ANALYSIS AND MANAGEMENT OF LOGISTICS DISTRIBUTION PERFORMANCE IN THE FMCG SECTOR

A thesis submitted to the
University of Petroleum and Energy Studies

For the award of
Doctor of Philosophy

in

Management

By

Pradeep Chauhan

April 2023

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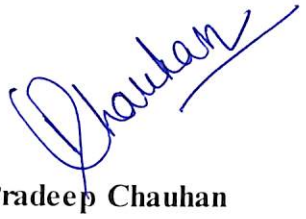
With the blessings of the Almighty,

I dedicate this thesis to my parents and my family

For their endless love, immense support, and encouragement

DECLARATION

I hereby declare that the work which is being presented in the thesis entitled "**ANALYSIS AND MANAGEMENT OF LOGISTICS DISTRIBUTION PERFORMANCE IN FMCG SECTOR**" in fulfilment of the requirements for the award of the **Degree of Doctor of Philosophy** and submitted to the **School of Business (SoB), University of Petroleum and Energy Studies (UPES), Dehradun - India**, is an authentic record of my work carried out during the period from **January 2017 to December 2022** under the supervision of **supervisor Dr. Rupesh Kumar, Assistant Professor (Selection Grade), 1` School of Business, University of Petroleum and Energy Studies, Dehradun, India**. The matter presented in the thesis has not been submitted by me for the award of any other degree or diploma of this or any other institution of higher learning, except where due acknowledgment has been made in the text.



Pradeep Chauhan

April 2023

THESIS COMPLETION CERTIFICATE

This is to certify that the thesis entitled "**ANALYSIS AND MANAGEMENT OF LOGISTICS DISTRIBUTION PERFORMANCE IN FMCG SECTOR**" is being submitted by scholar **MR. PRADEEP CHAUHAN** having SAP ID: 500057949 in fulfilment for the Award of DOCTOR OF PHILOSOPHY from the University of Petroleum and Energy Studies (UPES). Thesis has been corrected as per the evaluation reports dated 03 March 2023 and all the necessary changes/modifications have been inserted/incorporated in the thesis.

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ABSTRACT

The Fast Moving Consumer Goods (FMCG) industry creates products that completely encircle humans. In their daily lives, all people use these products. The industry has low-profit margins and faces numerous problems with distribution. This study talks about the distribution of fast-moving consumer goods as well as significant problems and difficulties that affect the performance of the distribution. It is essential that the distribution is technologically advanced, environmentally friendly, and integrated to be able to address those concerns over the quality and safety of products, and rising losses and wastage of goods. Innovation, integration, and sustainability will be the main areas of the supply chain's focus. The study used a review of pertinent and recent literature to pinpoint the key issues. Distribution inefficiencies are identified and categorized into various themes, including inadequate supply chain coordination and integration, infrastructure issues, outsourcing difficulties, transportation issues, Poor inventory management methods, inefficient warehousing practices, Inaccurate forecasting, and lack of technology. These are the elements that seriously hamper the effective and efficient distribution of fast-moving consumer goods and have an impact on the sector's overall expansion and profitability. Under each of these factors, various variables are further subdivided. To address these issues, mitigation strategies are suggested. To understand and address the current challenges for better planning and managing the distribution, it will be beneficial for both the decision-makers and the various stakeholders involved to resolve these issues. These problems consequently impact the partners involved in the fast-moving goods partners' profitability and competitiveness. There aren't many research studies on this relatively newer concept because the FMCG industry is still in the early stages of growth. No research suggests a model showing problems as a synergistic whole and offers strategies and solutions to either overcome or lessen the impact of the problems on the performance of the entire chain. This results in a sizable research gap. A further consideration in the current study has been given to FMCG goods in India. The issues influencing the performance of logistics

distribution were first categorized and further broken down into subcategories. Issues and their subcategories were categorized based on a thorough review of the literature and suggestions from the sector's stakeholders. SEM was then used to examine how the problems affected the performance. To prioritize the issues and their subcategories as well as look at how they interact, AHP and FAHP were used. In the second stage, strategies and solutions were suggested for implementation to resolve these problems or lessen their effect on the efficiency of logistics distribution. The solutions were divided into two groups: digital solutions and non-digital solutions. The Fuzzy TOPSIS was then used to analyze these solutions separately. To overcome or lessen the impact of the problem on the effectiveness of logistics distribution, FTOPSIS assisted in prioritizing the solutions. Because of this, the current study provides a useful setting for making wise decisions and putting strategies and solutions into action. This will increase the effectiveness of the logistics distribution performance.

Keywords: *Supply Chain; FMCG; logistics; distribution performance; SEM; Fuzzy AHP; Fuzzy TOPSIS; digitalization; Sensitivity Analysis.*

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The journey of pursuing a Ph.D. has been a long journey full of periods that were exhausting, challenging, sometimes giving a sense of groping for the unknown in the dark, still the years-long project has also been filled with gratification on achievement of milestones at various stages of this journey. It is a project which could not have been completed without the valuable guidance, support, and contribution in any form from the various people. I could not have completed this long voyage without the blessings of the Almighty who bestowed me with patience and wisdom for its successful completion.

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Dated: April 2023

Pradeep Chauhan

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

Abbreviations	Full Name
AHP	Analytical Hierarchy Process
AMOS	Analysis of Moment Structures
ASRS	Automated Storage & Retrieval System
ASV	Average Shared Variance
AVE	Average Variance Extracted
B2B	Business to Business
CAGR	Compounded Annual Growth Rate
CDC	Central Distribution System
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CI	Consistency Index
CII	Confederation of Indian Economy
COVID-19	Corona Virus Disease-2019
CPFR	Collaborative Planning Forecasting and Replenishment
CR	Consistency Ratio/ Composite Reliability / Critical Ratio
CSCMP	Council of Supply Chain Management Professionals.
DEA	Data Envelope Analysis
DEMATEL	Decision Making Trial and Evaluation Laboratory
Df	Degrees of Freedom
ECR	Efficient Consumer Response
EDI	Electronic Data Interchange
EFA	Exploratory Factor Analysis
EPC	Evolved Packet Core
ERP	Enterprise Resource Planning
F&B	Food & Beverages
FAHP	Fuzzy Analytic Hierarchy Process
FCM	Fuzzy Cognitive Map
FDI	Foreign Direct Investment

FICCI	Federation of Indian Chambers of Commerce & Industries
FIFO	First in First Out
FILO	First in Last Out
FMCG	Fast moving Consumer Goods
FNIS	Fuzzy Negative Ideal Solution
FPIS	Fuzzy Positive Ideal Solution
FSC	Food Supply Chain
FSN	Fast Slow and Non moving
FTOPSIS	Fuzzy Technique for Order of Preference by Similarity to Ideal Solution
GDP	Gross Domestic Product
GFI	Goodness of Fit Index
GIS	Geographic Information System
GOI	Government of India
GPRS	General Packet Radio Services
GPS	Global Positioning System
GSCM	Green Supply Chain Management
GSCP	Green Supply Chain Practices
GSK	Glaxo SmithKline
GST	Goods & Service Tax
HUL	Hindustan Lever Ltd
IBEF	Indian Brand Equity Finance
IBT	Inter Branch Transfers
ICT	Information and Communication Technology
IFI	Incremental Fit Index
IMF	International Monetary Fund
IOT	Internet Of Things
ISM	Interpretive Structural Modelling
ISO	International Standards Organisation
IT	Information Technology
ITC	Indian Tobacco Company
KBV	Knowledge Based View

KMO	Kaiser-Meyer-Olkin
KPI	Key Performance Indicators
LDP	Logistics Distribution Performance
LR	Literature Review
LSP	Logistics Service Providers
MADM	Multi Attribute Decision Methods
MCDA	Multi Criteria Decision Analysis
MCDM	Multi Criteria Decision Methods
MHE	Material Handling Equipment.
MICMAC	Matrice d'Impacts Croises Multiplication Appliques a un Classement
ML	Machine Learning
MPI	Malmquist Product Index
MT	Modern Trade
MT	Metric Tonne
NFI	Normed Fit Index
NVA	Non Value adding
OROP	One Rank one Pension
PI	Performance Indicators
PLI	Production Linked Incentive
PLS	Partial Least Square
PWC	Price Waters Coopers
QR	Quick Response Code
RDC	Regional Distribution System
RFID	Radio Frequency Identification
RFID	Radio Frequency Identification
RI	Random Index
RMR	Root Mean Square Residual
RMSEA	Root Mean Square Error Approximation
SAP-LAP	Situation Actor Process Learning Action and Performance
SC	Supply Chain
SCF	Supply Chain Flexibility

SCM	Supply Chain Management
SCME	Supply Chain Management Enablers
SCOR	Supply Chain Operations Reference
SCQM	Supply Chain Quality Management
SEM	Structural Equation Modelling
SKU	Stock Keeping Unit
SPSS	Statistical Package for Social Sciences
SRMR	Standardized Root Mean Square Residual
SSC	Sustainable Supply Chain
SSCM	Sustainable Supply Chain Management
SSCM	Sustainable Supply Chain Management
TAM	Technology Acceptance Model
TCE	Transaction Cost of Economics
TFN	Triangular Fuzzy Numbers
TISM	Total Interpretive Structural Modelling
TLI	Tucker Lewis Index
TMS	Transport Management System
TOC	Theory of Constraints
TOE	Technology Organisation Environment
TOPSIS	Technique for Order Preference Similarity to Ideal Solution
TRM	Total Relation Matrix
TSP	Transport Service Providers
UK	United Kingdom, Europe
USA	United States of America
VR	Virtual Reality
VTS	Vehicle Tracking Softwares
WEF	World Economic Forum
WMS	Warehouse Management System
WNFDM	Weighted Normalized Fuzzy Decision Matrix
WSN	Wireless Sensor Networks
WSP	Warehouse Service Providers

LIST OF FIGURES

LIST OF TABLES

CHAPTER I
INTRODUCTION

CHAPTER 1

INTRODUCTION

1. OVERVIEW

The fast-moving consumer goods (FMCG) sector is India's fourth-largest sector, with household and personal care accounting for 50% of FMCG sales in India. The FMCG market in India is expected to increase at a CAGR of 14.9% to reach US$ 220 billion by 2025, from US$ 110 billion in 2020. However, it is plagued with several inefficiencies in logistics performance, especially the physical distribution, which hamper the sector's growth. This study throws light upon the fast-moving consumer goods sector and the various issues affecting the logistics distribution performance of the sector and its stakeholders. The study also reflects upon the business problem and the research problem.

1.1 BACKGROUND: INDIAN FMCG SECTOR STATUS AND IMPORTANCE

The Indian economy is based upon the consumer goods sector especially the fast-moving products, which affects all aspects of human life in some way. India's GDP growth is significantly aided by the sector. There are three main divisions in the industry: beverages and food, which make up 19 percent of the industry; medical care, which makes up 31% of the total; and personal and household care, which makes up the remaining fifty percent. FICCI, 2020). It employs approximately three million people and accounts for around 5% of employment in the factories in India, making it the fourth largest segment of the Indian economy. There are two parts to India's FMCG market: organized and chaotic. The Indian FMCG market is largely fragmented in comparison to the US market, subjugated by a select few global

firms. About half of the souk is made up of homemade, unbranded, and unpackaged goods. This presents an enormous chance for marked item makers who can convince customers to purchase marked items (John et al., 2007). But the fast-moving consumer goods industry has changed a lot in recent years. Changes in lifestyle, increased access, and increased cognizance are the chief growth triggers for the sector. The urban souk is India's primary source of FMCG revenue contributing approximately 60% of total revenue. However, rural India's FMCG market has outpaced urban consumption over the past five years. The fast-moving products are responsible for fifty percent of overall rural spending, and semi-urban and rural segments are expanding rapidly. The Food Security Act, the GST Bill, and FDI (foreign direct investment) in the retail sector are among government initiatives that are anticipated to have a significant and beneficial influence on the nation's FMCG industry in the years to come. Companies looking to expand into the hinterlands will likely need online portals. By providing a less expensive and more convenient means of expanding a company's reach, the Internet has made a significant contribution. By 2025, India's internet users are expected to number one billion. The various factors listed below have contributed to India's FMCG sector's positive growth. The growing demand, increased investment in the sector, attractive opportunities, and the government's policy support are all highlighted in the IBEF report as contributing factors to this positive growth. India has the competency to reach a dominant position in not just food but the agricultural sector as well. It is the second largest food producer in the world, after China. In terms of overall production, consumption, export, and anticipated growth, the food processing industry is among India's largest and ranks in fifth place.

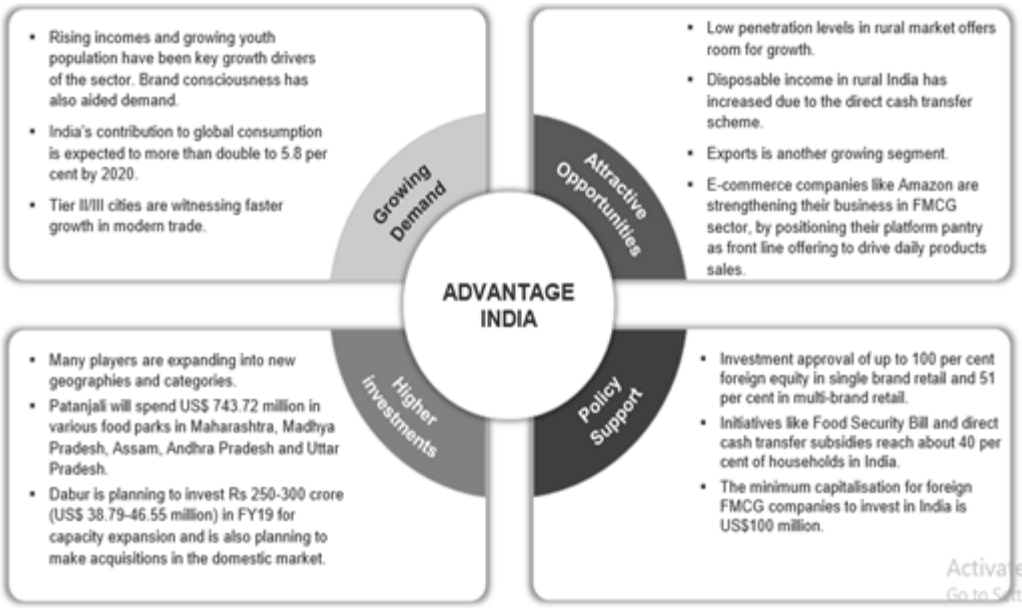

Figure 1.1 Advantage India [Source: IBEF 2021]

1.2 MARKET SIZE

India has one of the world's greatest economies in terms of consumer spending and purchasing power with a population of more than one billion. According to the International Monetary Fund, India's GDP growth has made it the largest economy in the world which is growing at the quickest rate. India's retail market is anticipated to grow from US$ 840 billion in 2017 to US$ 1.1 trillion by 2020. The modern trade sector is anticipated to expand at a rate of 20% to 25% annually, which would likely result in higher sales for FMCG companies. Revenue from the FMCG industry was Rs 3.4 lakh crore (US$ 52.75 billion) in FY18, and it is predicted that by 2020, this amount will increase to US$ 103.7 billion. The industry's value increased by 16.5% between July and September of 2018 thanks to higher private spending, higher rural income, and moderate inflation.

