities in other sectors.

Improved logistics can bring about important environmental benefits. Currently, the share of CO2 emissions from logistics is around 7% of the total CO2 emissions in India, which will undoubtedly grow as govt. manufacturing initiatives accelerates. In Delhi, freight amounts to 67% of the total PM2.5 emissions from the transport sector, 61% of the total SO2 emissions from the transportation sector, and 62% of the total NOx emissions from the transportation sector. Improving the efficiency of logistics can rein in growing demand for trucking services, helping India to meet its international climate commitments while simultaneously reducing pollution in India's most populated cities.

Overall there are existing barriers within goods transportation and inventory management as well as its economic, environmental and social impact. But there is a shift of opportunities to promote more efficient modes, reduce high inventory costs, improve low truck productivity and enhance the efficiency of urban distribution as far as logistics is concern w.r.t. current growing scenario in Indian market.

Logistics Performance Index (LPI):- LPI is an interactive benchmarking tool developed by World Bank, scores countries based on the efficiency of domestic and international freight logistics. Some of the criteria to score a country are logistics service quality, timeliness of delivery, quality of infrastructure, ability to track and trace consignments, efficiency of customs and border management clearance and ease of international shipment. LPI 2018 gives relative ranking of 160 countries across the globe.

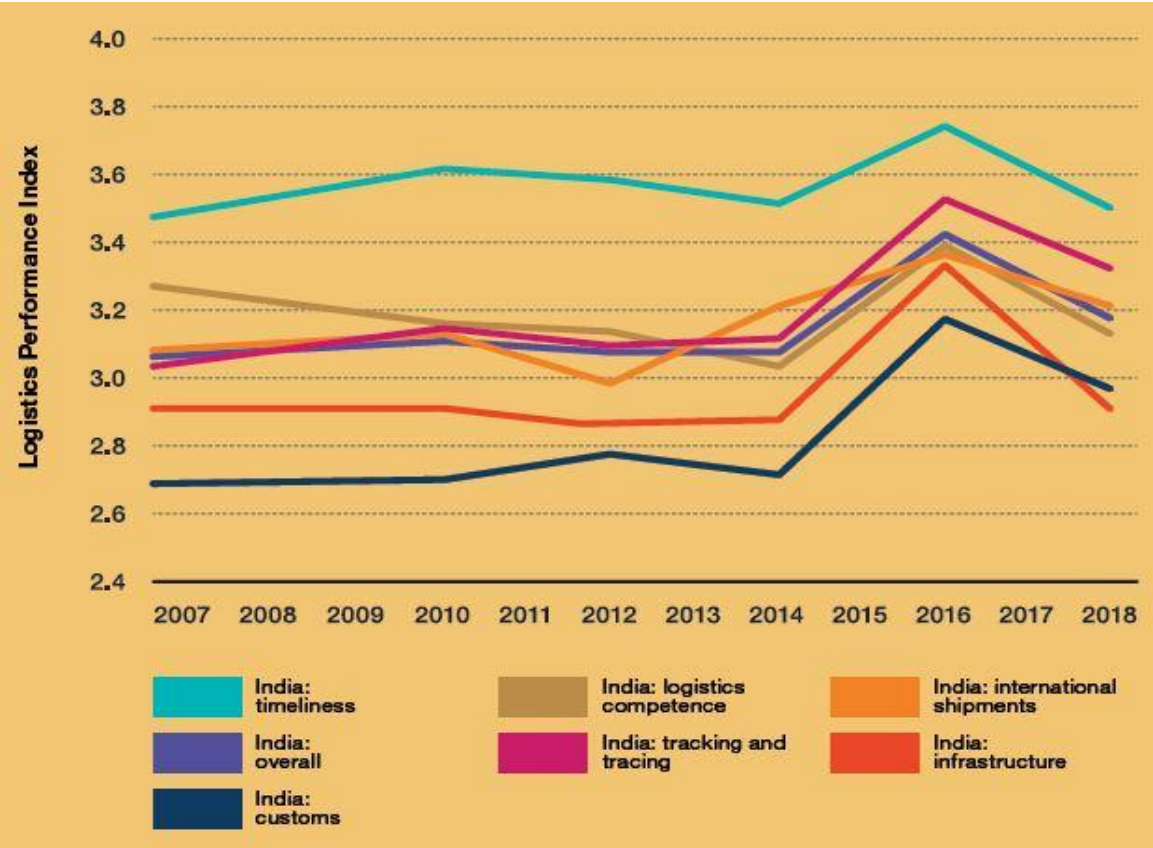


Figure 2.12 Logistics Performance Index of India

Source: (Goods on the Move: Efficiency & Sustainability in Indian Logistics, 2018)

India's LPI had improved from rank 54 to 36 between 2014 and 2016 due to improvements in infrastructure, programs like Make in India and techno-logical and digital improvements in the logistics supply chain. However, India is ranked 44 in LPI in 2018 with a score of 3.18 while Germany has the highest score of 4.2.

India's LPI can be further improved by reducing clearance time, optimizing border procedures (i.e. speed, simplicity and predictability of formalities) and improving quality of infrastructure (e.g. improving quality of roads, rail and ports, developing intermodal hubs, digitization and technological advancements). India can understand focus areas for investments and policy initiatives through a thorough analysis of LPI trends.

2.3 CASE STUDY

2.3.1 London – United Kingdom

Source: (Sustainable Urban Logistics Planning, 2019)

SULP development aims to provide authorities with a framework for a proper implementation of actions, in the context of the SUMP development, for efficiently addressing the challenges and achieving development of a sustainable urban logistics policy and plan which will result in the future sustainability expectations of a city being met.

Figure 2.13: London – SULP

Source: (Sustainable Urban Logistics Planning, 2019)

Role of Urban Logistics in SUMP:-

- One of the issues that have to be addressed in update and evolvement of SUMP is the effective and efficient distribution of goods in the city. The complexity of organizing urban freight distribution is driven by the vast range of activities resulting from relationships among a variety of actors with different and often conflicting needs and goals, and by a number of negative environmental consequences and social effects. These factors make it difficult for a policy planner to propose standard measures suitable for different urban contexts, as well as to develop a common understanding about future expectations.

- In parallel with the above, the science and practice of UFT and city logistics has been developing, and introducing novel solutions to address issues caused by UFT traffic.
- For addressing this, urban logistics aspect is to be provided with practical assistance in the city SUMP.

Challenges:-

- The lack of coordination of urban logistics actors (one who participates in the process) and data/information availability, contribute to insufficient urban planning and integration of urban freight into the city's operations.
- EU-USA Transportation Research Symposium, dedicated to city logistics research (May 30–31, 2013), the community raised the issue of the unavailability or the low quality of data on urban freight. It also stressed the need for more effective data collection methods and for the identification of the main drivers of the economic activity.
- This lack of awareness on UFT activities can be a serious obstacle when determining their current sustainability and planning and implementing appropriate measures to optimize these activities in economic, social and environmental terms.
- In most cities, city planning and traffic surveys are undertaken exclusively as regards to only passenger transport and not to goods transport. Main reasons for not including freight transport while planning a city are:-
  - Urban freight transport is a complex system, made up of numerous activities, and it is necessary to collect data from a large quantity of economic agents.
  - Shippers and transport operators are reluctant to share information about their operations.
  - Local authorities are not able to understand what kind of data is needed.

- Collecting and updating urban freight data can be too costly for local authorities.

2.3.2 Sarbagita – Indonesia

Source: (Mandi, 2017)

Denpasar, Badung, Gianyar and Tabanan are the core metropolitan areas of Sarbagita with more than 1 million inhabitants, there are major ports, Int. Airport and the most tourist destinations and most in demand by both domestic and foreign tourists. The Metropolitan area of SARBAGITA is located on the main freight transportation road because of every national roads and provincial roads in Bali are oriented towards SARBAGITA, and are located on a traffic road connecting Java and Nusa Tenggara.

In urban transport, there are many segments involved in the production and distribution chain: producers, wholesalers, transport operators, retailers and consumers. Each has its own advantages. As a result, there are many decision makers and their information is distributed among spatially dispersed individuals. Therefore, the distribution of urban transport often has high transaction costs and asymmetric information.

Figure 2.14: Sarbagita Metropolitan Area

Source: (Mandi, 2017)

Research Method:

- Qualitative research with multi-respondent stakeholders at government, industry and enterprise levels. This study used a combination of secondary and primary data. Characteristic of freight transportation was obtained through a roadside interview survey.

The general principles of integration in urban freight strategies include (May et al., 2006): Integration between policy instruments involving 1) different modes; 2) infrastructure provision, management, information and pricing; 3) between transport measures and land use planning measures; and 4) with other policy areas.

Rationalizing urban freight transport in the SARBAGITA metropolitan:

Short-term strategy; by doing optimization and regulation with a number of general solutions identified that are; restrictions on access to the city and parking restrictions; out-of-hours delivery; increase road capacity; and expand the number of loading and unloading areas.

Medium term strategy; With the concept of Urban Distribution Center (UDC) with various technical solutions. This is an interesting example for the analysis of differential impacts on the transport flow and emissions of green pollutants and gases in cities and inland areas.

Long-term strategy; Rail Base, i.e. transfer of goods from heavy vehicles to light vehicles causes a rise in the flow of light vehicles because goods must be sent from one point to all end destinations in the city. In this the total number of miles per tonne transported will increase, as do the amount of pollutant emissions and green gas and congestion and obstacles will remain the same in the city.

By rationalizing of the existing transport and logistics system, with the aim to integrate land, water/sea and air transport modes, both intra and inter-modal, in order to develop useful transportation and planning interventions to enhance urban freight transport.

CHAPTER 3 – CONCEPTUAL FRAMEWORK AND METHODOLOGY

3.1 CONCEPTUAL FRAMEWORK

For studying the concept of urban logistics planning it is identified from literatures that there is a need of the study in following field areas:

- Transportation and types of mode in city or region which is being studied,
- Current policies relating to logistics, warehousing and urban planning,
- Data storage centre and which types of data are required,
- Online web-based technology for logistics management,
- Warehousing or UDC if any available in that area and its future requirement identification, norms and standards for its location,
- Last mile delivery vehicles options availabilities,
- Other infrastructural facilities requirements like that of water supply, sanitation and sewerage, electricity, connectivity and
- Authorities dealing with logistics and urban planning are needed to be identified irrespective of the scale in which study is being done.

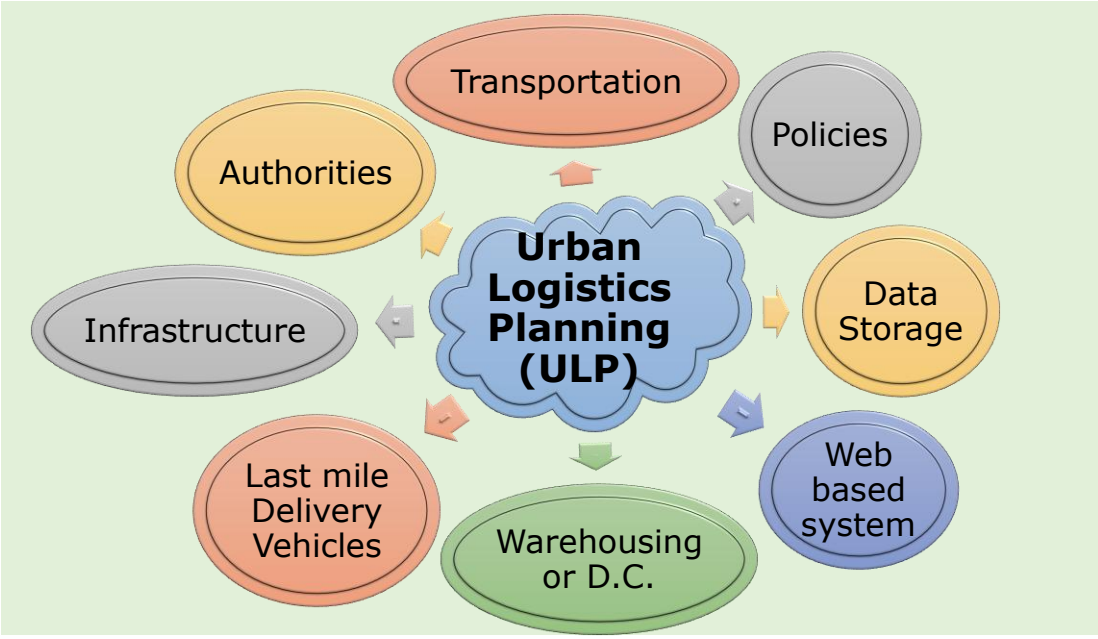


Figure 3.1: Conceptual Framework

After identifying the needs and what is current research providing in this field of study, the aim for the research was identified as: 'To develop a framework layout for the ULP.' This would be in terms to get the phases and parameters that are needed for drafting the logistics plan.

Now the objectives for the study that are going to fulfill the aim and provide the answers to research question are laid in following order:

1) To identify network of grocery and pharmaceutical supply chain in Porbandar city.
2) To identify the physical infrastructure facilities requirements for grocery and pharmaceutical supply chain.
3) To analyze parameters for efficient logistics network planning.

This would go in order step-by-step and each objective gets its linked with the following one and from that analysis and findings are done.

Looking at the scope of work, it is varied in many fields as logistics is related to many different fields and areas. Some areas are relating to benefit end user, reducing interdependencies, infrastructure improvisation and last but not the least for policy framework.

Limitations of work are in terms of lacks of data of logistics movements, focused on specific area/case and of specific sector S.C.

Research is based on main 2 assumptions that are in data collection process, the field data are taken as true as per the information provided by the person who has been interviewed.

3.2 RESEARCH METHODOLOGY

This research work uses Qualitative as well as Quantitative method of study for the Porbandar city. The reason for taking particularly this city as study is due to its connectivity with all 4 mode of transportation i.e. road, rail, airway (airport) and waterway (port).

Volunteer Non-Probability Sampling is carried out for the research work. In this sampling is done based on defining a set of similar characteristics of respondents without giving equal chances to any population size.
The field survey data was collected using an interview questionnaire in Google Forms (refer Appendix I and II) and for focus group interviews of parcel/courier and transport service providers and are presented in the form of maps and charts.

The two most essentials supply chains (S.C.) during Covid-19 pandemic situation were identified and data collection is carried out for these two S.C. After that these supply chains were sub-divided as per their availabilities as below:

1) Grocery Supply Chain
    - Cereals, Condiments, Pulses, Oil etc.
    - Packed Food Items (Flour, Biscuits, Wafers etc.)
    - Bakery and Dairy Food Items (Milk products and Breads)
    - Soft Drinks (Packed drinking water and Cold drinks)
    - Perishable Food Items (Fruits and Vegetables)

2) Pharmaceutical Supply Chain
    - Allopathic Medicines and Drugs
    - Ayurvedic Medicines
    - Surgical Products and Instruments (Syringes, Needles etc.)
    - Medical Devices and Equipments

Research is mainly done for groceries and pharmaceuticals S.C. and also for overall movements of goods in the Porbandar city.

For various objectives, data is collected through these techniques: Research Papers + Case Studies + Individual Survey through Questionnaire + Focus group Interviews + Various Policies + Open Street Map (O.S.M.) data + Other Data for GIS map preparation.

Methodology flowchart process for research work is shown in below figure 3.2:

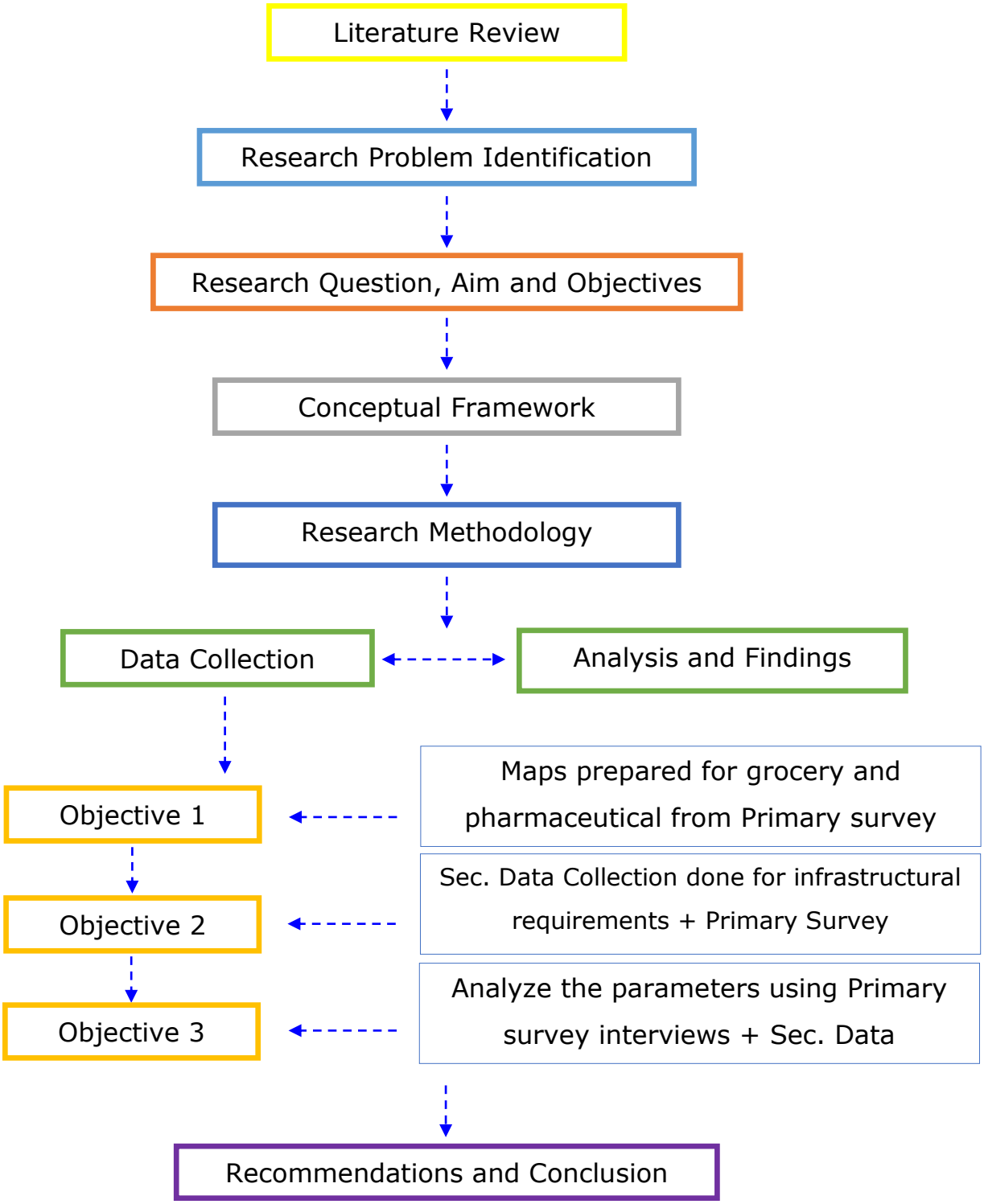


Figure 3.2: Research Methodology

CHAPTER 4 – DATA COLLECTION, ANALYSIS AND FINDINGS

4.1 STUDY AREA – PORBANDAR CITY OVERVIEW

Source: (DHDP, Porbandar, 2016-17)

4.1.1 Background of City

Porbandar, the birthplace of Mahatma Gandhi (Kirti Mandir) is situated at the end of Saurashtra (Gujarat State) and is an all-weather seaport on the Arabian Sea. City (earlier called as Sudamapuri) being connected with the two names – Sudama, the childhood friend of Lord Krishna and Mahatma Gandhi, the father of Nation.

Porbandar district is a part of Kathiawar peninsula located in the western part of Gujarat. The terrain of the district is flat level plain except for a small hilly tact in the North-Eastern part covering Ranavav and Kutiyana talukas. The elevation varies between 5 meters to 630 meters from mean sea level. Among the hill ranges, Barda hill is the prominent one and attains the maximum altitude of 630 meters.

Looking at the grocery S.C., Porbandar has general stores/ supermarkets that are scattered throughout the city at various locations so that all the localities of the city can avail its services to its residents with all the necessary items that are required in day to day life.

Healthcare services are generally considered to be one of the important and mandatory services in any city. Porbandar city is supported by excellent coverage of hospitals and nursing homes for better healthcare**.** Porbandar is known for its closed network of hospitals and medical centers that include specialty clinics, acupressure centers, yoga centers and many others, supporting the health services for every citizen.

Source: (Porbandar City Guide)

Growth of City –

Before 2005 – There was Porbandar city (M+OG), Bokhira Village, Chhaya Municipality and Khapat Census Town (CT).

- In 2007, Bokhira Village comes under Porbandar City (M+OG).
- In 2014, Khapat CT comes under Porbandar City (M+OG).
- At last in previous year 2020, Chhaya Municipality comes under Porbandar City (M+OG).
- After several minor changes the boundary of current Porbandar City (M+OG) gets fixed.
- This whole process of city growth is shown in below figure:

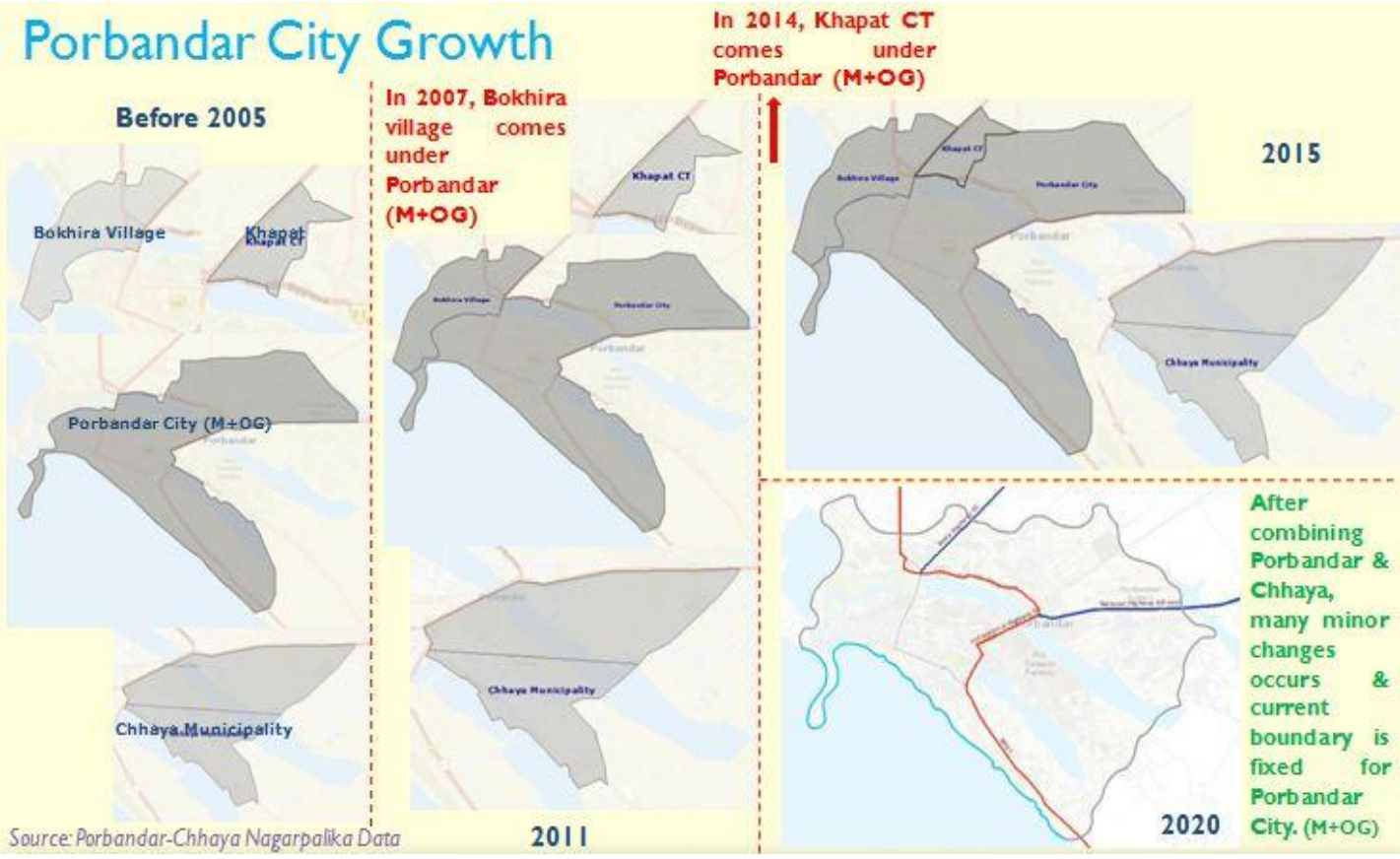


Figure 4.1: Porbandar City Growth

Source: (Porbandar-Chhaya Nagarpalika)

4.1.2 Demographic Profile

Below table shows the demographics of Porbandar District and its 3 talukas: Porbandar, Ranavav and Kutiyana.