The FMCG market in India is anticipated to increase from US$ 110 billion in 2020 to US$ 220 billion by 2025 at a CAGR of 14.9%. The Indian FMCG business rose by 16% in CY21, a 9-year high, despite widespread lockdowns. This growth was driven by consumer demand and value expansion from higher product prices, particularly for basics. While the urban markets experienced positive growth for the second consecutive quarter, the rural market saw an increase of 14.6% in the same period. Final consumption spending grew at a CAGR of 5.2% between 2015 and 2021. Real household expenditure is anticipated to increase 9.1% YoY in 2021, up from a forecast decrease of >9.3% in 2020 due to the financial impact of the pandemic. According to CRISIL Ratings, the FMCG sector would increase its revenue growth from 5-6% in FY21 to 10-12% in FY22. Price increases across all product categories will counteract the effect of growing raw material costs. Volume expansion and a rise in demand for luxuries are the main drivers of growth. Despite lockdowns around the nation in the April to June quarter of 2021, the FMCG sector grew by 36.9%. The number of households purchasing on the modern-trade channel climbed by 29.15 percent year over year in the third quarter, while the channel experienced a 19.2 percent YoY increase in sales.

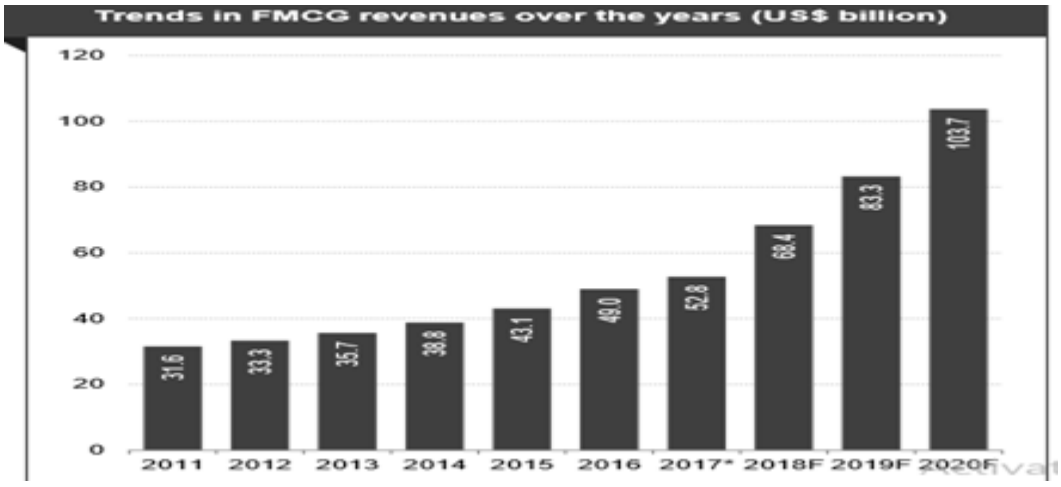

Figure 1.2 FMCG revenue trends over time (in billions of dollars)

1.3. MAJOR TRENDS IN FMCG SECTOR IN INDIA

1.3.1 INITIATIVES OF THE GOVERNMENT

The government has made the following noteworthy moves to support the FMCG business in India:

- The Indian government has authorized 100% and 51% FDI in the cash and carry sector and single-brand retail, respectively.
- The Indian legislature has created a brand-new Consumer Protection Bill with an emphasis on developing a comprehensive framework to ensure that customers receive justice in a simple, quick, affordable, and timely manner.
- The Goods and Services Tax (GST), which replaces the previous rate of 23-24%, benefits the FMCG sector because numerous things, such as hair oil, soap, toothpaste now come within the category of 18% tax. In addition, rates on product lines for food and personal hygiene declined to 0–5% and 12–18%, respectively.
- To support the "Atmanirbhar Bharat" plan and enhance India's manufacturing capabilities and exports, the Union Cabinet authorized the production-linked incentive (PLI) scheme in ten important industries, including white goods and electronics, on November 11, 2020. Changes in the packaged food sector will lead to higher farmer prices and fewer waste. With the ability to create medium- to large-scale jobs and a high growth potential, several product lines have been formed to serve the PLI program.
- As many major firms expand their operations into greater logistics and warehouses, it is envisaged that the GST would change FMCG logistics into a modern and effective model.

1.3.2 THE EFFECT OF COVID-19 ON THE INDIAN FMCG INDUSTRY

The 2019 Covid 19 pandemic has significantly harmed the global economy. The country-wide lockdown to stop the spread of the virus caused businesses across India to shut down. Despite the overwhelming demand that grocery stores, which make up 60% of all store-based retail, experienced during the initial lockdown, supply chain disruptions made it difficult for them to replenish stock. Products for personal hygiene like hand sanitizers, soaps, handwashes, wipes, masks, toilet cleaners, and disinfectants saw a surge in demand as a result of the pandemic, and this trend is expected to continue. During the pandemic, sales of food staples and convenience foods also significantly increased. Conversely, FMCG businesses that operate in non-essential categories like footwear, cosmetics, and apparel have experienced a significant drop in sales, and the consumer durables category has experienced a 30% decrease in sales compared to the previous year.

1.3.3. IMPACT OF DEMONETIZATION ON THE INDIAN FMCG INDUSTRY

FMCG was one of the industries affected by the demonetization process. The demonetization process was most detrimental to rural and semi-rural areas, which accounted for nearly half of its incremental demand. FMCG businesses experienced a real decrease in demand as a result of a liquidity crunch in these non-urban centers and realization delays. That appears to be changing, as the March quarter quarterly demonstrates. Liquidity is no longer a problem as nearly 85% of the demonetized currency is back in circulation. This has also meant that volume growth has picked up again, which was a big problem a few quarters ago.

1.3.4 RISING PURCHASING POWER OF RURAL INDIA

There have been a few important steps taken in recent years that are likely to result in a significant shift in the demand for FMCG products. People who are more likely to have a higher propensity to consume will receive more money through the 7CPC and the OROP. The public authority, in its last two financial plans, has zeroed in on provincial framework and enhancements in country pay levels. Demand for FMCG products in rural and semi-rural areas is multiplied by these two factors. Currently, the markets are betting that this could revolutionize FMCG businesses.

1.3.5 THE EFFECT OF GST ON FMCG COMPANIES

The Goods and Services Tax (GST) is also responsible for the phenomenal expansion of the FMCG industry. The announcement of the GST rates had a significant impact on FMCG businesses. To begin, the GST rate on the majority of food items has been kept between 0 and 5 percent. As a result, input cost escalation will be limited. Second, the GST Council has given daily-use products like toothpaste and hair oil preferential treatment in the toiletry market to increase consumption. Demand for FMCG products is expected to rise as a result of both of these factors. However, the most significant advantage of GST may be structural for the FMCG industries. In the past, every FMCG company relied on state-level taxation for its logistics, warehousing, and distribution infrastructure. With GST, India is closer to a one-tax, one-India system than ever before. From a business rather than a legal standpoint, FMCG companies can now ensure that their logistics and distribution infrastructure is optimized. Companies like Dabur, HUL, and ITC have been able to revolutionize the FMCG business in India over the past few years by utilizing cutting-edge technology in production and a very strong distribution chain. The country's urban areas have also been accessible to Britannia and Colgate Palmolive.

1.4 CONCEPTS AND DEFINITIONS

Before understanding the data and methods for analysis, it is imperative to understand crucial concepts and definitions. Therefore, this section exhibits a brief introduction and understanding of some important concepts such as SCM; FMCG, distribution, and issues and challenges in FMCG

1.4.1 AN OVERVIEW OF SUPPLY CHAIN MANAGEMENT

Authors have placed a greater emphasis on the relevance of the chain players, citing a suitable definition of supply chain management (SCM), given that the customer is the most vital constituent of the chain. Several definitions exist that focus on both sides of the movement of products and services, along with funds and information, from the source to the place of consumption to achieve profitability and sustainability targets in a highly competitive market. This chapter highlights the critical features of various paradigms of SCM as different scholars and practitioners have described it.

"Today's organizations must manage both the upstream companies-suppliers giving direct and indirect inputs and the downstream firms or the distributive network delivering and offering aftermarket service to customers," according to Monezka et al. (2002). Based on this, the authors propose a broad definition of SCM as follows:

"The supply chain encompasses all operations relating to the flow and transformation of goods from the raw materials stage to the end consumer, as well as the accompanying information flows. Up and down the supply chain, materials, and information flow. The supply chain includes systems management, operations and assembly, procurement, production scheduling, order processing, inventory management, transportation, warehousing, and customer service. Until the finished product reaches the ultimate end consumer, each customer becomes a provider to the next downstream organization."

SCM has a substantial impact on an organization's bigger strategy, particularly those connected to sourcing and purchasing (Monezka et al 2002), by integrating several organizations as chain members. Chain partners fall into three distinct categories: inbound suppliers, outbound customers, and internal operations. Production scheduling and order processing are two of the organization's major internal functions. Order scheduling entails full-fledged interactions with customers from the beginning, which encompasses it all from order receipt to post-sale services. Inbound suppliers control the supply of materials to manufacturers, ensuring that they arrive on time, in good condition, and at a reasonable cost. For the goods to reach the final consumer, they must transit through a distribution channel that includes several immediate actors. The logistics manager's job is to make sure that the distribution of products and transportation in the distribution chain runs smoothly.

Monezka et al. (2002) emphasized the interflow of goods, cash, and information among supply chain stakeholders (both upward and downward). As a result, managing the relationship between partners is critical, as it gives businesses a competitive advantage. The following are some of the advantages of supply chain management for businesses.

- Reduction in operational cost;
- Better delivery of goods;
- Enhanced quality;
- Less cycle time;
- Convenient access to technology (both product and process); and
- Less product development cycle.

According to Ross (2000), many challenges exist, making it difficult to offer a precise definition of SCM due to the concept's multiple applications. The author envisions SCM as a vigorous, inclusive growth and competition-oriented strategy

that is fueled by market volatility, which includes globalization vulnerability, unpredictability, and constant change. Ross has proposed the following definition for SCM:

"SCM is a constantly evolving management approach that aims to homogenize the collective productive resources and competencies of the business operations found both within the organization and outside of the firm's allied business associates situated along interlinking supply channels into an extremely competitive, customer enriching supply system focused on creating innovative solutions and synchronizing the flow of marketplace products, services, and information".

Ross (1998) emphasized the importance of consumers and asserted that SCM strategies must conform to their needs. SCM is extremely crucial in both the upward and downward information flow of customer demand, as well as satisfying requirements through goods distribution while ensuring cost efficiency and proper time management.

Most academics and supply chain experts acknowledge that SCM reduces costs while increasing sales significantly. According to Hoover et al. (2001), organizations that use efficient SCM practices have significantly lower costs when compared to competitors, with better margins and lower prices. Burt et al. (2003) state that all supply chain members should concentrate on the following aspects of adding value to SCM:

- Cost- SCM must prioritize cost management to decrease overall costs in the chain.
- Quality- SCM should emphasize Total Quality Management (TQM) to ensure that products entering the market are of superior quality.
- Time- SCM aims to minimize lead-time by delivering goods and services to customers on time.

- Continuous supply- SCM aids in the observing of market dynamics, which aids in the maintenance of supplier relationships.
- Technology- To gain a competitive advantage, SCM must organize technology both externally and internally.

1.4.2 SUPPLY CHAIN MANAGEMENT DEFINITIONS

Supply chain Management (SCM) may be defined as:

"a set of approaches used to efficiently integrate suppliers, manufacturers, warehouses, and stores so that merchandise is produced and distributed in the right quantities, to the right locations, and at the right time, to minimize system-wide costs while meeting service level requirements" (Simchi-Levi et al., 2008).

"Supply Chain is a set of entities that collectively manufacture a product and sells it to an end point" (Stern et al. 2001). "The supply chain is the network of organizations that are involved in the various processes and activities that produce value in the form of goods and services in the hands of the end customer" (Christopher, 1998). As per the study conducted by Ballou (2004), "Supply Chain refers to all the activities involved with the conversion and movement of goods and services, which include their attendant information flows, from raw material sources to end users". "Supply Chain management entails many independent organizations and evolves via intra and inter-organizational coordination and integration from the beginning to the end user. It entails the two-way flow of materials, services, and information, as well as the affiliated operational and managerial tasks. It aims to provide high value for its customers while maximizing resource utilization and gaining a competitive advantage" (Cooper et al., 1997). The critical aspects that influence SC are strategic advantage and integration, customer values, and chain partner coordination. By increasing value and productivity, any business can gain a competitive advantage. The advantage of productivity comes from getting better results with less use of resources than other people. Offering

individualized products or services, reliability, and responsiveness—all of which require resources and innovation—create value (Christopher, 1998). Supply chain partnerships facilitate integration and coordination, which necessitates long-term, robust interactions as well as the sharing of information, risks, and rewards (Ellram & Krause, 1944). Copper et al. say that (1997a), SCM is planning and controlling goods, information flow, and logistics activities both internally and externally. A supply chain is a series of links that connect consumers, manufacturers, distributors, retailers, and raw material suppliers. The supply chain encompasses functions that transform raw materials into finished goods. It will include not only suppliers and manufacturers/products, but also several intermediaries such as distributors, retailers, storage keepers, transporters, and, finally, consumers.

Studies in the literature have provided varying perspectives on SCM, and as a result, no universally accepted definition of SCM exists (Croom et al., 2000). Many interpretations of SCM have been discussed in the literature. Although the different definitions have various connotations, they all have one common thread: operations management across various organizations. Furthermore, SCM has universal rationality, and organizations will gain economic benefits (New, 1996).

1.4.3 OBJECTIVES OF SCM

It is understandable that, in response to changes in the business environment, organizations have taken some steps to establish strategic partnerships with supply chain members, to lower uncertainty and increase control over the distribution and supply of goods channels. Such collaborative efforts assist organizations in improving the performance (financial and operational) of each network partner by reducing table costs in the supply chain and inventories through increased sharing of real-time information. As a result, understanding the primary goal of SCM is critical.