Table 4.1: Demographics Data

Place	Porbandar City	Porbandar Taluka	Ranavav Taluka	Kutiyana Taluka	Porbandar District
Year	2011	2011	2011	2011	2011
Population	152760	384660	114568	86221	585449
Population 2020	223917	404541	121794	90880	617215
Population Density (persons per sq. km.)	-	336	195	152	253
Sex Ratio	-	946	959	955	950
Literacy Rate (%)	-	77.9	71.5	71.8	75.78
Total Household	-	81832	24584	18353	124769
Urbanization in % of total population	-	56.47	45.29	19.23	48.80
Total Villages (in 2015)	-	75	61	45	181
Total Geographical Area (ha.) (in 2015)	-	115045	36842	54808	2316 (sq. km.)
Total Forest Area (ha.) (in 2015)	-	1614	4038	4840	10492

4.1.3 Logistics Connectivity

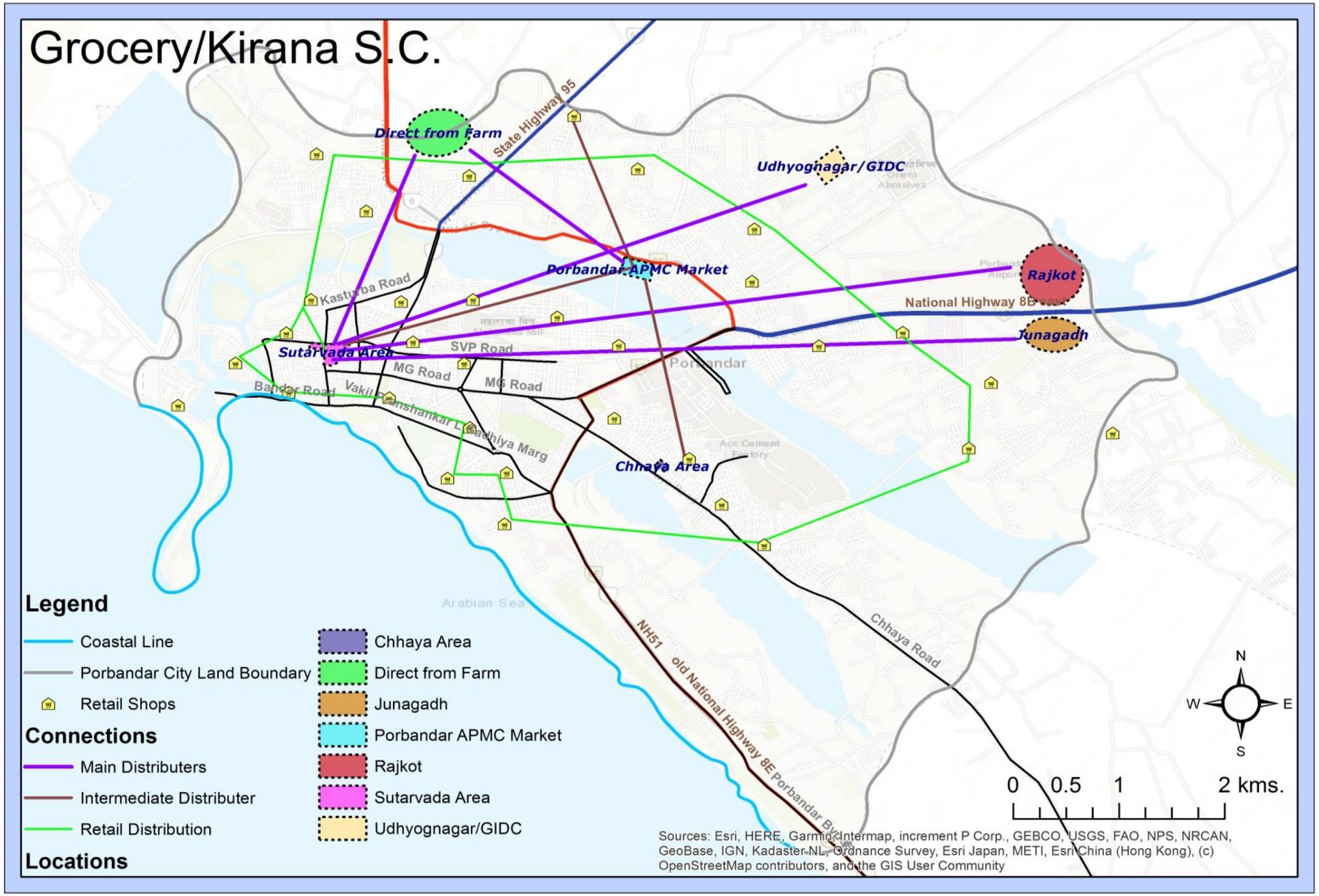
- Porbandar Railway (controlled by Western Railway)
- Road – Porbandar city connected by NH – 8B (old NH-8E) and SH – 06, 27, 28 and 31A
- Air – Porbandar Airport, managed by Airport Authority of India (AAI), closest international airport – Ahmedabad Airport
- Port – Porbandar Port, managed by Gujarat Maritime Board (GMB). It serves as an intermediate port for handling trade.

4.1.4 Industrial Profile

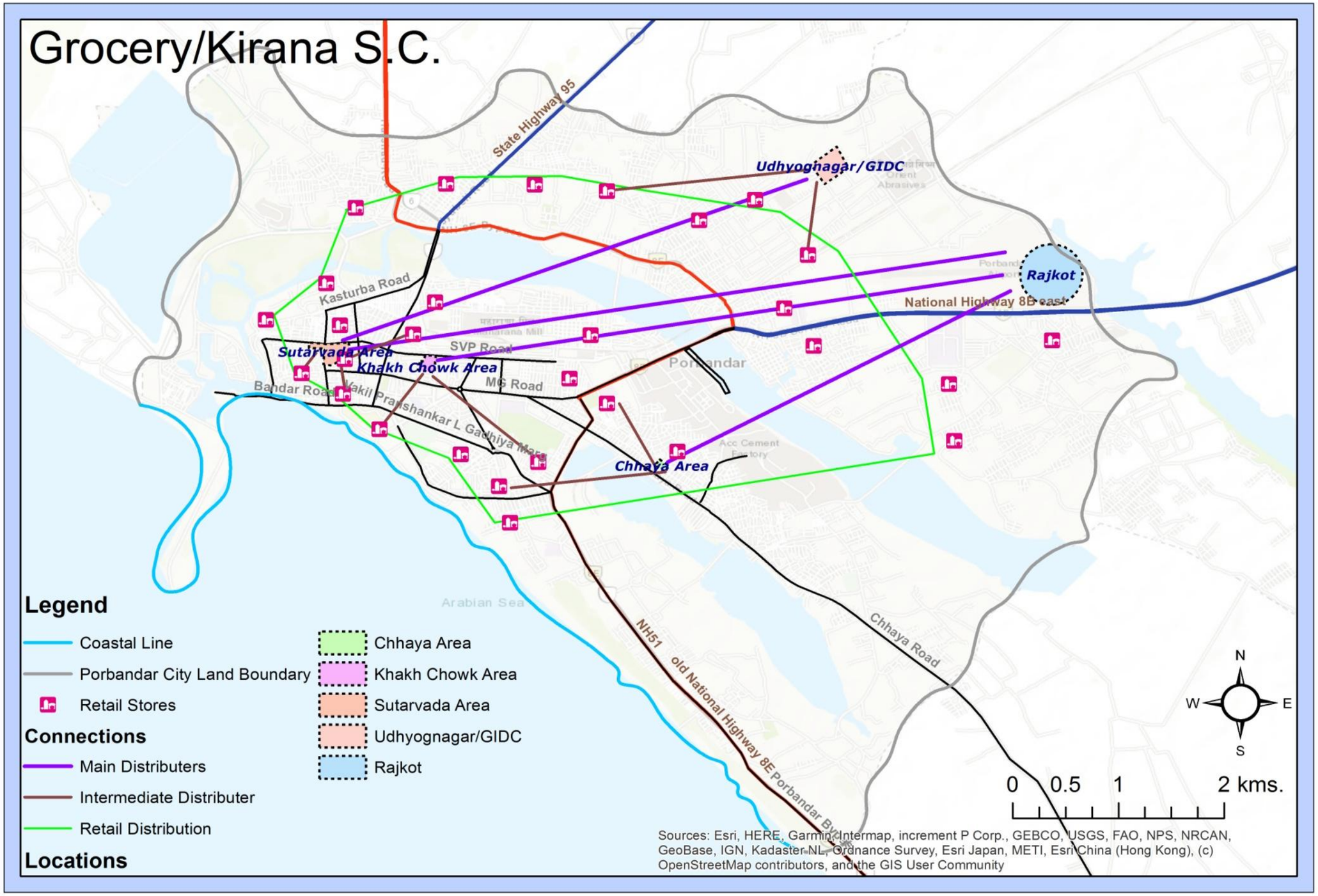
- The district comprises of 3 talukas viz. Porbandar, Ranavav, and Kutiyana. Porbandar has played a pivotal role in the industrial development of the Gujarat state.
- The small-scale industries have been developed in the nearby area of Porbandar city and Dharampur industrial estate.
- There are fish processing units, cold storage for fish, fishing net industries, cement articles manufacturing units as well as auto servicing units situated in the district. The Focus industry sectors of districts are Cement industry and Mineral-based Industries. The districts have 3 industrial areas with approx. 752 industrial units.
- Presence of a port centre has offered cutting edge to the district to catalyze the growth of industries, making it a terminal for export and import of goods. There is one proposed PPP project of 400 crores for Porbandar Port.
- Also port has capacity to increase the traffic from present 16 million tonne to 24 million tonne.