The fundamental objective is to "add value"

The goal of SCM is to increase overall value generation. The value of an item is the differential between the costs incurred by the customer and the effort expended by the supply chain to meet the customer's demand. In layman's terms, SCM is primarily concerned with meeting the needs of customers while also ensuring profit for them (Chopra, Meindl, and Kalra, 2010).

Furthermore, Copper et al. (1997b) state, "SCM is designed to face market challenges and assists the firm in eliminating non-value-adding activities." The primary goal of SCM is to increase organizational productivity and competency (Hsiao, 2006). It is also critical to reduce allied costs, improve flexibility, and thus increase SCM competency and performance. It is widely acknowledged that efficient and effective SCM can increase customer value while decreasing operating costs. Value is strongly related to supply chain profitability, and an effective and efficient supply chain optimizes performance in delivering customer requirements while reducing costs and ensuring resource optimization. Some of the primary objectives of SCM are as follows:

- *Cost minimization*
- *Profit maximization*
- *Customer fulfillment*
- *Reliability*
- *Shorter lead time in delivery*
- *Fast cash cycle*
- *Business development*
- *Economic delivery*
- *Right equality*
- *Less Inventory*

SCM is considered the best operational strategy for enhancing organizational competitiveness (Gunasekaran & Kobu, 2007, Winser, 2003). Realizing the

significance and impact of SCM management, businesses have begun to focus on continuous improvement to achieve SCM's desired outcomes and reap the benefits of an efficient and effective supply chain. Previously conducted scholarly studies discovered tangible gains from efficient and effectively managed SCM (Harrington, 1999; Alber & Walker, 1997; Cooper et al., 1997b; Higginson and Alam, 1997; Giunipero and Brand, 1996; Cooper and Ellram, 1993). The following are some of the advantages of a well-managed supply chain: A closer relationship with chain members Cost reduction

- Inventory reduction
- Productivity movement
- Cycle time reduction
- Reliable delivery responsiveness to changes
- Customer-level service improvement
- Profit margin improvement

1.4.4 SEVEN GOALS / PRINCIPLES OF SCM

Since the chapter has discussed the definition and meaning of SCM, this section mentioned the seven significant requirements for a prosperous SCM. The 7 R's (R means Right) of SCM are refers to right-

- Product
- Time
- Condition
- Quantity
- Place
- Cost
- Customer

1.4.5 SUPPLY CHAIN MANAGEMENT OF THE FMCG SECTOR

The FMCG sector is frequently confronted with industry-specific concerns, especially in the area of logistics management. Strict timelines, higher inventory levels, great distances between supply chain partners, greater transparency, and reliability are just a few examples. Failure to optimize the supply chain in the FMCG industry can have significant financial consequences, even jeopardizing profitability. Stock that does not move fast can quickly become obsolete, resulting in a net loss for the company. The FMCG industry's supply chain has evolved dramatically over the last 30 years. These changes took place in both the upstream and downstream supply chains. The nature of the products, distribution partners, and resources determine many stages of the FMCG distribution chain that are beyond the firm's control. Furthermore, FMCG manufacturers have relatively high warehousing and transportation costs than other product manufacturers. To run smoothly and efficiently, the FMCG supply chain must be flawlessly optimized. These requirements, as well as the high costs associated with them, enable enterprises in the FMCG sector in general, and the food industry at large, to optimize their inventory levels and goods transportation. An effective and efficient supply chain is a mutually beneficial process where more information translates to an improved judgment call. As an example, consider real-time inventory tracking. Real-time supervision helps to identify the frequency of product inflow and outflow to automatically trigger the requests for the supply. The fast-moving consumer goods sector is distinguished by complicated distribution systems and intense competition, appealing to organizations to consistently strive for innovation. The justification for switching from conventional management practices to more sturdy management solutions has indeed been attributed to competition in the industry, the nature of the goods, and the need to optimize the supply system to achieve new levels of productivity and potency. As a

consequence, it's vital to enhance and revaluate the distribution network as often as plausible, and new ideas. As a result, it is essential to consistently improve and optimize the supply chain, and new ideas are always welcome. In the pursuit of greater efficiency, new inventory and supply management systems are frequently implemented. Better-managed supply chain networks will surpass their peers, while improperly managed supply chain networks will struggle to compete. From suppliers to consumers, the supply-chain function helps to ensure that operations are well integrated, with cost, inventory, and customer service considerations made from the beginning to the end rather than by each function separately.

In today's business enterprises, supply chain methodologies are widely used. The Supply Chain Strategy's accomplishment determines market penetration and market accessibility in critical places for revenue recognition. Simply put, when a commodity is introduced to the market and advertised, it must be available for purchase and delivery at all sales counters throughout the country. Any lapse in product availability at the appropriate time can lead to a fall in customer demand and desire, which can be devastating. The design and management of transportation networks are critical in improving sales and marketing strategies.

In a global scenario, a third party manages finished goods inventory across multiple locations and distribution centers. In addition to the inventory at distributors and retail stocking locations, a large amount of merchandise would be in transit. Inventory control and visibility have evolved into critical components of Supply Chain Management because any inventory loss, regardless of where it occurs in the supply network, tends to result in a value loss.

The following key points illustrate the supply chain operating specifications in the fast-moving consumer goods sector:

- **Raw material supply:** The company gets raw materials from suppliers.

- **Product processing and manufacturing:** raw materials are transformed in processing centers and/or used in factories to produce finished goods.
- **Storage:** The products are either stored in a warehouse or delivered directly to distribution centers.
- **Distribution and delivery:** Finally, haulers deliver products to customers.

Inbound logistics is the process of moving, storing, and delivering goods into a business. The act of storing, transporting, and distributing goods to customers is referred to as "outbound logistics." Outbound logistics begins with a customer order, moves on to packing products in a warehouse, and then delivers the goods. In the field of supply chain management, inbound and outbound logistics are combined in an effort to reduce transportation and storage costs while simultaneously increasing the reliability and efficiency of distribution networks.

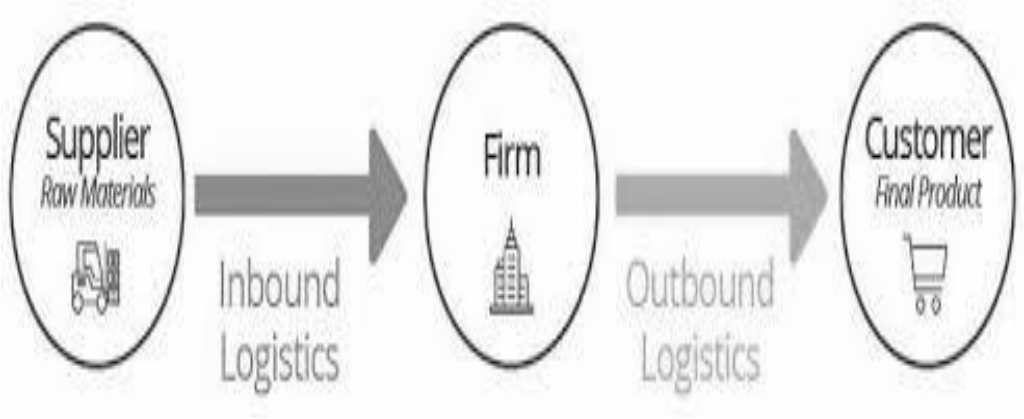

Figure 1.4 Inbound & Outbound Logistics

1.5 INDIA'S FMCG MARKET IN COMPARISON TO THE WORLD'S FMCG MARKET

India currently controls 0.68% of the global FMCG market; in any case, this offer is supposed to become fundamental over the course of the following 5 to 10 years, attributable to macroeconomics factors like further developing socioeconomics,

raised extra pay, the movement of coordinated retail in India's level II and III urban areas, changing client needs, etc. Japan, China, the European Union, and the United States are major FMCG markets. The FMCG sector is anticipated to grow at a CAGR of 4.4% globally, which is considerably lower than India's. Numerous worldwide FMCG organizations have settled in India.

Inferable from the mind-boggling utilization of web networks, FMCG associations have moved their concentration to Internet business worldwide. In 2015, online FMCG sales made up about 5% of all revenues worldwide. This is more than in India, where online FMCG sales made up about 1% to 2% of all revenues. Some major economies, like China and the Eurozone, as well as a few important emerging economies, like Brazil and Russia, are experiencing slower growth, which has slowed global economic development.

India, whose economic situation is significantly better than the United States', benefits from this. It is anticipated that India's per capita income will surpass INR100,000 (USD 1,505.4) in FY 2017, up from INR93,231 (USD 1,403.5) in FY 2016. Urbanization, the adoption of technology, and other structural changes are all significant contributors to a market that has greater potential than other markets.

1.5.1 INDIAN VS MULTINATIONAL COMPANIES

Indian companies like ITC, Patanjali, Amul, Godrej, and others have seen higher revenue growth than global brands like HUL, GSK, and Nestle, among others. Through inorganic development, Indian endeavors have extended their item portfolios, upgraded their stock chains, and helped their piece of the pie. Ayurvedic medicine, for example, is one of the underserved markets in which Indian businesses have focused their expansion efforts. These businesses have also been able to improve their position in comparison to multinational corporations thanks

to other factors like increased product innovation, appropriate product pricing, and expanding international operations.

1.5.2 HIGH LOGISTICS COST IN INDIA IS A CONCERN

Moving products and linking consumers and producers is an important part of the modern economy. Logistics is defined by the Council of Supply Chain Management Professionals (CSCMP) as "the process of efficiently planning, executing, and monitoring the flow of raw materials, work-in-progress inventory, finished products, services, and related information, from the point of origin to the point of consumption (including external and internal movements, as well as incoming and outgoing movements) to fulfill the customer's needs".

According to McKinsey research, the logistics sector in India accounts for 14% of GDP, significantly higher than in the United States or Europe, where it accounts for 8-9%. Indian competitiveness is harmed by high logistics costs. The reasons attributed to this higher cost of logistics are poor resource optimization and infrastructural challenges. Production is the process of creating commodities; yet, it is not complete until the products reach the final user or consumer. The primary goal of distribution management is to get products into the hands of the potential right customer at the right time and in the right place (Roosta et al. 2009). It is exceptionally difficult for these companies to stay afloat and survive because the profit margin is lower than in other industries (Shilpy Malhotra, 2014).

In the following figure, 3 shows the difference in logistics cost over GDP in comparison to developed countries.

Country	Logistics Cost/ GDP	Share of 3pl in overall logistics
China, India	13-15%	<10%
U.S.	9-9%	57%
Europe	10%	30-40%
Japan	11.5%	80%

*Source KPMG

Figure 1.5 Logistics Cost/GDP [Source: KPMG]

1.6 RATIONALE OF THE STUDY

Due to its complex distribution system and intense rivalry, the FMCG industry is constantly in need of supply chain innovation. although the core components of the Indian FMCG distribution system have largely not changed over time. Microeconomics has a significant impact on the supply chain structure in India.

According to Bowersox (2008), to provide an appropriate degree of customer service and avoid losing market share, a company's quick-moving goods activities must combine the elements of the distribution system. As a result, it's critical to deliver the proper sort and quantity at the right time, place, and price.

The FMCG sector in India is known for its low margins and success is mostly based on product volume. Businesses prioritize product accessibility within the complex distribution system to launch and sustain a successful company. Since there are several levels between the business and the end user, the quantity of Stock Keeping Units (SKUs) must increase to ensure availability at the final stage of distribution. The advent of significant third-party logistics (3PL) carriers and the growth of

domestic networks by Indian companies are altering the sector's offerings and business processes.

The FMCG sector frequently outsources logistics services for most activities, including manufacturing, transportation, packaging, and warehouse management. Non-performance and failures in strategies bring about higher costs and lower benefits on the grounds that an organization's prosperity is straightforwardly reliant upon the exhibition of its specialist co-ops. Metrics for performance indicators are essential in today's competitive global market.

The majority of businesses create matrices to measure the performance of service providers; however, they struggle to identify and create the appropriate matrices, as well as the availability of data and methods or instruments to collect the data required to highlight the success of service providers. Numerous tools have been developed to collect data and assess main transportation inefficiencies with the development of digital technologies. The global economy includes global operations, outsourcing, the supply chain, and e-commerce. In this new business environment, managers face the challenge of coming up with the right performance metrics and measurements to help them make the right decisions that will make their organization more competitive.

The financial success of retail firms is significantly influenced by logistics performance, as determined by logistics costs and quality, in accordance with Schramm-Klein and Morschett. The results of a Taiwanese study (Shang and Marlow, 2005) that focused on major manufacturing enterprises lend credence to the idea that financial success and logistics are intertwined.

The entire cost structure is subject to industry variation. The FMCG industry has the highest costs associated with materials and logistics due to larger quantities and a larger network. The primary components of the supply chain in India's FMCG sector, as well as their proportion of gross sales, are shown in the table below.

Rethinking coordinated factors administrations is normal practice in the quick shopper products (FMCG) area on the grounds that most exercises like warehousing, transportation, bundling, fabricating, etc are re-appropriated. Performance metrics and measures are essential for effectively managing logistics operations, especially in today's competitive global economy, because a company's performance is unswervingly reliant upon the performance of service providers. Non-performance and inefficiencies in the processes also lead to higher costs and affect profitability. Outsourcing presents challenges because of this. The majority of businesses create matrices to measure service provider performance; however, they struggle to identify and develop the appropriate matrices, as well as the availability of data and mechanisms or tools to capture the data required to highlight service provider performance. Numerous tools have been developed to collect data and evaluate distribution inefficiencies, particularly in primary transportation and warehousing issues, since the advent of digital technologies. The global economy is made up of global operations, outsourcing, supply chains, and e-commerce. In this new enterprise environment, managers face the challenge of developing appropriate performance metrics to assist them in making decisions that will increase their organization's competitiveness. Numerous organizations are as yet trapped in the time of physically finishing work errands and cycles, which raises doubt about their drawn-out suitability. The use of information systems as a more productive and long-term solution to the optimization issues that were discovered was the primary focus of the data analysis, which began with a comparison of the companies use of manual-based processes. Following a thorough review of the literature and consultation with experts, it was determined that several transport and warehouse-related issues are affecting the optimization of logistics distribution performance. This aided in identifying the differences between the two processes and determining whether the use of information systems can aid in the optimization of road transport and warehouse management within the FMCG industry. In addition, statistics regarding IS implementations and the financial advantages of

using it over manual processes were identified. The industry-specific cost structure varies overall. The FMCG industry is the most expensive when it comes to material and logistics costs because of its larger network and higher volumes. The table clearly shows the various components of the supply chain and the percentage of FMCG gross sales they contribute to in India (see figure. 1).