4.2 CURRENT WORKING S.C. IN PORBANDAR CITY

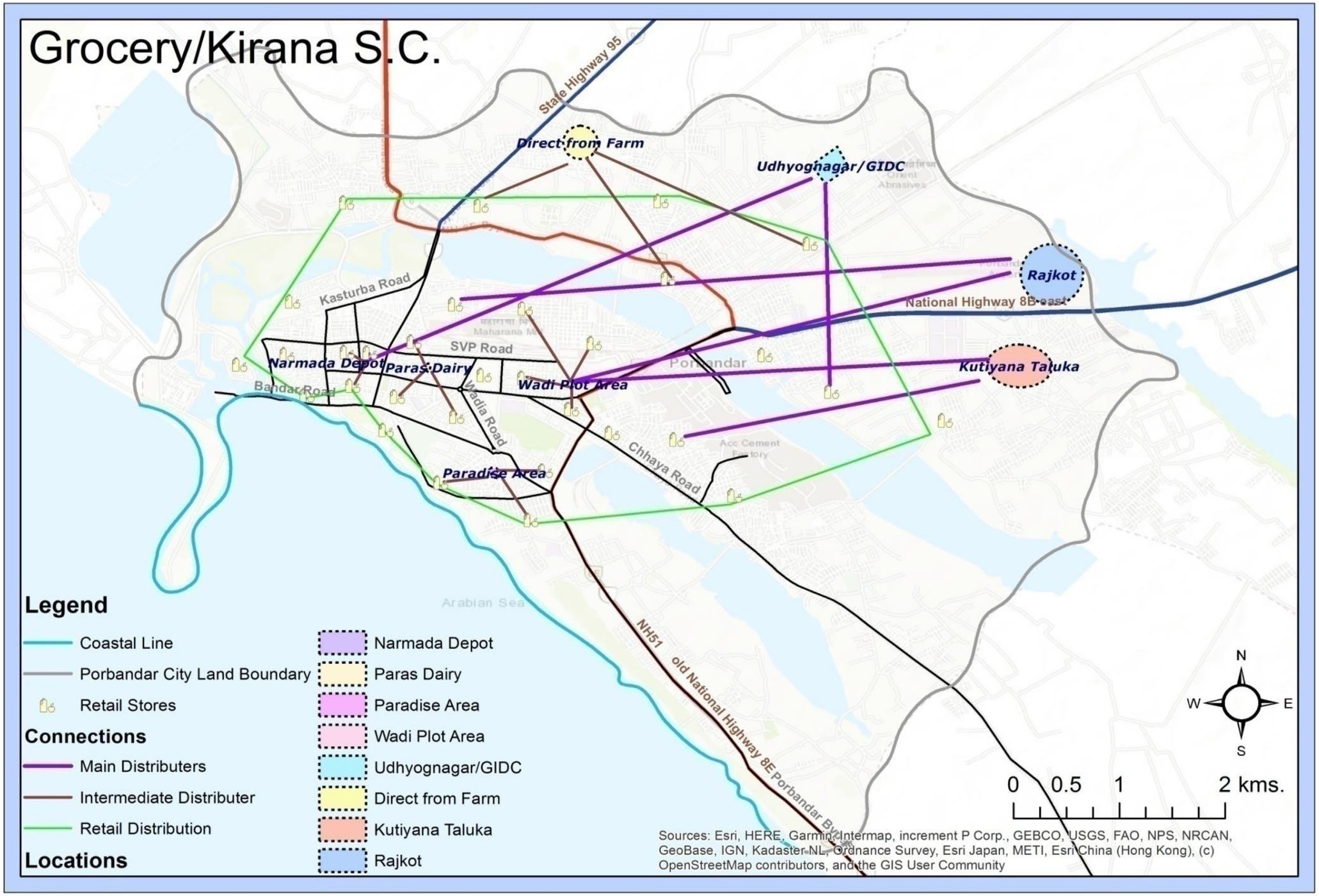
4.2.1 Grocery S.C. types



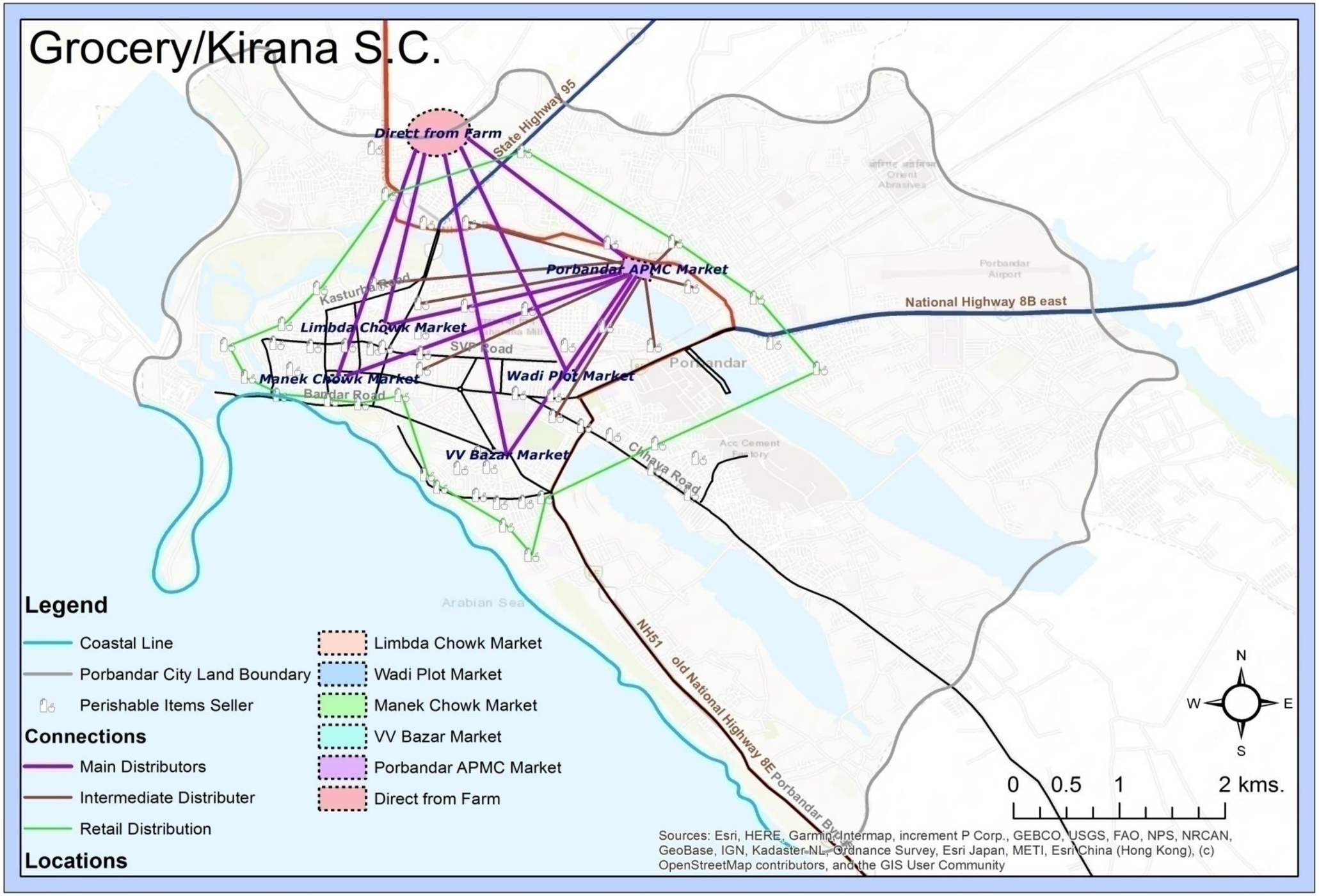
Map 4.1: Cereals, Condiments, Pulses, Oil etc. S.C.



Map 4.2: Packed Foods Items and Soft Drinks S.C.

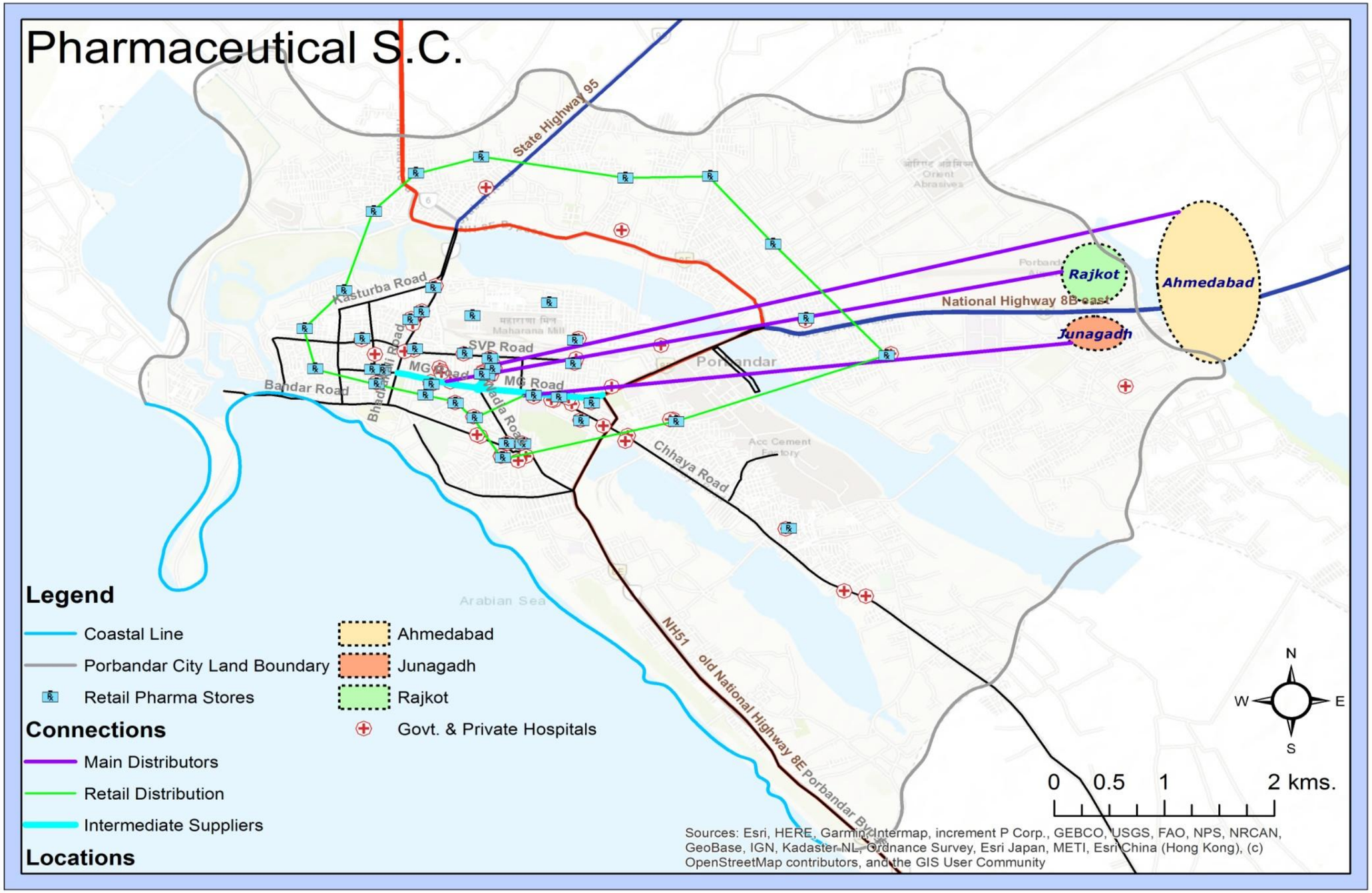


Map 4.3: Bakery and Dairy Food Items S.C.



Map 4.4: Perishable Food Items S.C.

4.2.2 Pharmaceutical S.C. types



Map 4.5: Allopathic Medicines and Drugs, Ayurvedic Medicines, Surgical Products and Instruments, Medical Devices and Equipments S.C.

4.3 PHYSICAL INFRASTRUCTURAL FACILITIES REQUIREMENTS

4.3.1 Upcoming Projects at Different Levels relating to Porbandar city Logistics

International Exposure

Source: (Establishment of Cruise Tourism in Gujarat, Port, Port Services and Logistics, 2017)

- Cruise Tourism – Development of existing ports, jetties into cruise terminals at Okha, Dwarka, Porbandar, Veraval which have existing tourist attraction to be part of the cruise circuit.
- Global Market Overview – Industry wide capacity utilization is more than 100% in 2014. An average of 6 % (total 100 % world cruise tourism) of cruise development was there in Asia in 2015. Cruisers spent $2,200 per person on their last voyage, with $1,635 spent on fare, $565 for onboard and shoring expenditure and $524 for airfare to the boarding port.

- Existing infrastructure to be developed and modified to receive passengers, back-end area of the ports/jetties can be developed into terminals.
- Presence of Medical Assistance - 24 hours presence of so many passengers away from land requires presence of medical assistance on-board ship. At least 5 beds per 200 passengers should be available round the clock with 360 degree medical support.
- GMB needs to develop medical clinic and other similar facilities on 3,750 sq. mt. of land with 2.63 cr. of budget.

National Exposure

Source: (List of Projects in Gujarat, 2018)

Initiative to modernize India's Ports through the Sagar Mala project so that port-led development can be augmented and coastlines can be developed to contribute in India's growth.

Through this project there is Port Modernization to be taken up by GMB for making coastal berth for passenger/cargo at Porbandar Port. The project is estimated to cost Rs. 37 crores and to be developed in Phase-II in Gujarat Coastal Economic Zones (CEZs).

State Exposure

Source: (BIG 2020, 2009)

In Rajkot, Gujarat there is proposed 'Small size multimodal logistic park' which would have an investment of 14 crores as a part of DMIC corridor.