1.7 BUSINESS PROBLEM

Poor infrastructure for the supply chain: The Indian FMCG market has faced significant difficulties due to a lack of storage and transportation facilities, rising energy and raw material costs, and other factors. Food items typically have a much shorter shelf life, necessitating quick delivery systems, regular product replenishment, and a wide range of distribution and storage requirements. Companies in the FMCG sector have been forced to rethink their logistics and supply chain management strategies to remain competitive and efficient because some aspects of the industry have defined them. Many inefficiencies exist in transportation especially in primary movements i.e. from production facilities to warehouses and between different warehouses. These inefficiencies will not be eradicated unless identified, measured, and analyzed. FMCG products are functional products with low margins but regular demand in the market. Fisher (2007) suggested efficient supply chain is the best-suited supply chain for functional products. The physically efficient supply chain is characterized by cost efficiency; hence, all possible efforts be explored to reduce the cost. Transportation and inventory are the major chunks of logistics cost, if these areas are targeted and improvised it could lead to better logistics performance. Hence, there is a great need to measure the inefficiencies related to transport and inventory through digitalization.

A survey of manufacturing companies in India conducted by Chandra and Sastry (2004) identifies transportation and dispatch planning as an area of concern. Only 11% of the sample companies in that survey own their own fleet of trucks; 98% of the sample companies have a contract with trucking companies to make dispatches. Third-party logistics (PL) service providers are utilized by 36% of these businesses for dispatching. Many inefficiencies exist in transportation especially in primary movements i.e. from production facilities to warehouses and between different warehouses.

This study will concentrate on determining inefficiencies prevailing in physical distribution and how the logistics performance of the main components of physical distribution (warehousing & transportation) be improved with; the help of digitalization i.e. the use of digital technologies. These two areas are generally outsourced to third-party logistics service providers (3PLs) and are plagued with a lot of inefficiencies due to a lack of coordination and real-time monitoring issues. The operations are inefficient, as the existing performance metrics are not capturing the data, which can highlight the performance of resources. However, with digital tools like warehouse management systems (WMS) and Transport management systems (TMSs), the operational performance of the various processes can be captured at the macro level, which enables the managers to take corrective actions to improvise the existing processes. In light of the foregoing discussion, the researcher intends to undertake a research study in which the most essential aspects that can affect fast-moving product distribution performance will be discovered and studied.

1.8 RESEARCH QUESTIONS

A few critical research questions are considered to fill gaps in the existing literature on the supply chain of fast-moving consumer goods. They are as follows:

1. What are the factors leading to poor logistics distribution performance, especially in the warehousing and transportation of the FMCG sector in India?

2. How can digitalization be used to create a model for improving logistics distribution performance by optimizing transportation and warehousing in the FMCG sector?

1.9 OBJECTIVES OF THE STUDY

The following are the objectives of the current study:

1. To identify the factors leading to poor logistics distribution performance, especially in the warehousing and transportation of the FMCG sector in India.

2. To create a model for improving logistics distribution performance by optimizing transportation and inventory in the FMCG sector through digitalization.

1.10 SCOPE OF THE STUDY

The current study will primarily concentrate on the impact of inefficiencies in the FMCG physical distribution sector. Also, how will transportation and warehouse optimization affect distribution logistics performance in India's Fast Moving Consumer Goods (FMCG) sector? The logistics performance is further limited to primary and secondary road transportation, as well as warehouse optimization (post-manufacturing).

- Product transportation from the manufacturing facility to central distribution centres (CDCs).

- The stock transfers from the Central Distribution Centres (CDC) to Regional Distribution Centres (RDCs).
- The Inter Branch Transfer (IBTs) of stocks i.e. transfer between different warehouses.
- The order processing management and delivery of goods from Regional Distribution Centres (RDCs) to the customers.

1.11 SUMMARY

Many businesses are still caught in the period of manually accomplishing job tasks and processes, which raises concerns about their long-term viability. The data study included a comparison of organizations' usage of manual-based procedures, with a primary focus on the use of information systems as a more productive and long-term solution to the optimization concerns discovered. This helped to identify the differences between the two processes and, as a result, to decide if the use of information technology may aid in the optimization of road transport in the FMCG business. Following the analysis of the data, it was discovered that there are still a number of transportation concerns affecting business optimization. It also discovered statistics on an IS that had already been installed, as well as the financial benefits of using it over manual processes.

1.12 STRUCTURE OF THE THESIS

The work presented in this thesis has been arranged in the following six chapters:

Chapter 1: Introduction & Background

Chapter 2: Literature Review

Chapter 3: Research Methodology

Chapter 4: Data Analysis & Findings

Chapter 5: Conclusion & Recommendation

Chapter 6: Bibliography

1.13 CHAPTER SUMMARY

The chapter summary is given in the tabular form below:

Table 1: Organization of the Thesis

Chapter I Introduction	• Background: Indian FMCG Sector Status And Importance • Market Size • Major Trends in the FMCG Sector In India Initiatives of Covid-19 On The Indian FMCG Industry • Impact of Demonetization on The Indian FMCG Industry • Rising Purchasing Power Of Rural India The Effect Of GST On FMCG Companies • Concepts And Definitions • An Overview Of Supply Chain Management • Supply Chain Management Definitions Objectives Of SCM • Seven Goals / Principles Of SCM • Supply Chain Management Of The FMCG Sector

	• India's FMCG g Market In Comparison To The World's FMCG g Market • Indian Vs Multinational Companies • High Logistics Cost In India Is A Concern • Rationale Of The Study • Business Problem • Research Questions • Objective of The Study • Scope of The Study • Summary • Structure Of The Thesis
Chapter II Literature Review	• Overview • Literature Review at a Glance • Theme-based Literature Review o Theme I – Supply Chain Management of Fast-Moving consumer Goods o Theme II – Past Studies on Supply Chain Efficiency & Defining Supply Chain Efficiency. o Theme III- Difficulties in the Delivery of Fast-Moving Consumer Goods.

	○ Theme IV-The Importance of an Effective Supply Chain in the FMCG Sector ○ Theme V-Measures to improve Supply Chain Efficiency ○ Theme VI-Theoretical Underpinning • Literature on Data Analysis Techniques • Summary of the Chapter
Chapter III Research Methodology	• Rationale for the Study • Problem Statement • Research Questions • Research Objectives • Research Design • Research Methodology • Conceptual Model Proposed • Research Hypotheses Data Collection • Questionnaire as Survey instrument ○ Development of Questionnaire ○ Administration of Questionnaire • Sampling • Proposed Research methods and techniques • Chapter Summary

Chapter IV Data Analysis & Finding	• Overview • Phase I: Identification of Issues leading to inefficiency in Logistics Distribution Performance-Main Categories & Sub Categories • Sampling • Data collection • Common Method Bias • Phase II: Analysis of Issues using DEMATEL, SEM and AHP/FAHP • Development of Final Model and Suggestion of Solutions • Hypothesis Testing & Final Model • Development of the Measurement Model • Development of Structural Model & Model Fitness • AHP and FAHP: Ranking of Sub Categories of Issues • Sensitivity Analysis: • Chapter summary
Chapter V Discussion	• Overview • Finding of the Study • Prioritization of the Solutions to Overcome the Distribution Issues

	• Suggested Solutions to overcome Logistics Distribution Performance • Implications of the Findings • Conclusion • Limitations • Directions for Future Research
Chapter VI References	• References

[**Source:** Author's composition]

CHAPTER II
REVIEW OF LITERATURE

Chapter II

Review of Literature

2. OVERVIEW

A review of the literature is a succinct presentation of information relevant to a particular context that helps formulate specific research questions. The main definition of a literature review is "a more or less systematic method of gathering and summarizing prior information" (Snyder, 2019). Research hypotheses might be developed based on an examination of prior material. This chapter presents a thorough analysis of the literature on supply chain management of fast-moving consumer goods (FMCG), difficulties in distribution, and problems impacting the efficiency of these goods' logistical distribution. Three main themes have been used to organize and display the pertinent literature. The review has been simplified and systematized as a result of this. Literature on Transaction Cost Economics Theory and Theory of constraint is done along with various other theories associated with supply chain management to furnish a total view associated with the subject of the examination.

2.1 LITERATURE REVIEW AT A GLANCE

Literature is reviewed on five major themes along with literature on underpinning theories and found that a combination of the Theory of Constraints (TOC) and Transaction Cost of Economics (TCE) is most suited for the topic of study. A literature study revealed significant conclusions and gaps that motivated the current investigation. For studies relating to the domain to be mentioned, literature is gathered to fulfill the researcher's needs for studies that are specific to that area. In this study, several literary sources were searched using a theme-based method.

Industry reports, academic articles, newspaper stories, and research papers were the sources examined. As a result, the literature gathered from the aforementioned search is organized and divided into the following various themes.

2.2 THEME-BASED LITERATURE REVIEW

There is a relatively small quantity of studies on the subject of the distribution of fast-moving goods. Reviewing articles that contribute to a deeper understanding of this field and identifying pertinent research gaps becomes crucial as a result. Old and current, pertinent topics and issues are reviewed to do the subject justice. For a better understanding of the content and applicability of the research area, the literature review took into consideration both qualitative and quantitative factors. The various themes considered for this study are given below.

Theme I: Supply Chain Management of Fast-Moving Consumer Goods (FMCG)

Theme 2: Defining Supply Chain Efficiency & Past Studies on Supply Chain Efficiency

Theme 3: Challenges in the distribution of Fast Moving Consumer Goods (FMCG)

Theme 4: Significance of Efficient Supply Chain in the FMCG Sector

Theme 5: Measures to improve Supply Chain Efficiency

Theme 6: Past Studies on Theories

The chapter outlines a logical research flow, beginning with an understanding of the current state of the fast-moving consumer goods sector, followed by the identification of research gaps, the formulation of a research problem, and the applicability and appropriateness of the theoretical premise. The development of research objectives, attribute selection, and the questionnaire as a data collection instrument are all aided by the literature review. The meaning of further developed operations dissemination execution is likewise underlined. As a result of this analysis, major inferences and gaps are derived. Keeping the business problem in mind, a thorough review of the literature was conducted under the six minor themes listed below.

Figure 2.1 Diagrammatic representation of the Themes for Literature Review

2.2.1 THEME I: SUPPLY CHAIN MANAGEMENT OF FAST-MOVING CONSUMER GOODS (FMCG)

There are various studies discovered which were carried out pertaining to fast-moving consumer goods concerning supply chains globally and in the Indian scenario particularly. The studies which have been carried out globally are given below-

The Fast Moving Consumer Goods (FMCG) industry-specific characteristics of supply chain performance were established by Bala & Kumar (2011). The procedures, components, and typology of the FMCG supply chains are examined. The common problems that the FMCG supply chains encounter are also examined. Comparing three supply chain operating models, it is determined that SCOR is the one that is most appropriate for the FMCG sector. The outcomes also comprise an examination of the research cases' typology across two product categories.

Salam (2017) attempted to comprehend the connection that exists between trust, technology, and supply chain collaboration, as well as how these elements influence the efficiency with which businesses operate. A study to collect data focused on supply chain managers in Thailand for fast-moving consumer goods (FMCG).

To determine the effect of business intelligence systems on companies' environmental performance, Joghee et alresearch.'s (Joghee et al., 2021) empirically investigate how business intelligence systems impact both internal greenings practices (the 7Ps) and external greening practices (collaborations, social concerns, corporate environmental management, and supply chain management). The results significantly support the hypothesis of the intended study. As a result, both individually and collectively, businesses' green performance is influenced positively and significantly by greening procedures and business intelligence systems.

Three multiobjective fuzzy mixed integer linear programming models for the sales and operations planning process were created by Nemati and Alavidoost in 2019. A crisp model that is comparable in terms of customer service quality and total supply chain cost is used to compare the performance of the fully integrated fuzzy model to that of the crisp model. All of the models were created for a multi-site manufacturing corporation that had to deal with a variety of clients and product families, as well as third-party logistics, distribution centres, and raw material

suppliers. The models are put to use in a real situation at an Iranian FMCG manufacturing company, and the outcomes confirm that the fuzzy model is preferable to the crisp one.

In his research, Prashar (2022) sought to elucidate and contrast the factors that led to the adoption of SSCM techniques in the Indian FMCG sector. To understand the complex causal relationships that existed between the identified SSCM factors and to highlight the most significant ones, a method based on the Grey-Decision Making Trial and Evaluation Laboratory (DEMATEL), hybrid multiple-criteria decision-making (MCDM) technique, and sensitivity analysis was used.

An example of how carbon emissions concerns, such as emission caps and carbon tax plans, should be taken into account while making operational decisions on the introduction of new fast-moving consumer goods (FMCG) products, like product procurement, production, storage, and transportation, was provided by Aggarwal, R. (2018).

Roy et al. (2020), studied how various manufacturing firms are seeking to make the required changes in processes and supply chains due to rising pressure to be ecologically sustainable. However, for those efforts to be successful economically and environmentally, they must be used strategically. This study presents a decision-making framework that combines a fuzzy cognitive map (FCM) with data envelopment analysis (DEA) to evaluate environmental sustainability practices centered on their effects on an organization's entire supply chain network.

Modgil et al. (2020) examined the issues and performance of the firm's supply chain at the time in an attempt to analyze a case from an Indian biscuit manufacturing company. The research can provide the organization with the solutions it requires to realize both tangible and intangible benefits. SAP-LAP (situation, actor, process, learning, action, and performance) methodology was used. This analysis can help

the business by comparing the current performance status with the desired performance of the organization.

Cadden and others By examining how much performance is influenced by buyers' and supply chain participants' organizational cultural fit, (2013) aimed to improve our comprehension of buyer-supplier relationships. According to the findings, good performance outcomes between supply chain partners were achieved through complementarity rather than congruence.

To reduce the lead times for fulfilling client orders while lowering storage costs and dangers, Li et al. (2008) made an effort to find effective distribution solutions. The center's operator must be certain of the products—or even the percentage of a given sort of product—that should be processed through cross-docking. This essay offers a methodical approach and paradigm for assessing cross-docking distribution in an organization. In the publication, testing analysis is provided together with a discussion of a prototype system.

Mostafa et al. (2021) emphasized the importance of lowering distribution costs by considering the company's strategic decisions, such as giving important customers higher priority and assigning each client to the nearest warehouse. A non-linear model is used to solve the problem. The solution is a hybrid heuristic that, based on availability and other strategic considerations, alternates between the best-advised location and potential real-world business locations. The Monte-Carlo recreation is utilized to assess different designs for the chose areas. Battezzati and Magnani (2000) emphasize certain management approaches, regions of substantial development and industrial deferral, and a general lack of scale economics in their examination of the supply chains for FMCG and durable goods in Italy.

Khan et al. (2018) investigated how three green supply chains (GSC) practice organization commitment in Pakistani FMCG companies. Green distribution, green purchasing, and green transportation were used as independent variables to assess

the effectiveness of GSC practices. With the exception of green purchasing, exploratory factor analysis and linear multiple regression showed that the remaining two variables—green transportation and distribution—were significant and helpful in evaluating organizational performance.

Based on a discrete-event simulation model that models a supply chain for fast-moving consumer goods (FMCG), Bottani and Montanari's (2010) study. The bullwhip impact and the effects of various supply configurations on overall supply chain costs are to be quantified.

Bottani et al. claim that (2010), RFID technology and the EPC Network's real-time visibility of product movements have the potential to lessen the bullwhip effect and the need for safety stocks in the supply chain.

Rajeswari (2012) suggested a modified structure for enhancing the delivery system by offering a better location and ideal inventory holdings to construct a better delivery infrastructure at a more affordable price. By adopting a new distribution structure with fewer logistical issues, this project seeks to optimize the overall delivery system. This study suggests an improved approach and compares it to the current one. To make it easier for wholesalers to grasp, every part of the savings percentage has been computed.

Salam et al. (2016) outlined and illustrated the relationship between inventory quantity and consumer service threshold in their study. To evaluate an inventory system, this study employs a simulation model based on business data from a retail fast-moving consumer goods chain in Thailand. The findings imply that in addition to lower logistics costs, operating an effective supply chain is essential for achieving a responsive service level. The findings also demonstrate the importance of true and accurate information in service supply chains.

As per Bloem and Bean (2015), the objective of the review was to pick the best methodology in the circumstance of re-appropriating operations. In a case study

involving a South African fast-moving consumer goods (FMCG) company, the decision-making strategies were utilized. The case study considered two logistical tasks: secondary distribution and finished goods warehousing. The outcomes of the linear programming (LP) method recommended internalizing the secondary distribution function while outsourcing the warehousing function until further research into demand trends could be made.

According to Kayikci (2018), there are numerous reasons to consider the impact of digitalization on logistics and supply chains' significance for industry 4.0. In this regard, the study looks at the advantages of digitizing logistics and how it will affect sustainability. The research is being carried out as a single case study involving Turkish FMCG companies and their transportation service providers. It is qualitative in nature, with a series of linked semi-structured interviews serving as the foundation.

According to Potter and Yingli (2007), this is because of the recent rapid growth of wireless communication and information technology. This study looks into the tracking system's implementation and the effects it has on both shippers and carriers. Along with the cost-benefit analysis, technical and managerial issues are investigated. According to the report, real-time tracking technology in logistics is still in its early stages in the UK, but it has enormous growth potential. The case's vehicle telematics systems are contrasted with alternative technologies such as RFID, with a brief overview of each technology's benefits and drawbacks.

Aljunaidi and Ankrah's (2014) study tried to determine whether it was suitable for the fast-moving consumer goods (FMCG) industry, and the alleged universality of lean was put to the test. Based on the findings of the review, lean might be applied to FMCG activities because the very sorts of waste that lean found in the auto area exist there also. A theoretical framework for lean implementation in the FMCG

sector was developed as a result of the study's determination of the requirements for successful implementation.

Dixit et al. (2020) carried out a study at an outsider planned operations specialist co-op (LSP) utilizing FMCG item families. The picking problem can be solved by using a combination of ABC-FSN categorization and leanness assessment to design the ideal storage arrangement and identify activities that do not add value (NVA) to reduce picking waste. This study provides substantial insights that, in contrast to traditional inventory classification methods, will assist managers in designing layouts with the effective flow, particularly in the FMCG industry.

Malmquist product index (MPI) and dynamic network data envelopment analysis (DN-DEA) techniques were utilized by Ying Feng et al. (2018) to discuss the overall effectiveness, We want to comprehend how the numerous divisions' variations in the effectiveness of their logistics performance fluctuate over time.

RESEARCH GAPS IN THEME 1

• Literature indicates that there are few studies on SCs for fast-moving consumer products. Mentioned studies are in a general context.

• There is a lack of studies performed on supply chains specific to inefficiencies that exist in fast-moving consumer goods.

• There is hardly any study done which considers a synergistic view of the issues in the distribution of fast-moving consumer goods to achieve enhanced performance.

2.2.2 THEME II-PAST STUDIES ON SUPPLY CHAIN EFFICIENCY & DEFINING SUPPLY CHAIN EFFICIENCY

The subject of the supply chain has become dominant to academicians and researchers, this has resulted in an increase in definitions and phrases.

Oliver (1982) defined SC as "the systematic collaboration between people, processes, and information of alike organizations to create tangible or intangible values and deliver them to the customers". Supply chain management is defined by Borade (2007) as "the management of money, material, manpower, and information both within the supply chain and across the supply chain with the aim of maximizing customer satisfaction and achieving competitive advantage". Beamon B. (1998), defines Supply Chain as "a structured manufacturing process wherein raw materials are transformed into finished goods, then delivered to end customers". As per Bridgefield Group (2006), Supply Chain as "a connected set of resources and processes that starts with the raw materials sourcing and expands through the delivery of finished goods to the end consumer". In a growing globalized economy where the environment is extremely competitive and dynamic, an organization can achieve or maintain a significant competitive advantage through Supply Chain Management. As a result, efforts to not only manage but also improve, a supply chain's productivity and efficacy are critical to maintaining a competitive advantage in a global market, as competitive rivalry will only get

Supply Chain efficiency

The majority of supply chain professionals use performance analysis to increase supply chain efficiency (Estampe et al., 2013, Chen, 2013). Productivity in the store network is one of the most important exhibition requirements and can play a significant role in network enhancement. By improving and managing supply chain performance, all stakeholders in the supply chain are encouraged to collaborate on resource and incentive sharing, accelerating time-to-market, forecasting, sharing

real-time data, and improving products and processes (Stadtler and Kilger, 2008; Akyuz and Erkan, 2010). According to Stephens (2001), a tool for achieving best practices and increasing supply chain efficiency because it improves the overall performance of the company as well as its financial success (Lu et al.,), organizations now require supply chain efficiency. Since supply chain performance is largely determined by efficiency (Lu et al., 2019; 2016 Brandenburg; Ellinger and others, 2012; Ellinger and others, 2011; Aramyan and others, 2007).

Additionally, according to Nikfarjam et al., supply chain efficiency is one of the most important performance factors that can significantly influence supply chain development and provide competitive advantages. 2015). According to Hofer and Schendel (1978), efficiency is a company's capacity to produce goods and services for immediate customers at relatively low overall costs (Mooney, 2019). This capability is dependent on the company's capacity to reduce waste and make full use of resources.

Ketokivi and Mahoney (2020) examined the intellectual and theoretical foundations of Transaction cost economics (TCE), its primary goals, and its applicability as a supply chain efficiency theory.

Yoon et al., (2016) looked at how healthcare organizations' supply chain (SC) efficiency was affected by innovation leadership and SC innovation. The findings indicate that SC innovation is influenced positively by innovation leadership, which in turn increases SC efficiency.

According to Stajniak & Koliski (2016), one of the fundamental elements of controlling analysis is supply chain efficiency analysis. Transport processes are critical in ensuring physical material flow throughout the supply chain.

The purpose of Brandenburg's (2016) study was to examine how supply chain (SC) efficiency has changed over time and how this has affected company value.

According to the findings, the businesses suffered significant value losses as a result of their imbalanced cost and working capital management.

Han and Zhang (2021) conducted extensive research on how supply chain efficiency management can be improved using machine learning and neural network technology. This study proposes a supply chain risk management model that is based on neural networks and machine learning.

A study was conducted by Negi and Anand (2019) to identify the most significant factors that contribute to supply chain inefficiency at the wholesale stage of India's mango supply chain in terms of poor quality, long lead times, and high costs. Efficiency enhancements for the supply chain were also suggested.

Through network-based operation and optimal procurement system design in the case of blending technologies, the study's goal was to learn how to make automotive manufacturing companies more competitive (Nagy and co. 2018).

Home et al. say that (2015), the supply chain's efficiency could help very small businesses expand. It precisely investigates how mobile payments facilitate supplier transactions.

In the context of global supply chain management, Wang and Cullinane (2015) investigate container terminal efficiency. The primary findings are that large-scale production is linked to higher efficiency and that the majority of the terminals under consideration exhibit significant inefficiency.

Moyano (2020) discovered that internal lean management has a positive impact on the efficiency of the focal company only when it improves the implementation of lean supply chain management. When lean management is implemented throughout the supply chain, the outcomes demonstrate an increase in the efficiency of the focal company.

RESEARCH GAPS IN THEME 2

- According to the literature, supply chain efficiency is a critical factor in the success of any organization. Various studies have been conducted in various sectors, but very few studies have been conducted on the supply chain efficiency of fast-moving consumer goods (FMCG).
- There is hardly any study conducted on the inefficiencies that exist in the distribution of fast-moving goods in India.
- Few studies have looked at how supply chain efficiency affects the efficiency of fast-moving consumer goods.

2.2.3 THEME III- DIFFICULTIES IN THE DELIVERY OF FAST-MOVING CONSUMER GOODS (FMCG)

The movement and storage of goods from the point of manufacture to the consumer are known as physical distribution. It involves the involvement of logistical partners in the movement of goods, services, data, and money from the producer to the consumer (Coyle et al., 2013). Services for trade, wholesale, and warehousing (such as consignment, inventory management, and storage), as well as the movement and handling of goods (Stern and ElAnsary, 1992), and, in theory, retail, are all included in physical distribution, according to Rodrigue and Hesse. Effective distribution ensures product availability, meets customer service needs, and maximizes profits while minimizing costs. Distribution networks, which have historically been the focus for decades in order to increase efficiency and lower costs (Oke & Long, 2006), have been highlighted by Singh and Dar (2014).

According to the authors, in India, the effective physical distribution of fast-moving consumer goods is hindered by several issues. The authors attempted to compile the various factors discovered and classified them as follows: inadequate supply

chain coordination and integration; infrastructure issues; outsourcing; ineffective transportation and warehousing; ineffective forecasting; and technological issues. It is critical to have seamless connectivity and integration between the many participants to make the supply chain profitable and efficient.

The intricate structure of the supply chain, which is made up of various activities and functions, presents numerous significant obstacles to efficient coordination (Arshinder, 2008). As per the study conducted by Andraski (1998), firms need to focus on providing timely awareness of critical processes because failure to do so harms supply-chain relationships and reduces product availability.

Logistics infrastructure is a critical component that directly enables and contributes to a country's economic growth. India's economic development will be jeopardized due to a lack of logistics infrastructure (McKinsey, 2010). A 2012 Asian Development Bank research claims that because of the city's fast urbanization, delivery vans are having trouble entering the cities because urban traffic management has not kept up with the development. The old, neglected vehicles are fuel guzzlers and have shown to be quite inefficient. The situation is made worse by the bad traffic and poor road conditions, which increase wear and tear and cause more breakdowns. The fragmented nature of the truck industry and informal operations, such as non-roadworthy vehicles operating without insurance or a license or overloading further harm the infrastructure (Kumar, 2014).

Mentzer et al. discussed the strategic importance of third-party logistics (3PL) service providers in 2000. Although outsourcing logistics has many benefits, it also increases the supply chain's vulnerability. A paradigm was put forth by Konig and Spinler (2015) that compares the results of outsourcing logistics to internal resources and provides a combined risk management strategy. Different gaps between expectations and fulfillment are caused by a variety of external causes (Gupta et al., 2011). Selviaridis and Spring (2007) assert that a rigid third-party

logistics service provider experiences many drawbacks, including a lack of security and control, poor infrastructure, ineffective avenues for collaboration, and superior reporting systems.

Transportation is a crucial component playing a dominant role in SC considering that the markets (customers), manufacturing plants, and suppliers are widely scattered. According to Langley et al. (2007 b), India's transportation system has significant flaws that make it extremely inefficient by international standards and a significant obstacle to the nation's economic development. Dhulipala and Patil claim that India has one of the largest rail networks, but because it was unable to increase capacity to keep up with the expanding market, the proportion of rail freight has decreased from 85% in 1950 to 29% now. Due to the lack of efficient transportation options, high transportation costs, and an unstructured economy, India faces significant transportation-related difficulties.

Effective inventory management enhances the consumer‘s expectations of stock availability along with reducing the overall logistics cost. It has many different components, complicated lead times, price seasonality, and other requirements. The forecasting process is complicated by a number of aspects, such as product life cycle information, promotion plans, competition strategies, supply chain capacity, and, to some extent, inputs from cross-functional teams. Osei-Mensah (2016) assessed the impact of inventory management techniques on service delivery, while Wacuka (2015) investigated the connection between supply chain performance and inventory management control.

Warehousing is becoming more and more challenging with the rise in numbers of stock-keeping units (SKUs), increased demand fluctuation, short product lifecycle, and intensified marketing activities. Picking productivity (Kovac and Djurdjevic, 2020), on-time delivery (Cakman et al., 2012), storage space allocation-assignment (Reyes et al., 2019), returned goods, and other factors all affect warehouse

productivity (BonillaRamirez et al., 2019b). Numerous technological problems hinder the efficient distribution of FMCG goods.

New technology if implemented properly offers numerous benefits like reducing cycle time, scaling up operations, improving agility with improving the efficiency of the supply chain with improved customer service (Kinuthia and Akinnusi, 2014). Existing operations deliver better outcomes in terms of improved customer service, reduced cycle time, and a streamlined supply chain when integrated with new technology (Kenneth and Laudon, 2017). The various issues related to the inefficiency in distribution extracted from literature are tabulated below

Numerous technological problems hinder the efficient distribution of FMCG goods. If properly adopted, new technology has several advantages, including shorter cycle times, increased operations scale, and enhanced agility along with improved supply chain efficiency and customer service (Kinuthia and Akinnusi, 2014). When new technology is incorporated into existing operations, the results are better in terms of enhanced customer service, decreased cycle time, and streamlined supply chains (Kenneth and Laudon, 2017). The various issues related to the inefficiency in distribution extracted from literature are tabulated below-

Table 2: List of issues leading to inefficiencies in distribution of FMCG products

S.No	List of Issues	Description	Reference

1	Lack of Coordination and Integration	Coordination and integration are critical components of any supply chain's success.	Cooper and Lambert (2000) Ballou et al., (2000) Stank et al., (1999) Lee, (2000) Horvath, (2001)
2	Infrastructure Issues	Logistics infrastructure has a significant impact on trade and distribution costs. Poor infrastructure increases the distribution cost	Mishra, (2008) Dwivedi, (2018) Haddad, (2017) Adewole, (2019)
3	Challenges associated with outsourcing	Logistics outsourcing is a commonly used practice, which is followed by most of the companies, especially in physical distribution.	Tsai et al., (2012) Webb and Laborde, (2005) Yazdani et al., (2021) Govindan et al., (2019)

4	Transport Inefficiencies	Transportation management has a straight effect on SC performance.	Sternberg et al., (2013), McKinnon and Alan, (2009), Ajiboye, (2017), Goldsby, (2014).
5	Inventory & Forecast related issues	An accurate forecast and effective Inventory management are critical factors for supply chain efficiency.	Bose and Pekny, (2000) Reiner and Fichtinger, (2009) Hamisi, (2011) Aljunaidi and Ankrah (2014)
6	Warehouse Inefficiencies	Warehouse performance has a direct impact on effective distribution.	Gur et al., (2006), Parikh and Meller, (2009), Balk et al., (2017), Pane et al.,(2019).