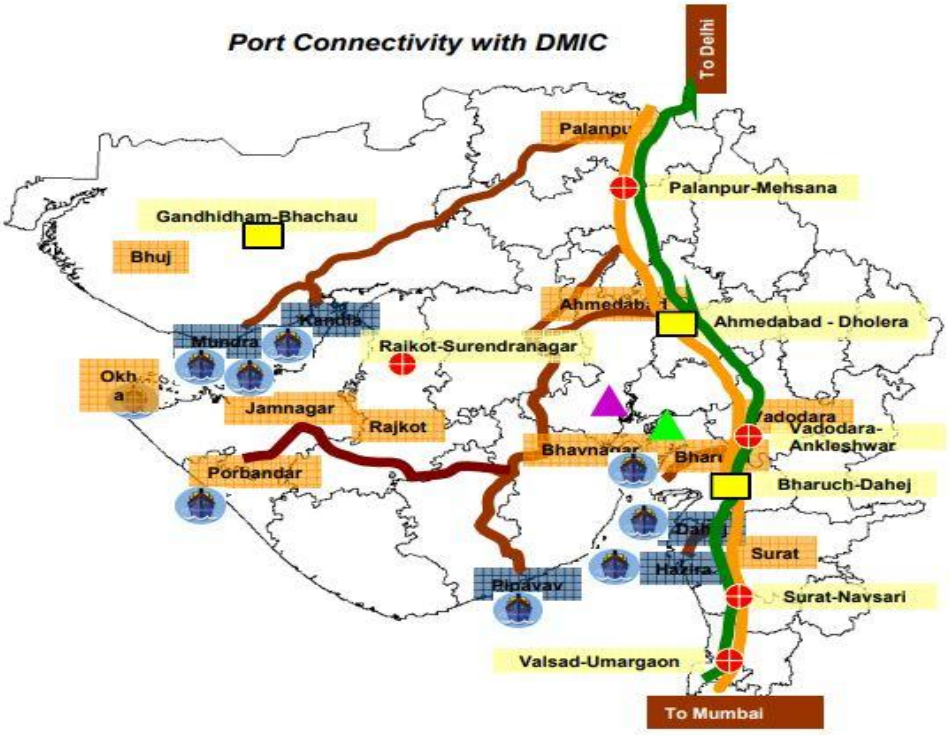


Figure 4.2: Porbandar Port Connectivity with DMIC

From Porbandar, major commodities can be transferred to this Rajkot park and further terminated to different locations from there.

District Exposure

Source: (DHDP, Porbandar, 2016-17)

Currently there is one working industrial estate in Porbandar District. It has an area of 193.20 Ha. Power supply in this estate is 15 Megavolt Amperes (MVA) and Water supply is 0.78 Million liters per day (MLD).
There is one proposed industrial estate at Miyani in Porbandar district.

4.3.2 Field Survey

As earlier mentioned the survey was conducted on field for the grocery and pharmaceutical S.C. through a questionnaire and also done for identifying overall goods movement in the city from courier/parcel and transport service providers in the form of focused group interviews.

The questions that were asked to the grocery and pharmaceutical survey participants and the responses received there on are represented in the form of pie-charts as follows: (figure A is for grocery responses and B for pharmaceuticals responses)

Q-1) Do you think that if distribution of your parcel is speeded up, then you can have better customer network?

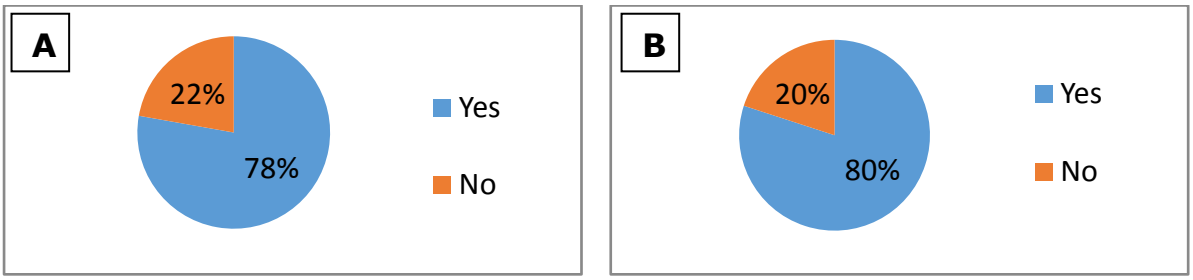


Figure 4.3: Q-1 Distribution Speed-up

From chart it is clearly being identified that there is requirement of more distribution centres for both sectors as a part to increase the speed up of goods parcel for better customer segment network.

Q-2) Peak-hours timing of Deliveries

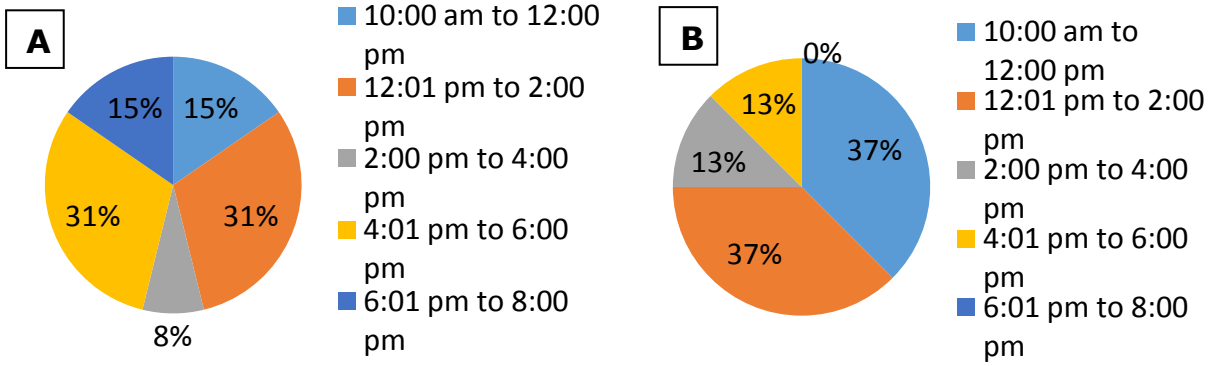


Figure 4.4: Q-2 Peak hour delivery timings

For grocery sector peak hour delivery timings are from 12:00 pm to 6:00 pm and for pharmaceutical sector it is from 10:00 am to 2:00 pm.

Q-3) Type of Vehicle Used by Delivering Agent

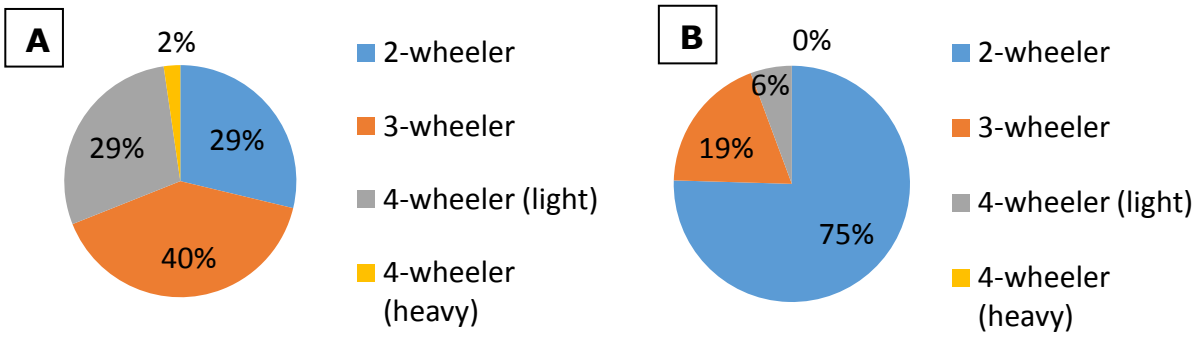


Figure 4.5: Q-3 Vehicle used for delivery

For grocery sector 2-wheeler, 3-wheeler and 4-wheeler light trucks are most preferred and for pharmaceutical sector 2-wheeler is mostly preferred.

Q-4) Do your transport service provider use technology for tracking orders?

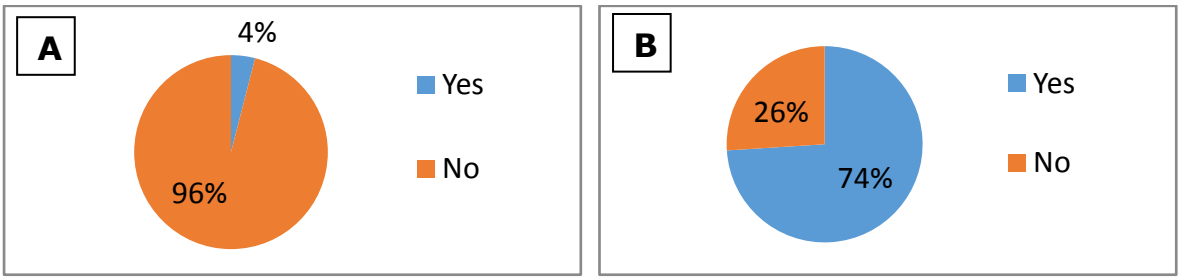


Figure 4.6: Q-4 Tracking orders facilities

From chart it is clearly being identified that there is requirement of tracking facilities in grocery sector while it is good enough in pharmaceutical sector.

Q-5) Impact of Covid-19 on Distribution of products

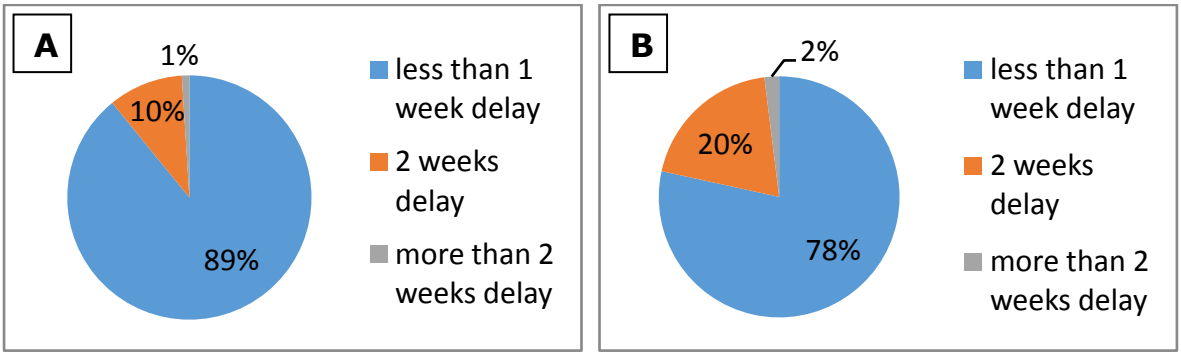


Figure 4.7: Q-5 Pandemic Impact on distribution

Both the sectors are the most essentials one which had the minimalist affect due to Covid-19 pandemic and we can see this from the above charts that most products are being delivered within 1 week time span.

Q-6) Waste from your store is thrown at

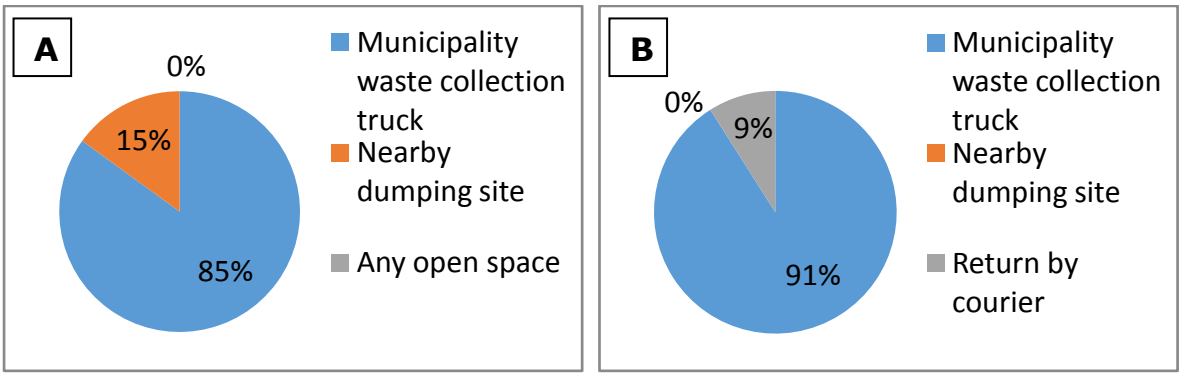


Figure 4.8: Q-6 Waste Collection

For knowing the reverse logistics scenario in the city, this question was added to know how waste is being collected at stores and it was identified from the survey that most waste are being collected by municipal trucks only.

Reverse Logistics –

Following type of waste are generated (but are not limited to) in each S.C. as shown in below table and also there dumping site locations are shown in map.

Table 4.2: Types of waste in both S.C.