7	Technological Issues	The prime reason that contributes to inefficiencies in the overall distribution of fast-moving consumer goods is poor technology integration in different.	Kamble et al., (2019) Angeles, (2005) Francisco and Swanson, (2018) Bala and Kumar (2011)

2.2.3.1. LACK OF COORDINATION AND INTEGRATION

The logistics partners are required to work in a unified and coordinated fashion. Moharana et al., (2012) explain coordination as the active cooperation of members and resources that led to the synchronization of various elements and harmonious adjustment of interactions to make different things work together. Coordination is a vital component for common objectives and can be achieved by sharing the right information that helps in joint decisions and activities. Logistics information is crucial for effective decision-making that helps in optimizing cost and reducing inventory. Coordination can be viewed as "glue" that binds together different processes, structures, and the entire supply chain (Soroor, 2009). In a study conducted in 2000, Lee suggests the impression of SC integration at different echelons through coordination including sharing of information that enhances supply chain performance (Sawik, 2009). The main factors affecting coordination activities include flexibility limitations, variable interests, postponement of conveyance, and poor data quality (Rodrigues, Vasco and Potter, Andrew and Naim, Mohamed, 2010). Turnaround time (TAT) can assure higher efficiency. (Parwani and Jagadeesh, 2012). The competition is shifted from

individual companies to the supply chain (Christopher, 1992). Some of the integration challenges are listed below in table-

Table 3: Lack of Coordination and Integration

Issue	Variables	Source
Lack of Coordination and Integration	Lack of visibility	Barratt and Oke, (2007) Silvera, (2017)
	Poor Information Sharing	Ogunlela and Lekhanya, (2016)
	Poor Information quality	Bottani et al., (2010)
	Not sharing information on time(Real-time)	Fosso Wamba et al., (2007), Malkanthie, (2017)
	Lack of cooperation & coordination among supply chain partners	Hosseini et al., (2021)

	• Inadequate use of advanced IT to integrate the supply chain	Bloem and Bean, (2015)

2.2.3.2. POOR INFRASTRUCTURE ISSUES

Robust infrastructure is required to move goods from the production centers to the consumption centers at the right time in the right condition with optimum cost. Poor infrastructure is one of the biggest hurdles in reducing different losses and distribution costs of goods. The logistics infrastructure in India has a poor network and stands low on quality (Deloitte Report, 2014) further revealing the inefficient and inadequate transportation infrastructure in the country. One of the prime issues is the regional concentration of production and geographical diversification of distribution activities which is further aggravated within efficient infrastructure and accompanying technologies. The poor condition of rural roads and lack of transport utility is a common phenomenon, which also creates a lot of hindrances in the distribution of FMCG products in rural areas (Dwivedi, 2018). The table below covers the infrastructure challenges-

Table 4:Infrastructure related Issues

Issue	Variables	Source
	Poor Road Conditions	Dwivedi, (2018)
	Avoidance of good quality roads due to higher toll charges	Perera et al., (2020)

Infrastructure Issues		
	Poor network connectivity	Aderamo and Magaji, (2010)
	Traffic congestion	McKinnon, (1999)
	Poor working conditions for drivers	Mahajan et al., (2019)
	No entry into the cities for bigger trucks.	Parkan and Dubey, (2009)
	Extra and unplanned halts during transit	Raghuram and Sanghani, (2017)
	Poor storage and warehouse condition	Negi and Anand, (2018) Thakkar et al., (2012) Singh et al., (2021)
	Poor loading and unloading facilities	Sandee, (2016)
	Lack of mode/career selection	Sandee (2016)

2.2.3.3 THIRD-PARTY OUTSOURCING CHALLENGES

Outsourcing has become a common phenomenon in every business today. Outsourcing, according to Griffith (2001), is "the strategic use of outside resources or suppliers to perform activities traditionally handled by internal staff and resources." Logistics outsourcing is deploying a vendor to carry on logistics activities based on a contract (Razzaque and Sheng, 1998). It is regarded as a common strategic tool for the reduction in costs and improved competitiveness (Lieb, 2005; Makukha, 2004). According to Langley (2005), 3PL services are used by 67% of businesses in Latin America and 74% of businesses in South Africa. Rahman et al. (2019) identified and prioritized the challenges for multinational 3PLs operating in China in terms of strategic importance. The logistics industry landscape requires significant resources to assist in meaningful action with remedies and mitigation strategies for the disruption-causing consequences (Langley, 2017). In the FMCG sector, it is quite evident that most of the functions are outsourced to third-party operators like transportation service providers (TSPs) and warehouse service providers (WSPs). Apart from transportation, and warehousing, manufacturing (contract manufacturing) has become common these days. Outsourcing poses various challenges in the effective execution of operations due to poor coordination at times. Ansari and Modarress (2018) identified 3 PL service providers' challenges in meeting customers' continued growth needs, as well as security issues caused by the incompatibility of IT systems. The different challenges pertaining to outsourcing are mentioned in table 5.

Table 5: Third Party Outsourcing Challenges

Issue	Variables	Sources
Challenges associated with outsourcing	Poor performance due to low-cost emphasis	Huo et al., (2008).
	Poor information flow	Haixia, (2010) Aktas et al., (2011)
	Cultural mismatch/incompatibility	Akta et al., (2011).
	Lack of control	Serdarasan, (2013) Bloem and Bean, (2015), Ali Syed and Siddiqui, (2019).
	Lack of cooperation	Malkanthie and Jayamanna, (2017) Srivastava, (2019).
	Lack of trust	Mitra and Bagchi, (2008)
	Lack of knowledge, skills, and competencies	Moffett et al., (2002) Ogorelc, (2007) Sangka, (2017).
	Labor unions (Trade union activities) & political influences	Malkanthie and Jayamanna, (2016) Magagula, et al., (2020)

	Poor understanding of customer's expectation	Kumar & Singh, (2012) Hwang et al., (2016) Bolumole, (2003)
	Inadequate employee quality	Malkanthie, (2017) Selviaridis and Spring, (2007)
	Customers' unrealistic expectations	Kumar and Singh, (2012)
	Inadequate service and service level descriptions	Malkanthie, (2017)
	Loss of control and capabilities	Selviaridis et al., (2008) Ellram and Cooper (1990)
	The incapability of third-party logistics service providers to handle emergencies.	Njambi and Katuse, (2013) Selviaridis and Spring, (2007)

2.2.3.4. TRANSPORTATION INEFFICIENCIES

The products are rarely consumed at the place where they are produced. As mentioned above most of the fast-moving consumer goods do not own any fleet of their own and outsource all their transportation needs to third-party transport

service providers (TSPs). This leads to many inefficiencies in the distribution system. Shaw (2009, explained efficiency as the utilization of a firm's resources to get the output against input, in financial and non-financial terms. Transport Management Systems use technology to attain the objectives of transportation like lower cost, on-time delivery with the best use of resources (Stock and Lambert, 2010). Poor transportation leads to the in transit-damages, total inventories, and overhead costs which further create external diseconomies that give birth to inefficiencies and unreliability in the supply chain (Gulyani, 2001). Hu et al., (2019) develop an internet-based model for locating hubs at a capacity level along with the routing of loads. Resat and Turkay, (2019) analyzed the Turkish transportation industry by using a mixed integer linear optimization model. Elnaz Irannezhad, (2020) suggested blockchain as a solution for fragmented freight transportation which is grappling with a lack of trust and lack of transparency. This information asymmetry and lack of visibility are the significant contributors to inefficiencies that result in disagreements over unanticipated costs. Transportation-related challenges are depicted in table 6-

Table 6:Transportation inefficiencies.

Issues	**Variables**	**Source**
Transport Inefficiencies	In-transit delays	Sanchez-Rodriguesa, (2009) Zeng and Rossetti, (2003) Privett and Gonsalvez, (2014)
	Road Congestion	Sanchez-Rodriguesa, (2009)

	Poor visibility of in-transit inventory	Zhang et al (2011) Hughes, (1994)
	Vehicle Routing Problem	Dekker et al., (2009) Viswanathan and Mathur, (1997) Sateesh and Ray, (1992)
	Increase in daily traffic and idle-time	Naicker, (2020)
	Vehicle capacity utilization	Van de Klundert and Otten, (2011)
	Detention at loading and unloading	Gupta and Jigeesh, (2019)
	Delays caused by unplanned driver stops	Sanchez-Rodrigues et al., (2009)

	Seasonal fluctuations and supply/demand of trucks	Ganesh and Gajanand, (2018)
	Unpleasant working conditions of drivers.	Garbarino et al., (2018)
	Unloading/Loading delays	Sanchez-Rodrigues et al., (2009)
	Vehicle Routing and Scheduling system	Sanchez-Rodrigues et al., (2009)
	Shortage of drivers	Rana and Caplice, (2020) Smith and Srinivas, (2019)
	Crashes due to driver Fatigue	Neubauer et al., (2017) Gander et al., (2006)

2.2.3.5. INEFFICIENT INVENTORY MANAGEMENT & POOR FORECASTING

Forecasts have been essential for SC management in the Indian FMCG sector. To achieve an equilibrium between supply and demand management, demand forecasting is an essential component. At one end of the supply chain, stock outs and lost sales are caused by forecasts that are always incorrect. On the other hand, having too much inventory increases the burden of blocked capital, the cost of obsolescence, and the cost of servicing products in the supply chain. This causes a number of problems, including a poor return on investment for distributors and retailers in the downstream supply chain. Sanders et al., (2016) discovered, through their research, that sharing inventory management tools results in an enhancement in the supply chain performance of organizations (Lee, 2013). It is extremely challenging to forecast demand to supply the products while managing the uncertainty in the market (Vayvay et al., 2013). Poor forecasting and inventory management also lead to product expiry and shelf life issues, which put additional pressure on the supply chain. The skewed-sales toward the month's end also affect the overall demand planning. The Inventory management and forecast-related issues are given below in table 7.

Table 7: Inefficient Inventory Management & Poor Forecasting

Issue	Variables	Source
Inventory & Forecast	Inventory Shrinkage (damages and shortages)	Singh et al., (2021)

related issues	Poor Inventory tracking (Batch/Lot tracking)	Muiga and Patrick, (2019)
	Inventory Ageing	Gupta and Iyengar, (2014)
	Product Expiry (Poor shelf life)	Van Elzakker et al., (2013) Basson et al., (2019)
	Stock outs	Gruen and Corsten, (2002)
	Forecasting Errors (effect of weather and season)	Basson et al., (2019)
	Longer lead time	Battezzati and Magnani (2000) Alzoubi, (2018)
	Capacity constraints	Aggarwal (2018), Adebanjo and Mann, (2000)
	Poor inventory turnover	Grubor et al., (2013)

	Skewed sales towards month end	Chinna (2016), Singh and Misra, (2018)
	Bullwhip effect	Gupta and Saxena, (2020) Bottani et al., (2010)

2.2.3.6 WAREHOUSE INEFFICIENCIES

Many reputed FMCG firms failed to realize the benefits of effective and efficient warehousing. As a result, most of the Indian warehouses fail to perform with respect to international standards. Warehouse design has a direct impact on revenue maximization, and layout can be very important in this regard. The operation should be optimized by utilizing storage efficiently and effectively (Shah and Khanzode, 2015), maximizing supply availability and consumption (Rushton et al., 2006), and maximizing demand output (Heragu et al., 2005). Dixit et al., (2020) conducted a study to improve picking efficiency through a lean approach. Kenneth Ruebrdanz, (2011) gave the golden rules related to storage techniques, order processing, and picking efficiency for the optimization of warehouse operations. Opposition to the liberalization of foreign direct investment (FDI) in retail is one of the major impediments to technological advancement in warehousing. The effective distribution of goods is not possible without efficient warehousing. The Indian warehouses are plagued with many inefficiencies. Major warehouse-related inefficiencies are depicted in the following table 8-

Table 8: Warehousing Inefficiencies

Issue	Variables	Source
Warehouse Inefficiencies	Delay in loading and unloading	Simons et al., (2004)
	Poor documentation issues	Edward Mokua, (2017) Krishnadevrajan et al., (2015)
	Poor storage and handling	Rangaswamy and Vinoth, (2009) Bonilla-Ramirez et al., (2019)
	Faulty Layout	Wibowo et al., (1978) Magistrale et al.,
	Poor working condition	Bhatia et al., (2021)
	Picking inaccuracy	Gong and De Koster (2011), Lu et al., (2016)

	Ineffective Order Processing	Brouwer (1972), Rutagira and Awichi, (2020)
	Lack of skills	Dewa, (2017), De Kok, (2015)
	Picking inefficiency	Chavira (2018), Dixit (2020)
	Underutilization of warehouse space	Dixit (2001), Krishnadevarajan et al., (2015)
	Defective dispatching	Dixit et al (2020)

2.2.3.7 TECHNOLOGICAL ISSUES

Many people engaged in this sector do not have either sound knowledge or have poor knowledge regarding the latest technologies in the distribution domain. This leads to an inefficient supply chain, which increases the total cost and reduces the profitability and customer service level. Various latest technologies have been introduced like Barcodes, RFID, Sensors, Warehouse Management systems (WMS), Transport Management Systems (TMS), Automated Storage and Retrieval Systems (ASRS), Robots, the latest wearable computers, etc. which can revolutionize productivity. However, due to various reasons still, the technology

penetration in this area is quite limited. Miralam, (2017) examined the impact of the warehouse management system (WMS) on warehouse operations in an auto spare parts warehouse in Saudi Arabia. Mukolwe and Wanyoike (2015) studied the effect of e-logistics and the study revealed numerous benefits of automation of warehousing activities by enhancing the speed of operations, and accuracy with reduced wastage. Warehouse management systems improve supply chain performance. IT-enabled cold chain management systems can make it possible to deliver perishable products on time, despite the fact that their shelf life is limited. Monitoring logistics activities becomes more efficient when IT is used (Kakhki, 2019; Bosona, 2013); the cost of food products stored in warehouses are moderated (Jagtap, 2019; Manzini, 2013); response time is reduced, and performance improves (Han, 2017; Theoni, 2017).