Grocery/Kirana Waste	Drugs and Pharmaceuticals Waste
Packaging waste	Cytotoxic and Cytostatic waste
Spoiled food	Pharmaceutical stock which is out of date
Plastic waste	Pharmaceutical stock which is no longer required
Damaged fruits and vegetables	Home-use personal care products
Organic waste	PPE waste
Cardboard Paper waste	All other waste associated with pharmaceutical product packaging

Current Waste Processing Technique: Plastic waste segregation & other waste land filing	Current Waste Processing Technique: Vermi Composting

Figure 4.9: Grocery S.C. dumping site location

Figure 4.10: Pharmaceutical S.C. waste site location

4.3.2 Location Factors and Norms

Source: (URDPFI, 2014 Volume I, 2015)

Location Factor for Proposing Freight Distribution Centre –

- It should be located on main corridor of goods movement,
- It is generally located on fringe of developed lands,
- It should have proper linkage with other freight generating activities as well as developed areas,
- Consideration for intra city goods movement pattern should be kept in view and
- Multimodal connectivity with train corridors and waterways. (if possible)

Distribution Centre should be permitted in:

a) Central District
b) Sub central District
c) District Centres
d) Community Centres (Only Filling Station i.e. only loading service)
e) Residential & Industrial Use Zone in Urban Areas
f) Along National and State Highways
g) Villages identified as growth centres
h) Freight Complex and
i) Proposed major roads

8.2.11.3. Space Norms – Table 8.16 – pg. 297 (URDPFI – 2014, Vol. I)

- Food Grains = 1054 kg stored per sq. mt.
- Fruits and Vegetables = 721 kg. stored per sq. mt.
- Chemicals and fertilizers = 968 kg. stored per sq. mt.

8.4.7. Distribution services – Table 8.57: Norms for Distribution Services – pg. 365 (URDPFI – 2014, Vol. I)

- Milk Distribution = 5000 population to be served = 150 sq. mt. area is required.

4.4 EFFICIENT LOGISTICS NETWORK PLANNING

Source: (Goods on the Move: Efficiency & Sustainability in Indian Logistics, 2018)

In land use policy, there are two main outcomes which can support efficient logistics.

The first is connectivity – land should be made available for logistics development at major modal intersections that are in proximity to significant freight generating areas, such as cities or industrial clusters.

The second is density – logistics facilities that are clustered with other logistics facilities can create economies of density that lower transport costs and increase efficiency.

Benefits –

- Efficient logistics can improve the lives of rural households and farmers and generate more employment opportunities.
- With improved connectivity to rural areas and availability of efficient cold chain logistics, necessities such as vaccines would be available in all rural areas thus preventing deaths.
- This would also improve farmers' income with decreased wastage of fresh fruits and vegetables.
- Improvement in logistics infrastructure and efficiency will lead to a decrease in logistics costs, improved air quality, more employment opportunities, decrease in road accidents, and accelerated economic growth.

4.4.1 Framework for Drafting City Logistics Network Planning

Table 4.3: Phases

Source: (Sustainable Urban Logistics Planning, 2019) & (Matusiewicz, 2019)

Principles	Phases	
Principle 1 - Plan for sustainable mobility in the functional city. Principle 2 - Develop a long-term vision and a clear implementation plan. Principle 3 - Assess current and future performance. Principle 4 - Develop all transport modes in an integrated manner. Principle 5 - Cooperate across institutional boundaries. Principle 6 - Involve citizens and relevant stakeholders. Principle 7 - Arrange for monitoring and evaluation. Principle 8 - Assure quality.	1) Preparation and Analysis	Set up working structures
		Define the development process & scope of plan
		Analyze the current UFT situation
	2) Strategy Development (Roadmap)	Develop vision & objectives with stakeholders
		Set targets & indicators
		Responsibilities allocation
	3) Measure Planning (Plan Preparation)	**Data Collection**
		Compilation of data
		Analysis and Findings
		Interaction between policymakers, stakeholders and the public.
		Final Report/Document Formation
	4) Implementation and monitoring	Identify funding sources for improvement and continuous assess of financial capacities

Table 4.4: Parameters

Logistics Parameters		Specific list of data for preparing ULP
Location Planning	Location of Production Unit or Port/Railway	1. Location of establishment 2. Type of establishment

<table>
<tr><td></td><td>Location of Intermediate Supplier</td><td rowspan="5">3. Size of establishment
4. Frequency of goods flow (per day or per week)
5. Vehicle Type
6. Trip begin location
7. Trip end location
8. Parking area requirements (mapping of current areas)
9. Type of cargo
10. Charges levied (per cargo or per kg)
11. Reliable delivery times (night time deliveries), minimizing delays
12. Technology, ITS, satellite navigation system, freight incentives
13. Cargo consolidation
14. New and/or upgraded terminals (ports and road)
15. Variation during year (seasonal market data)
16. Raise awareness and knowledge/information transfer
17. Future projects proposed idea should be noted
18. Reverse logistics arrangements
19. Solid waste management locations
20. Waste type and processes
21. Impact of Disaster/Pandemic needs to be studied</td></tr>
<tr><td></td><td>Location of End Market</td></tr>
<tr><td rowspan="2">Distribution Planning</td><td>Identify Current Distribution Points e.g. warehouse/UDC</td></tr>
<tr><td>Identification of Delivery Locations</td></tr>
<tr><td rowspan="2">Transport Planning</td><td>Route/Tour Identification</td></tr>
<tr><td>Mode of Shipment</td></tr>
</table>

4.5 DATA ANALYSIS AND FINDINGS

4.5.1 Grocery S.C.

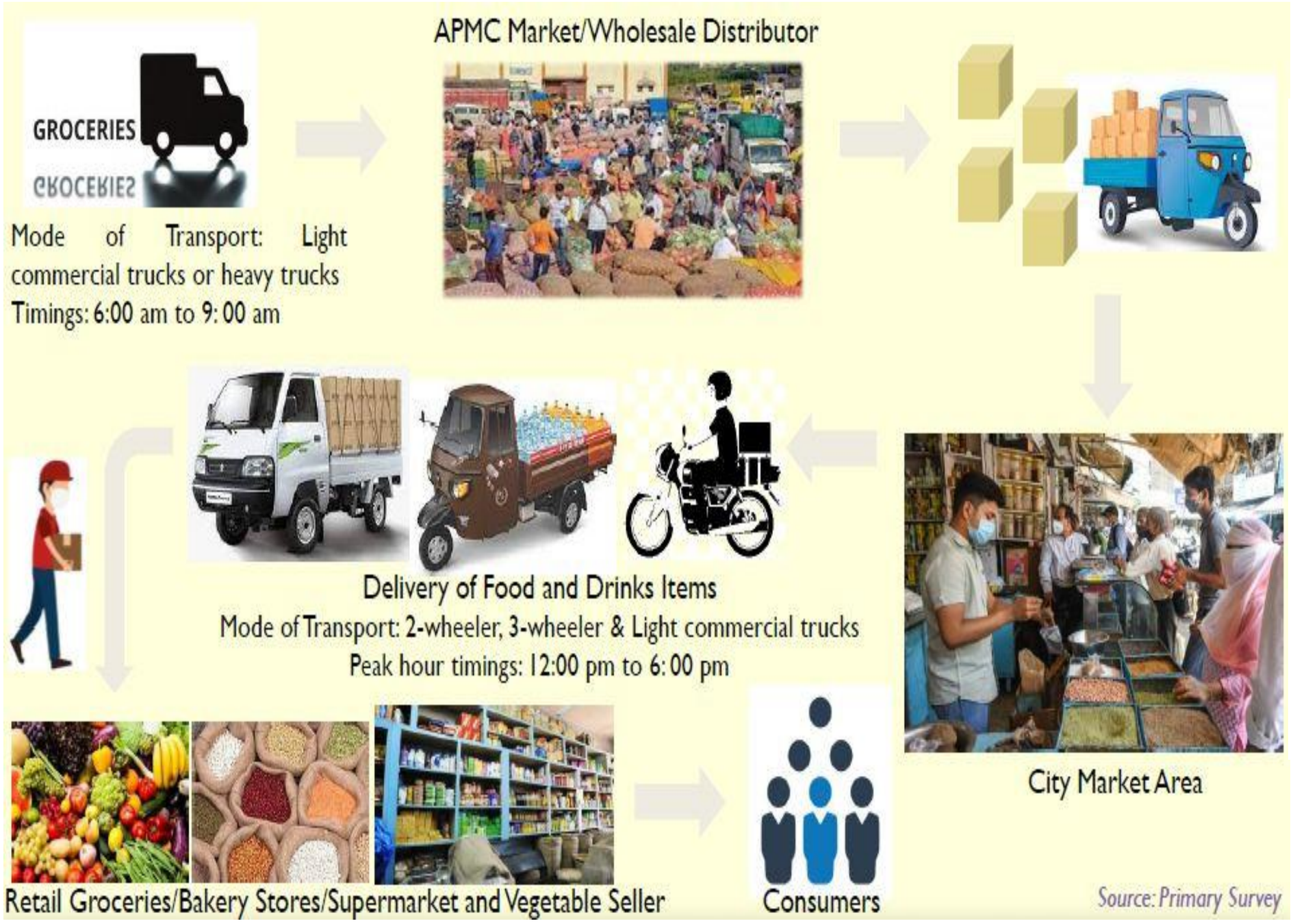
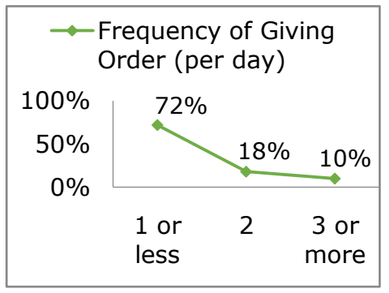


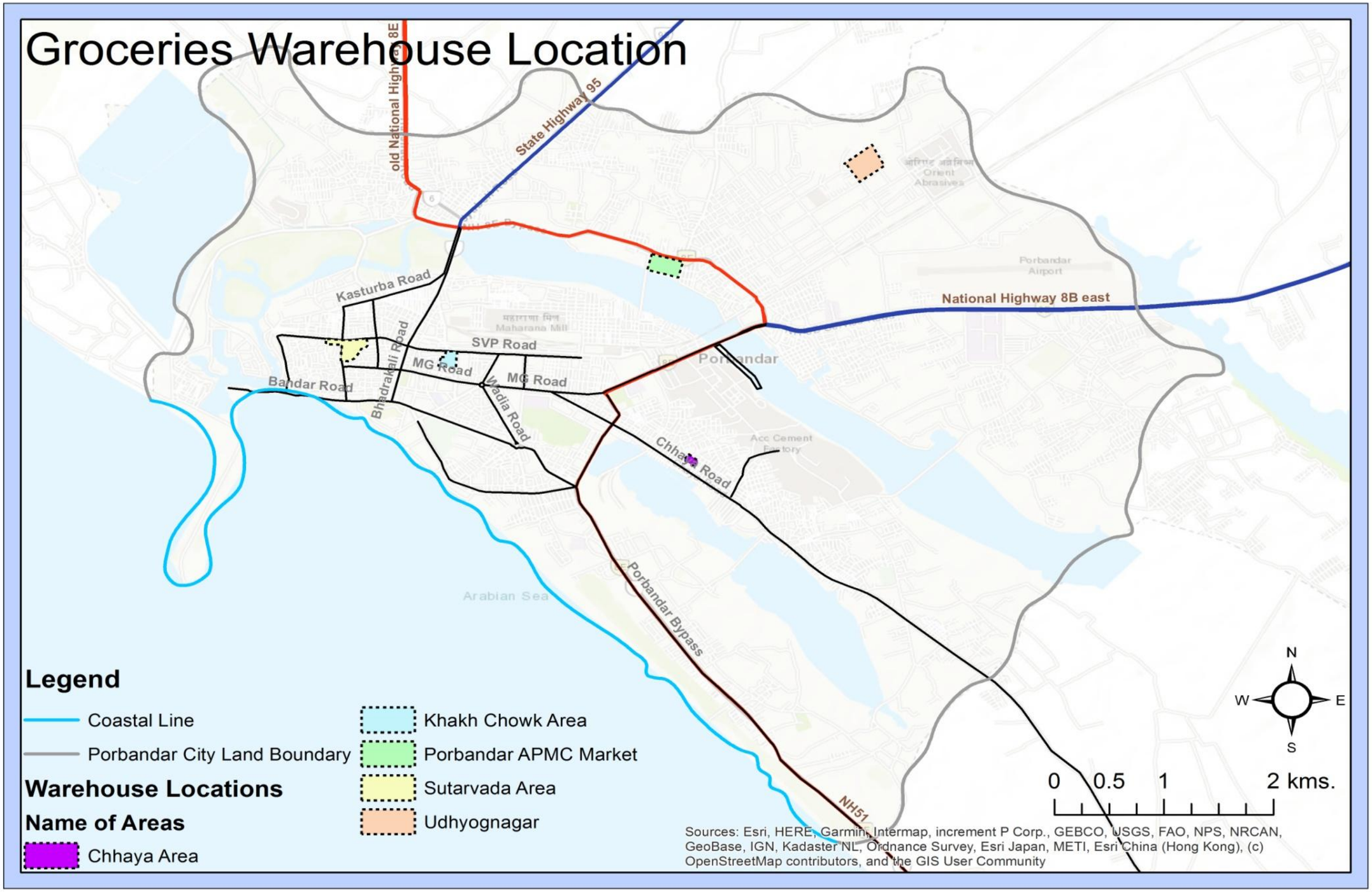
Figure 4.11: Current Running Groceries S.C. in City

Inferences:

Figure shows how grocery products are received, at what time and at which place it is being warehoused at different city locations and from there it gets distributed to retailers and then it gets selled to consumers in Porbandar city.