The use of technology in conjunction with a supportive infrastructure can have an impact on supply chain collaboration (Beverly, 2002). The information system architectures must be in line with the firm's information requirements to respond to changing customer demands (Duclos, 2003). Grunow (2013) proposed RFID as a cutting-edge technology to help reduce waste in perishable FSCs. Gogou et al. (2015) proposed using database-based software to calculate the status of the shelf-life as the product moves through different links of the chain. In their research on sustainability, Farooq et al. (2016) presented an electronic pedigree traceability system incorporating RFID and sensor technology to enable remote monitoring of agricultural food and stop the circulation of dangerous and contaminated food products. Wilson and Clarke (1998) proposed a software system to handle the local and global location, collation, and dissemination of data containing traceability-related information via electronic communication and the internet. In their study, Cheng et al. (2001) proposed a virtual network structure to aid in the communication, coordination, and sharing of competencies and resources within organizations. Wireless sensor technology enabled real-time data acquisition, while

QR codes assisted workers, managers, and consumers in ensuring the 120 quality and safety of the products through information, both static and dynamically monitored. Sharing information can help improve supply chain performance. An incorrect choice of technology or technological solutions can have a negative impact on operational performance and result in economic losses for the organization, while inappropriate resource usage and allocation will have an adverse environmental impact (Jadhav, 2009). As a result, it is critical to select appropriate advancements to meet the firm's and supply network's well-defined requirements while also assisting in achieving higher levels of performance (Tu, 2021). The technology-related issues are tabulated below (Table 9)-

Table 9:Technological Issues

Issues	**Variables**	**Source**
Technological Issues	Lack of IT capabilities.	Balocco et al. (2011), Alicke et al (2017)
	Non-adoption of efficient Technology	Jalil (2019) Lin (2009) Archer (2008)
	Obsolete technology	Nunez-Merino (2020), Chaudhuri (2016) Kumar (2011).

	Lack of Trust in technology (Security & Privacy)	Pishdar et al. (2018) Imeri et al. (2019). Zhang & Lee (2006)
	Cybersecurity Connectivity Lack of Professionals	Nozari et al (2022) Cheung et al. (2021) Li & Xu (2021).

RESEARCH GAPS IN THEME 3

- Numerous issues exist in the supply chain of fast-moving consumer goods, as evidenced by this, but there has been little research that offers solutions to all of the issues in a comprehensive manner.
- There are many studies pertaining to the specific area of the supply chain but there is hardly any study conducted to address the inefficiencies that exist in the distribution of fast-moving goods in India.
- There have been studies on the use of IT in the supply chain, but there has been little research on the distribution of fast-moving consumer goods.

2.2.4 THEME IV: THE IMPORTANCE OF AN EFFECTIVE SUPPLY CHAIN IN THE FMCG SECTOR

This issue addresses and highlights the significance of an effective supply chain in India's FMCG industry. The significance of supply chain efficiency for the players involved in meeting the needs of the consumer and the Indian economy as a whole has been highlighted by several researchers. In the FMCG industry, supply chain efficiency is essential to boosting stakeholders' profitability, which would also aid in the reduction of waste and losses. Furthermore, this would aid in the preservation of the value and quality of these goods, resulting in dependable and timely delivery to customers at the appropriate time by maintaining proper quality at reasonable prices. It can be deduced that efficiency in the supply chain is the need of the hour in the FMCG sector, implying the importance of further research in the area of SCM.

The outsourcing of logistics services is a common practice in the FMCG sector as most of the activities like warehousing, transportation, packaging, manufacturing, etc. The challenges exist with outsourcing as the performance of a firm is directly reliant on the operation of the service providers and non-performance and inefficiencies in the processes lead to higher costs and affect profitability. Most businesses create matrices to measure the act of facility providers, but they struggle with the identification and development of the right matrices, as well as the availability of data and mechanisms or tools to capture the data required to highlight the performance of service providers. With the advancement of digital technologies, a plethora of tools have been developed to collect data and assess inefficiencies in primary transportation. In this new business environment, managers need to come up with the right performance metrics to help them make the right decisions that will help their organization become more competitive. According to Schramm-Klein and Morschett, the financial performance of retail firms is significantly impacted by logistics performance, as indicated by logistics costs and quality. The financial success of major Taiwanese manufacturing enterprises was found to be positively correlated with logistics (Shang and Marlow,

2005). The overall cost structure varies by industry. Due to higher volumes and a larger network, the FMCG sector has the highest cost of material and logistics activities.

Figure 2.2 below depicts the various supply chain components and their share of the FMCG sector's gross sales in India.

Supply Chain Cost Type	Cost in FMCG Sector		
	Average	Lower bound	Upper Bound
Cost of Material	52.92	15	90
Cost of Labor	8.90	0.51	70
Cost of Production Overheads	11.78	0.5	40
Storage Cost	3.52	0.16	12
Inbound Transportation Cost	3.38	0.12	20
Outbound Transportation Cost	3.38	0.12	20
Warehousing Cost	2.06	0.1	8
Secondary / Tertiary Transportation Cost	2.02	0.2	10
Distributor's Margin	6.35	0.1	20

Figure 2.2 Cost of various components of Supply Chain in the FMCG Sector

Source: Researchgate (Sahay & Gupta, 2002)

Sanders and Premus (2005), Wu et al. (2006), Yusuf et al. (2004), and others argue that elements like firm IT capability, internal and external collaboration, and supply chain integration enhance firms' financial performance. These authors have also looked at the connection between logistics management practices and financial performance.

Every single study (World Global Logistics Research Team, Michigan State University, 1995; D'Avanzo et al. (2004), the European Logistics Association, and A.T. Kearney, 2003) has found a direct correlation between outstanding financial success and excellence in logistics.

Outstanding logistics performance is projected to have a favorable effect on stock values in addition to the immediate effects of lower costs and higher revenues (Christopher and Ryals, 1999; 1999 Walters).

To assume that there is a direct link between successful financial outcomes and logistics performance is presumptuous. As a result of strong logistical performance, it is predicted that the company's financial performance will be reflected in greater profitability and productivity, as well as opportunities to grow more quickly in comparison to competitors in a particular industry.

RESEARCH GAPS IN THEME 4

- Although, a plethora of literature is available on supply chain efficiency hardly any study exists which addresses the inefficiencies that exist in the distribution of FMC goods.
- Very Few studies were found to address the inefficiencies that primarily exist in warehousing and transportation for FMC goods.

2.2.5 THEME V: MEASURES TO IMPROVE SUPPLY CHAIN EFFICIENCY

2.3.5.1 IMPORTANCE OF DIGITALIZATION IN LOGISTICS

According to Ashayeri and Gelderes (1985), space efficiency, methods of order picking, and material handling were traditionally taken into consideration in warehouses. Today's greatest design problems for warehouses include tighter inventory control, quicker response times, and a wider range of stock-keeping units (SKUs). Even however, these challenges may to some part be sparked by the adoption of different administrative paradigms, such as the distribution center stock plan or "lean" tactics like little time to spare. IT capabilities have been used to

demonstrate that there are additional prospects for improvement (Gu et al. 2007). These IT capabilities can be put into use by utilizing integrated warehouse management systems, barcodes, RFID tags, automatic identification (Auto-ID) sensors (iWMS), and cable or wireless communication networks.

After implementing smart glasses solely for picking in their Netherlands warehouses, DHL saw an increase in operational efficiency of 25%. 2016 DHL Logistics Trends Radar In the logistics sector, big data is rapidly gaining traction in India. Business intelligence tools like Insta Intelligence, which automates logistics procedures, have been developed by companies like Wipro. Sawyer is a collaborative robot with just one arm that was developed for logistics purposes. The Internet of Things (IoT) is a system that combines and joins electronic gadgets so they may communicate with one another and exchange data online (2016 DHL Logistics Trends Radar). In warehousing and supply chain management, a variety of tools work independently to do their assigned jobs. All procedures can be completed without a hitch if these gadgets interact and coordinate their actions. This boosts time effectiveness.

IoT has been acquainted in India with help from online installment doors as well as areas like media communications and power. The logistics industry has not yet been affected by the IoT revolution. The Warehousing industry is expected to expand primarily thanks to technology. According to Thehindubusinessline.com (2018), India has only recently realized the enormous potential of technology-driven innovation in this expanding industry. As per the McKinsey Worldwide Organization, processing plant activities and gear streamlining can create up to $3.7 trillion in esteem by 2025. (Numeroka et al., 2015) Research conducted by the World Economic Forum (WEF) indicates that digital transformation will have

societal benefits worth $2.4 trillion and a value of $1.5 trillion at stake for logistics players over the next decade.

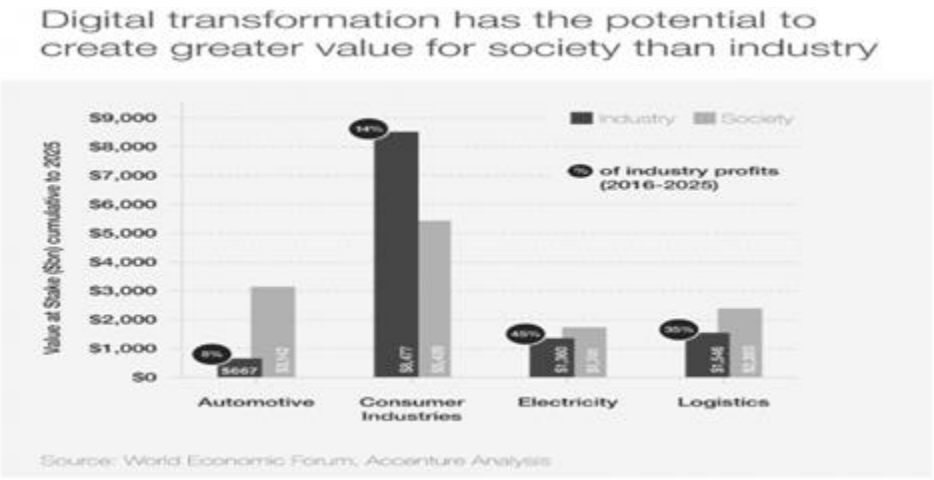

Figure 2.3 Value at Stake in billion US $ [World Economic Forum]

Source: World Economic Forum

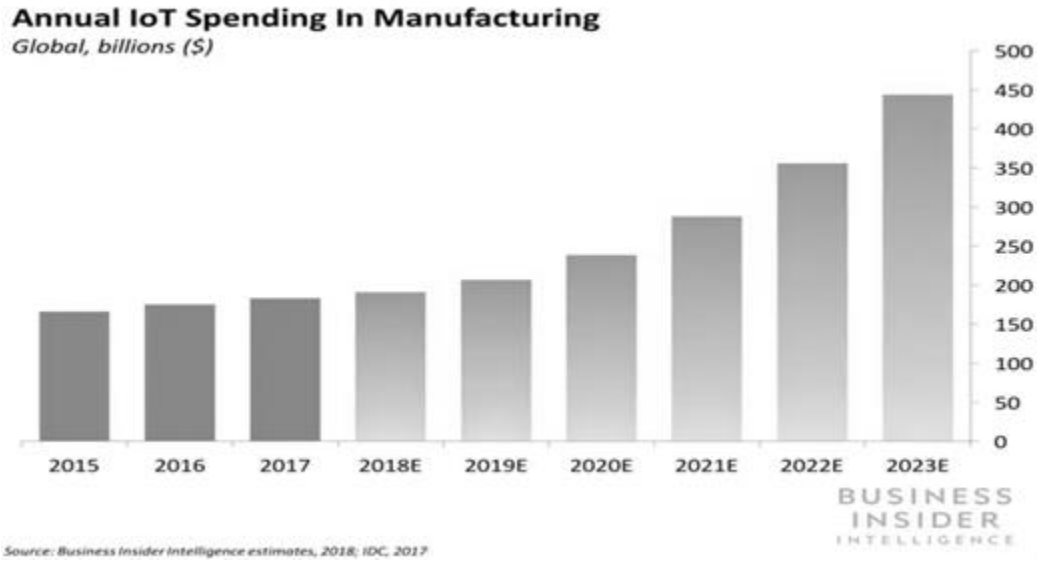

Figure 2.4 Global IOT Spending (US$ billion)

Source: Business Insider Intelligence estimates 2018

Collaboration in the supply chain can be impacted by utilizing technology in conjunction with a supportive infrastructure (Beverly, 2002). to meet the shifting needs of customers, information system architectures must be aligned with the organization's information requirements (Duclos, 2003). The optimal use of various logistics and supply chain techniques and technologies such as GPS, GPRS, GIS, ICT, and RFID results in sustainability. RFID's role is unquestionably an enabler of globally-judged criteria of economic, environmental, and social dimensions (Arora, 2018). The importance of technology can be further understood by the different studies carried out by the Confederation of Indian Industries (CII), NITI Ayog, Forbes, and some management and consultancy firms.

The table below depicts the significance of technology in logistics and supply chain management.

Table 10: Importance of IT (Information Technology)

IT has a variety of roles in the Indian logistics industry. However, its primary goal is to enforce and clean internal hygiene while also managing operations more efficiently. IT also performs traditional functions such as increasing productivity and standardizing information management.	CII Report, (2013)
Shipping-independent innovation can possibly change how we move products today. Intelligent platooning, in which trucks form platoons and drivers can rest while the platoon moves, can help increase safety and hauling efficiency. This method also ensures optimal road-space utilization, which aids in the improvement of road infrastructure capacity.	NITI Ayog, (2018)

The future supply chain will be smaller, more efficient, and, most importantly, self-organized. Over the next 15 years, industry participants will cautiously adopt a few radical technologies that will drive this unprecedented rate of change.	Forbes.com, (2016)
Logistics has seen several technological advancements as a result of technological advancements. Several innovations are taking place in the field of inbound logistics. Vehicle tracking and dispatch keep track of each vehicle's location and inventory. Annual traffic density figures are used to determine the most cost-effective routes for transporting goods. The truck routes and manifests are generated dynamically based on their inventory loads, and the delivery is tracked and monitored.	Viswanadham (2014)
In the next five years, experts in transportation and logistics will place a higher value on data and analytics than any other industry—90% in T&L, compared to an average of 83% nationwide. 8 The industry has never had access to more data. Here, there are numerous opportunities to enhance customer service and performance.	PWC (2016)
The industry faces a new obstacle in the form of rapid technological adoption. Indian logistics could benefit greatly from the application of newly developed technologies, but infrastructure development and application must keep up.	Dhlsmartucking .com (2018)

Poor logistics planning, the use of inadequate logistics software, and poor outsourcing choices, such as choosing the incorrect vendor or carrying out delivery duties with insufficient resources, are the main causes of inefficiencies in the distribution of finished goods to customers.	Techopedia (2018)
Inefficiencies in goods distribution are caused by poorly managed inventory, which results in unexpected inventory runs.	Millennium Logistics (2016)
According to PLS Logistics Services (2013), unreliable distribution networks prevent customers from obtaining products at any time for consumption, which results in inefficient supply chains. Poor transportation solutions are another factor driving up costs and lowering service levels.	PLS Logistics Services (2013).