Most products comes from Rajkot, Junagadh or directly from farms.





Map 4.6: Groceries Warehouse Location

4.5.2 Pharmaceutical S.C.

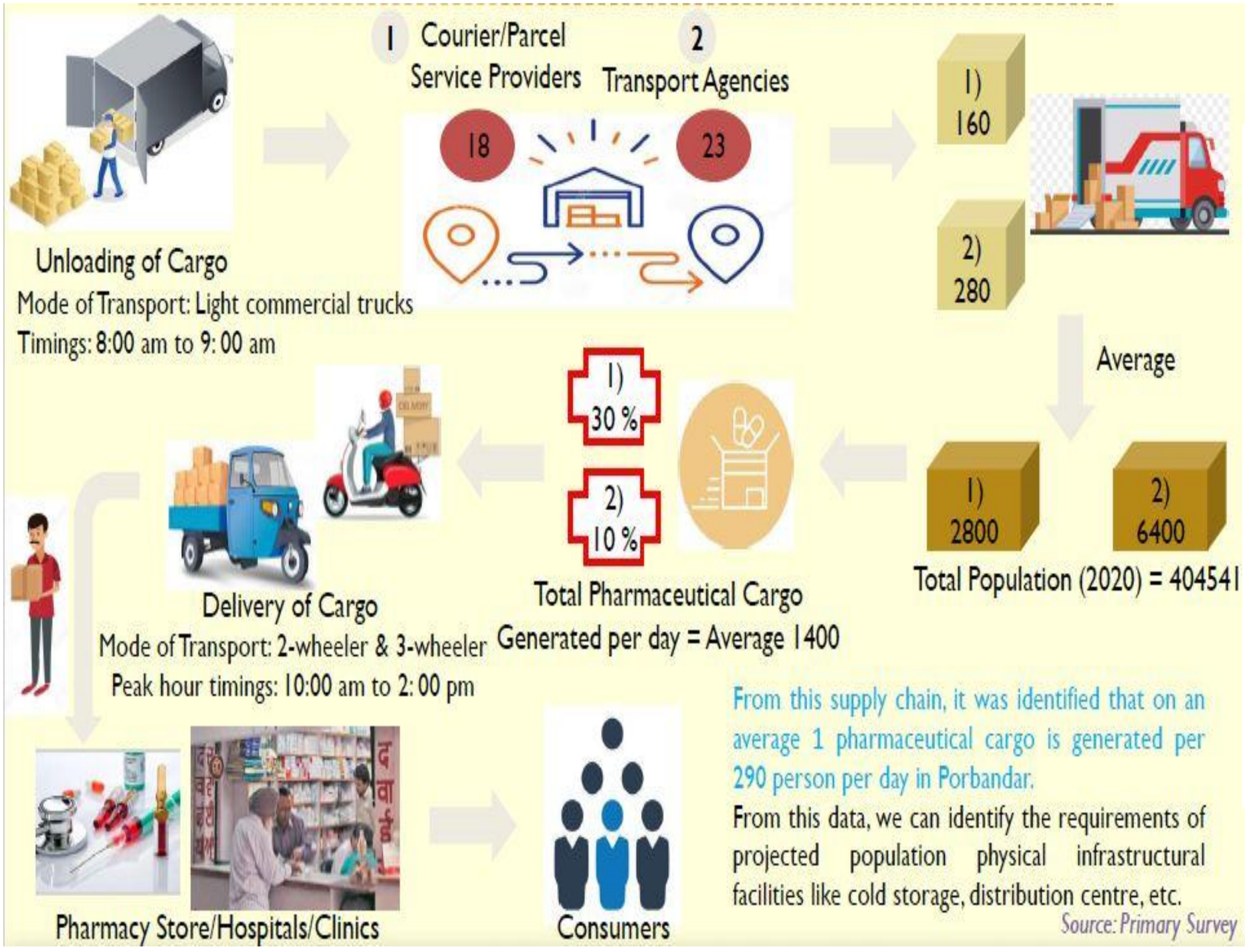
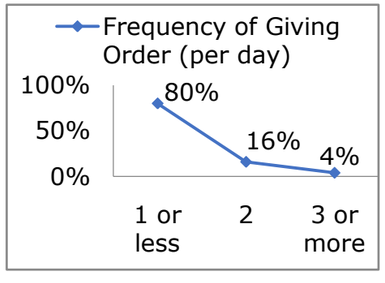


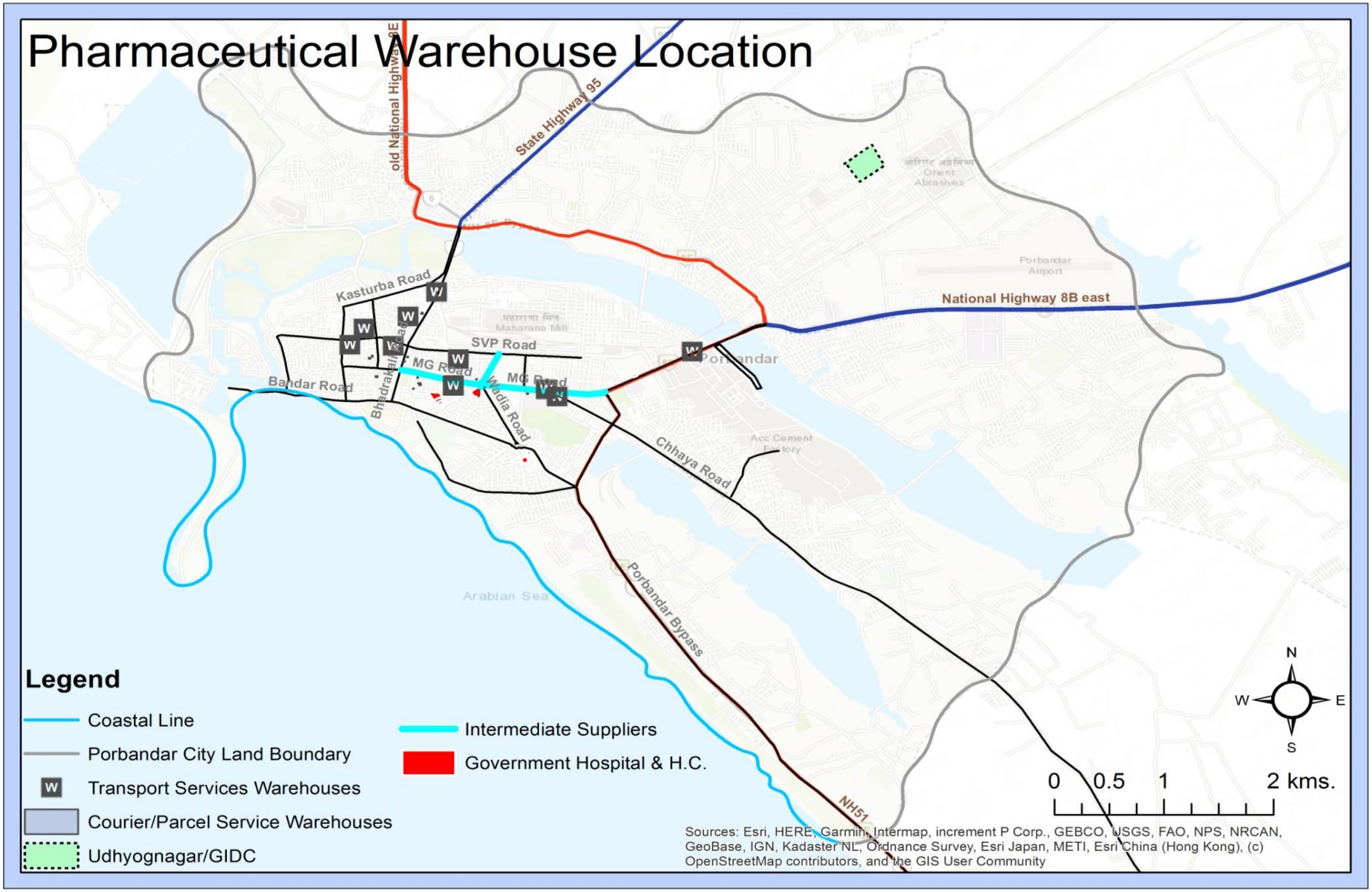
Figure 4.12: Current Running Pharmaceuticals S.C. in City

Inferences:

Figure shows how pharmaceutical products are received, at what time and at which place it is being warehoused at different city locations and from there it gets distributed to wholesalers or directly to retail pharma stores or hospitals or clinics in Porbandar city.

Most products comes from Ahmedabad, Rajkot and Junagadh.





Map 4.7: Pharmaceutical Warehouse Location

CHAPTER 5 – RECOMMENDATIONS AND CONCLUSION

5.1 RECOMMENDATIONS

5.1.1 Digitized Urban Distribution/Consolidation Centre (UDC/UCC)

- Distribution/Consolidation centers are among the highest potential infrastructure solutions to urban logistics inefficiency.
- These centres are cross-docking infrastructure which aggregates deliveries going into urban centers and regroups them into consolidated shipments which allow for greatly enhanced loading and routing efficiency of delivery trucks.

- The next generation being digitized at a rapid pace, the logistics sector is also doing its best and therefore it is a prior need of data localization within the country for making digitized supply chain.
- But when considering it for Porbandar city, digitization of supply chain can be just a thought in process, which can take the time of nearly 8-10 years to be at a level where currently other sectors are digitized in India.
- For this reason, the recommended UDC/UCC should have one inbuilt digitized data centre (or data banks) where various supply chains data like tracking system, product/cargo details, vehicles nos., best possible delivery route identification etc. information can be stored and can collect data for future logistics planning, which in turn can increase the customer network.
- Private logistics players in business are digitizing their supply chain network through web-based GIS, tracking product system, machine learning at inventories locations, smart warehousing, AI based system and many other techniques.

- From these technologies, the recommended centres can generate big data in their servers and can create their data bank for future logistics planning of Porbandar city in terms of various business expansion and research & development work. Such centers in-turn can reduce the current inefficient supply chain problems.

Characteristics of UDC/UCC: Source: (Liberato, 2015)

- Easily accessible and fairly close to the city centre (around 2.5 km)
- Platform for loading and unloading goods
- Should have a digitized data collection system
- Warehouse of 600 sq. mt. (including a small office and facilities)
- Should have minimum external area of 500 sq. mt.

Working of UDC/UCC: Source: (Liberato, 2015)

- Bottom-up Approach (thinking about last mile deliveries to a long term business model). The freight/goods are collected by the UDC/UCC driver, and then directly delivered to the final destination.

- At the beginning
  - A full public (Municipal) management (in a direct way or by means of a Municipally-owned Company) is to be preferred.
- At a later stage
  - Public-Private Partnership (PPP)
  - Approach based on a public tender and on a relevant "service contract" regulating the relationship between Public Administration and Private Company.

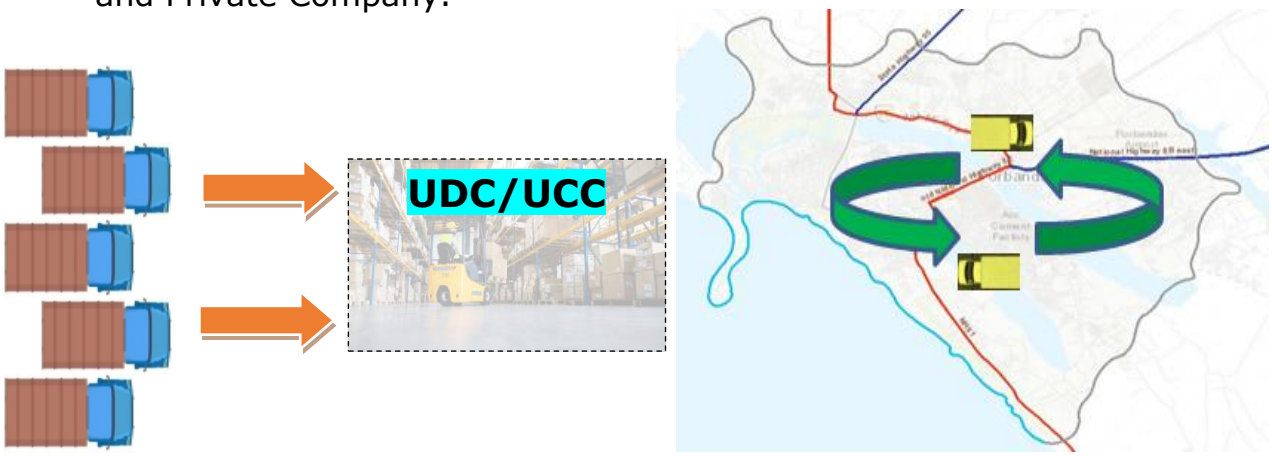


Figure 5.1: Working of UDC/UCC

Benefits:

- Direct storage from Suppliers
- Direct delivery services at any destination
- Specific solution for 'self supply'
- Out of hours/night time deliveries
- Delivery service extension to nearby urban surroundings
- Third party warehousing with on-demand delivery
- Parking facility
- Packaging collection (reverse logistics)
- Goods tracking system
- Promotion of electric vans/vehicles
- Other added value services

5.1.2 Logistics Space in city Development Plan

- Porbandar city have benefited with access to all 4 transport modes i.e. road, railway, port and airway.
- Due to this much good access, city can be converted to major logistics movement access zone for nearby Saurashtra region and might be for Gujarat and India in nearby future.
- For making it happen, the city needs one mini logistics space where it can have access to all the freight transport from different places to one single place and from there is gets distributed to several parts of city area, taluka, to whole Porbandar district and to nearby Saurashtra region and Gujarat state.
- The concept of urban logistics space are typically only successful when they can be built on low value brownfield land such as abandoned industrial facilities or underutilized parking facilities.

5.1.3 Waste Collection and Distribution System as a part of Reverse Logistics

- For waste processing, it is recommended that when the product gets delivered by the wholesale distributors, during this the waste is collected from retailer and then it gets stored at the wholesaler space.
- From there it gets transfer directly to the waste collection truck and from there to the waste management plant.
- For Porbandar city, it requires the plant of plastic recycling so that the total plastic waste collected and segregated can be processed in this plant and can be used further by the manufacturers.

Figure 5.2: Waste Site to Plastic Recycling Plant

5.1.4 EV's movement for last mile freight delivery

- Electric vehicle are taking up the road transport market in many foreign countries. But in India, currently there is huge scope for this type of new fuel vehicle running system.
- Logistics sector can boost the 60.2% road transport petrol/diesel based fuel share to electric vehicle fuel in 5-10 years and can benefit the environment and reduce the road pollution at the highest level.
- From primary survey, it was identified that there is maximum usage of 2-wheeler vehicle for last mile deliveries, which we can change it to electric vehicle by proposing the required infrastructure facilities like new electric filling stations, solar highways etc.

- This can reduce the final delivery cost to end-user and may attract new customer's network.

Figure 5.3: 2 and 3 wheeler electric delivery vehicle model

5.2 CONCLUSION

- Development is only possible if the process works as a whole. Development plans have been taking place in our country in urban planning practices, but the process of implementing them in productive ways is the thing which can lead us to development. The future for logistics industry in India is bright and the further expectation in recent Covid-19 pandemic situation for vaccine and medical supply, rising online businesses, etc. would push the industry to reach edit to greater heights. Therefore, India must adopt a holistic approach in designing integrated transport networks for urban logistics planning in the process of updation in Development Plans.

- There is a need for an strong vision and aim to make the country digitally strong and empowered with different upcoming technologies for creating databanks in logistics sector. This can provide information sharing platform and other facilities for infrastructural requirements and for framing polices at different levels and for various ineffective supply chains.

- For efficient flow of goods, promoting excellence and, improving the quality in logistics sector, a proper networking should be done

including the reverse logistics process, in the form of ULP/ Logistics Master Plan or it may gets included while revising the current City Development Plan. It must be done by every municipality or Municipal Corporation (M.C.) or regional authorities for improvement in logistics sector.

- Governance in urban regions for logistics development can slow down current logistics sprawl and redevelop logistics sites of warehousing or distribution/consolidation centres in dense area.

- If logistics planned properly it can be a key contributor to the economic development of the country, as well as other potentials too in the field of:
  - managing wastage of product in reverse logistics process making the S.C. more efficient,
  - promote the urban distributions for more competitiveness,
  - enhance self data-localization within the country,
  - drive the 'Make in India' and "Atmanirbhar Bharat" initiative with integrated transport mode connectivity,
  - reduce climate change footprints with EV' as last mile connectivity and
  - accelerate the post pandemic small and retail business scenarios.

- With the afore mentioned efforts, if done and implemented speedily then it is hoped that in the next 8-10 years the Porbandar city logistics network would benefit the commercial sector as well as the consumer sector in the groceries, pharmaceuticals and other various sectors too.

- As a way forward it will ultimately reduce the logistics cost and ensure that the Logistics sector serves as an engine of growth and a key driver for transforming the city economy with increase in the number of units of industrials at the city and also for nearby district areas as well.

5.3 FUTURE RESEARCH

Due to time constrains and Covid-19 pandemic situation this research is only focused on the grocery and pharmaceuticals S.C. for a particular case study site i.e. Porbandar city.

There are various future options in this field of research in terms of ULP. It could be done by taking various other S.C. running in the city for e.g. textile, construction materials, automobile, fishing and poultry, furniture and glass materials movement, ceramic industry etc. S.C. can be studied for Porbandar city. Also the phases and parameters that were identified and analyzed (Table 4.3 and 4.4) can be utilized for framing the draft city logistics network plan.

As it was earlier mentioned that the scope in logistics industry is getting raised day-to-day, similar type of study can be done for other cities or region or at village cluster level also so that it can cater the upcoming logistics sprawl problems and make the industry more efficient and fruitful for future logistics operations.

For future researcher in logistics always remember that:

"Less is more in logistics. Instead of putting all the things on the table, focus should be first done on efficient execution of the current available!"

APPENDICES

APPENDIX I: KIRANA/GROCERY SURVEY FORM

Survey Form was filled through online mode using Google Forms. Below listed are the questions asked for Grocery/Kirana S.C.

* Required

1. Name of respondent * _____

2. Address of store (in Porbandar) * _____

Example - Shop No. A012, Sudama Chowk, Porbandar

3. Type of store *
   - Retail Business
   - Wholesale Distributors
   - Supermarket store
   - E-Grocery Supplier

4. Products/Items you sale *
   - Cereals, Condiments, Pulses, Oil etc.
   - Packed Food Items (Flour, Biscuits, Wafers etc.)
   - Bakery & Dairy Items (Milk products & Breads)
   - Soft Drinks (Packed water & Cold drinks)
   - Perishable food items (Fruits &Vegetables)

5. Type of vehicle used by delivering agent *

for delivering your order

   - 2-wheeler (e.g. bicycle/bikes/scooter)
   - 3-wheeler (e.g. auto-rickshaw)
   - 4-wheeler (e.g. light trucks/vans)
   - Heavy truck
   - Self pick-up

6. Peak-hour timing of deliveries *

- 10:00 am to 12:00 pm
- 12:01 pm to 2:00 pm
- 2:01 pm to 4:00 pm
- 4:01 pm to 6:00 pm
- 6:01 pm to 8:00 pm
- Other _____

7. Transportation charges you pay per week (INR) *

- Upto 300
- 301 to 600
- 601 to 900
- 901 to 1200
- more than 1200

8. Mention the address from where your parcel comes (Transport Location) * _____

(Atleast 2 address point in Porbandar)

9. Do your transport service provider use technology for tracking orders? *

- Yes
- No
- Maybe

10. Frequency of giving order *

	1 or less	2	3 or more
Per day			
Per week			
Per month			

11. Most of the orders you make are from *

- Porbandar District
- Saurashtra Region

- Gujarat (outside Saurashtra)
- Out-state (other than Gujarat)

12. Do you need more distribution centers of storage of the products/items you sale? (e.g. mini logistics space) *

For fulfilling demand of your customer / your network

- Yes
- No

13. Do you think that if distribution of your parcel is speeded up, then you can have better customer network? *

- Yes
- No

14. Parcel or Product waste from your store is thrown at *

- Municipality waste collection truck
- NGO's for waste collection
- Nearby dumping site
- on Roads/Streets/any open space
- Other _____

15. Impact of Covid-19 on distribution of products *

Time taken for deliveries after order day

- less than 1 week delay
- 2 weeks delay
- 3 weeks delay
- more than 3 weeks delay

16. Any suggestions for making logistics services more better in Porbandar city. _____

APPENDIX II: PHARMACEUTICAL SURVEY FORM

Survey Form was filled through online mode using Google Forms. Below listed are the questions asked for Pharmaceutical S.C.

* Required

1. Name of respondent * _____

2. Address of store (in Porbandar) * _____

Example - Shop No. A012, Sudama Chowk, Porbandar

3. Type of store *
   - Retail Business (e.g. Medical store)
   - Wholesale Distributors
   - Surgical Products
   - Ayurvedic Store
   - E-Pharma Store

4. Products/Items you sale *
   - Allopathic Medicines & Drugs
   - Ayurvedic Medicines
   - Surgical Products & Instruments (Syringes, Needles etc.)
   - Medical Devices & Equipment's

5. Type of vehicle used by delivering agent *

for delivering your order

   - 2-wheeler (e.g. bicycle/bikes/scooter)
   - 3-wheeler (e.g. auto-rickshaw)
   - 4-wheeler (e.g. light trucks/vans)
   - Heavy truck
   - Self pick-up

6. Peak-hour timing of deliveries *
   - 10:00 am to 12:00 pm
   - 12:01 pm to 2:00 pm

- 2:01 pm to 4:00 pm
- 4:01 pm to 6:00 pm
- 6:01 pm to 8:00 pm
- Other _____

7. Transportation charges you pay per week (INR) *
   - Upto 300
   - 301 to 600
   - 601 to 900
   - 901 to 1200
   - more than 1200

8. Mention the address from where your parcel comes (Transport Location) * _____

(Atleast 2 address point in Porbandar)

9. Do your transport service provider use technology for tracking orders? *
   - Yes
   - No
   - Maybe

10. Frequency of giving order *

	1 or less	2	3 or more
Per day			
Per week			
Per month			

11. Most of the orders you make are from *
   - Porbandar District
   - Saurashtra Region
   - Gujarat (outside Saurashtra)
   - Out-state (other than Gujarat)

12. Do you need more distribution centers of storage of the products/items you sale? (e.g. mini logistics space) *

For fulfilling demand of your customer / your network

- Yes
- No

13. Do you think that if distribution of your parcel is speeded up, then you can have better customer network? *

- Yes
- No

14. Parcel or Product waste from your store is thrown at *

- Municipality waste collection truck
- NGO's for waste collection
- Nearby dumping site
- on Roads/Streets/any open space
- Other _____

15. Impact of Covid-19 on distribution of products *

Time taken for deliveries after order day

- less than 1 week delay
- 2 weeks delay
- 3 weeks delay
- more than 3 weeks delay

16. Any suggestions for making logistics services more better in Porbandar city. _____

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