RESEARCH GAPS IN THEME 5

- There has been research on the use of IT in the supply chain, but little on the use of digitalization to reduce inefficiencies in the distribution of fast-moving consumer goods.
- There are few studies on the role of IT and new technologies that take into account the cost, quality, and integration of various links in an FMCG supply chain.
- There has been little research focused on overcoming issues while also suggesting solutions and the use of digitalization in overcoming distribution-

related issues of FMC goods, which will aid in achieving improved performance and thus reducing food waste and losses.

2.2.6 THEME VI: THEORETICAL UNDERPINNING

To deliberate the theoretical premise for this study, different theories such as stakeholder theory, organizational theory, transaction cost economies theory, agents theory, theory of constraints, and resource-based view were studied in this study (Sanderson et al., 2015; Halldorsson et al., 2007). Following careful consideration, it was determined that the combination of Goldratt's Theory of Constraints Thinking Process and Williamson's Transactions Cost of Economics theory is the most applicable to this study.

Table 11:Theories underpinning logistics outsourcing strategies

Social Science theories that underpin logistics outsourcing strategies.	
Theories	Notes explaining why logistics outsourcing is used to coordinate logistics integration throughout the supply chain
General System's Theory(Von Bertalanfy 1950;1968)	claims that the success of the entire supply chain is dependent on the cooperative performance of individual supply chain enterprises and permits an open definition of supply chain scope (Gregson, 1977; 1971 Christopher The business can redesign traditional function-oriented systems through outsourcing to profit from systems integration (Gregson, 1976; 1989, Stevens).
Resource-Based Theory (Penrose 1959)	The author believes that the company is a collection of resources (Penrose, 1959; 1984 Rumelt; Wernerfelt, 1984) and skills that give them an

	advantage over competitors (Barney, 1991; (1991, Conner) According to Olavarrieta & Ellinger (1997), A business might acquire resources from its surrounds through outsourcing to survive and improve its operational performance. 2003 publication by Salvador, Forza, and Choi (Rungtusanatham).
Channel Theory (Bucklin 1966)	The Supply Chain, according to Bucklin (1966), is a group of organizations that manages each stage of the process of moving a product and its name from manufacturing to consumption. outlines the reasons why companies outsource and see the supply chain as a full marketing system (Scott & Westbrook, 1991). To achieve a standard structure or "best value for money," an organization is said to be outsourcing (Stern, El; Ansary, and Coughlan 1996).
Transaction Cost Economics (Williamson 1975; 1985;1991;1996)	Outsourcing is a hybrid governance method that blends market and hierarchical elements to lower transaction costs (Aertsen, 1993; Hobbs 1996; Anderson1997). The study of outsourcing decisions can be done using transaction cost economics. involving supplier involvement, client-3PL partnerships, and operational performance (Ellram, 1991; Anderson, 1997) Skjoett-Larsen and Mikkola, 2003).

Agency Theory(Jensen & Meckling 1976)	Explains why organizations and service providers form alliances (Blancro and Ellram, 1997; Stock 1997; Logan 2000). Relationships in the supply chain's costs and benefits are examined. Distinguishes methodologies for forestalling supply advantage with specialist organizations by client firms (Stump and Heide1996).
The Value Chain Concept(Porter 1980;1985)	According to Stock 1997), logistics is a value-added activity that aids in the development of competitive advantage. The substitution of inventory with efficient communication and information flow integration of logistics into the value chain can be made easier by members of the supply chain. (La Londe, 1984).
Network Theory (Ford1990;1997)	Explains, according to Hakansson and Snehota (1995), how various kinds of (3PL-client) relationships are formed based on the extent of contractual limitations. Outsourcing allows businesses to manage and coordinate processes across the supply chain, and alliances across the supply chain facilitate logistics integration (Ellram, 1990; 1995, Hakansson and Snehota; Ford1997).

2.2.6.1 THEORY OF CONSTRAINTS

This theme discusses previous research on Goldratt's "Theory of Constraints" Thinking Processes. An extensive literature review was carried out, and previous studies from both the global and Indian perspectives were discussed. Several studies have been conducted on the TOC thinking process in general, in which the

researchers propose a structure and discuss the application of TOC to a general supply chain, as well as how the TOC philosophy can be used to expand the general framework for cooperation in SCM.

The Theory of Constraints (TOC) is a method for identifying the most significant constraint (or constraint) that prevents an objective from being accomplished and then improving that constraint methodically until it no longer functions as a constraint. In assembling, the imperative is regularly alluded to as a bottleneck. The TOC proposed by Goldratt was found to be the most appropriate for this study. Simsita et al, 2014; Kim et al, 2008, Mabin & Baldestone, 200: Rahman 1998 conducted an extensive literature review on the TOC thinking process. The studies are centered on discussing TOC development, evolution over time, methodology development, comparisons with other methods, investigations of thinking process characteristics, and so on. Because TOC is popular for overcoming supply chain bottlenecks, the term also refers to a number of other related productivity concepts advanced by Dr. Goldratt or other adherents of his philosophy (Polito et al., 2006). Taylor and Ashthana (2016) investigated a division of a manufacturing company that was experiencing inventory control issues. Ehie and Sheu (2005) investigate the feasibility of integrating six sigma and TOC to improve the performance of a manufacturing system. Taylor and Paynor (2008) investigated how a skilled employee can be retained in an organization using the thinking process logic. Many studies discuss the practical application of TOC to manufacturing. Taylor and Ashthana (2016) studied a segment of a manufacturing company facing inventory control problems. Ehie and Sheu (2005) investigate the prospective integration of six sigma and TOC to enhance the performance of the production system. Taylor and Paynor (2008) evaluated how a skilled employee can be retained using the thinking process logic in an organization. According to (Taylor and Esan, 2012), "Goldratt's Theory of Constraints (TOC) focuses on the efficiency of all processes

as a whole rather than the efficiency of any single process". Table 12 below depicts the application of the Theory of Constraints in various fields.

Table 32: Application of Theory of Constraints

S.No	Author (Year)	Context	Inference	Region
1	Taylor & Ashthana(2016)	Manufacturing	Uses of Goldratts Thinking process with the intent of investigating solutions to the inventory control solution	USA
2	Rahman (2002)	Supply Chain Management	Application of thinking process to determine the key success factors in SCM and to understand underlying associations among these reasons.	Australia

3	Singh & Misra (2017)	FMCG	Discovers the current operational model of TOC, particularly in the outbound supply chain, and exposes the related bottlenecks that occur during applications.	India
4	Brzozowska et al (2016)	Agribusiness	Identification of manners for improving the logistics information management system in an agribusiness enterprise based on methods for project management encountered in	Global

			the theory of constraints.	
5	Taylor and Sheffield (2002)	Health Insurance	Applications of Goldratts Thinking process in claims processing centers in the USA and suggested improvements.	USA
6	Polito et al (2006)	Airline Industry	Application of TOC to solve the case of the airline industry for improving and enhancing competitive outcomes.	USA
7	Ehie and Sheu (2005)	Manufacturing	Integrating Six Sigma & TOC in the operations may enhance the performance of	USA

			the production system.	

2.2.6.2 TRANSACTION COST ECONOMICS THEORY

Most FMCG companies outsource their transportation and warehousing needs to third-party logistics service providers (3PLs). This theory is best suited for making or buying decisions, as well as outsourcing. According to transaction cost theory (Williamson, 1979, 1986), the ideal organizational structure maximizes economic efficiency while minimizing exchange costs. According to the notion, there are expenses associated with monitoring, regulating, and administering different types of transactions.

Strassman (1997) discusses using selling and general administrative (SGA) costs as a proxy for coordination costs in financial statements. Firms incur SGA expenses while managing, planning, promoting, and coordinating their organizations to effectively deliver goods and services to customers. However, these costs only reflect the costs of internal and external coordination and do not include the costs of managing transaction risk. TCT seeks to determine which governance structure maximizes a given firm's performance (e.g., efficiency) (Alaghehband, Rivard, Wu, & Goyyette 2011). Table 13 below illustrates the application of TCE in various fields.

Table 13: Application of Transaction Cost of Economics Theory

S.No	Author (Year)	Context	Inference	Region

1	Erin Anderson (1988)	Electronic Component	This study is an empirical test of the transaction cost determinants of salespeople's opportunism.	USA
2	Ahmadjian & Oxley (2005)	Automotive	This study examined the usage of partial equity stakes and volume-based reliance balancing in the automotive supply relationship.	Japan
3	Allen & Lueck (1992)	Agriculture	This study is an effort to examine the rationale of contractual arrangements in modern agriculture.	USA
4	Anderson et al (1998)	Insurance	This study looked at insurers and their independent agents to see if it was possible to develop committed relationships between insurers and independent agents.	USA
5	Toni Ashton (1997)	Health Services	This paper examines contracting experiences between the	New Zealand

			purchaser and provider of health services.	
6	Doh et al. (2004)	Telecom Infrastructure	This study looked into the factors that influence the outcomes of those negotiations, as measured by the proportion of newly completed telecommunications infrastructure projects that are private rather than state-owned.	Various Countries
7	Schmidt & Wegner (2019)	Supply Chain	This study examined a number of areas for future research into the way SCM might be inclined by blockchain in the future.	Not country-specific
8	Bahli & Rivard (2007)	Information Technology	This paper proposes a scenario-based conceptualization of the IT outsourcing risk.	Canada
9	Radianti et al (2019)	Higher Education	The advantages and applications of virtual reality (VR) in various contexts have been the subject of research.	Norway

2.2.6.3 SUITABLE THEORIES FOR THE STUDY

After deep consideration, the combination of the Theory of Constraints (TOC) and Transaction Cost Theory is found to be the best-suited theory for this study. The theory of constraints advocates the removal of bottlenecks (inefficiencies) that exist in the studied area due to manual processes whereas the Transaction Cost Analysis primarily focuses on outsourcing issues and reducing the transaction cost by effectively controlling, coordinating, and monitoring.

Table 14: Suitable Theories for Study

Theory Justification	**Justification**	**Suitability for study**
Agency Theory	The theory is based on the Agency problem and assumes a contractual agreement between the principal and agent for a specified or indefinite future period.	Suitable
Resource Based View(RBV)	The RBV considers the firm to be the primary unit of analysis, implying that firms with rare, valuable, and unique resources can achieve long-term competitive advantage by implementing novel value-creating strategies that competitors find difficult to replicate.	Not Suitable
Stakeholder Theory	The interdependent connections that a business has with its numerous stakeholders, including clients, partners, employees, investors, communities, and others- are emphasized in stakeholder theory according to which a business should generate a return for its stakeholders.	Not Suitable

Institutional Theory	According to institutional theory, the regulative, normative, and cultural-cognitive elements use coercive, normative, and mimetic mechanisms to influence organizational social behavior.	Not Suitable
Transaction Cost Analysis	The central argument of transaction cost theory is that firms save money by selecting a form of governance that minimizes production and transaction costs.	Suitable
Diffusion of Innovation Theory	The progressive dissemination of a new concept among affiliates of a societal system through specific routes of communication routes referred to as "diffusion of innovation" (such as interpersonal or mass media).	Not Suitable
Theory of Constraints	By concentrating on a restriction that hinders a system's ability to perform at a higher level, it seeks to initiate and implement breakthrough improvement. It is a laser-focused methodology for achieving rapid progress.	Suitable

RESEARCH GAP (THEORY)

Based on the above literature review, a gap is identified as though various studies are conducted on supply chain inefficiencies but very limited studies have been carried out in the FMCG sector to improve the logistics distribution including primarily the transportation and warehousing. The current study will target this area.

2.2.7 LITERATURE ON DATA ANALYSIS TECHNIQUES

In their study, Cox et al. (1997) used simple and hierarchical regression analysis to assess barriers to fruit and vegetable intake. Lockie (2004) used path analysis to examine demographic, attitudinal, behavioral, and motivational factors that influenced food product selection. The research was conducted on organic food. In this study, Bechini (2005) proposed a generic data model for the safe and secure transmission of traceability information. They also proposed a modular suite of Internet specifications that enterprises could use to conduct business more easily and efficiently. In their 2008 study, Rijswijk et al. used the Hierarchical Value Map and discovered that quality and safety were related to traceability and aid in increasing consumer confidence. Piramithu (2005) proposed that, with advances in internet and e-commerce applications, the dynamic configuration of supply chains could lead to performance improvements. AFSC's key performance indicators are efficiency, responsiveness, flexibility, and quality (Aramyan, 2007).

Sagheer (2009) created a framework for analyzing the competitiveness of the Indian agro-food chain by combining two management streams: Value Chain Analysis and strategic competitiveness. Raab presented a model based on linear programming theory in their 2011 study with the goal of production and distribution planning while focusing on product quality. Bourlakis conducted a comparative analysis of the Greek dairy's supply chain partners in 2014. The analysis was done to track the overall and individual members' sustainability performance using key indicators like flexibility, efficiency, quality, and responsiveness.

In their 2014 study, Jothimani et al. demonstrated the application of an integrated approach of FAHP, SCOR, and TOPSIS to measure supply chain performance for third-party logistics providers. In their study (2013), Kumar and Agarwal used ISM (interpretive structural modeling) to develop mutual relationships among the

empowering agents of e-applications in the Indian AFSC. The ISM was used to display a hierarchical model at multiple levels displaying the enablers, as well as a digraph depicting the independence and driving power of identified enablers. Bag (2016) identified barriers to green cold chain management in his study, as well as contextual and hierarchical relationships between the variables affecting green cold chain practices. In the study, ISM (Interpretive structural methodology) was used to create a directed graph, while the MICMAC technique was used to categorize variable dependence and driving power. To investigate the connection between SC integrity, SC integration, and the impact of food integrity on firm performance, Ali (2017) developed a conceptual model based on the S-S-P paradigm. The SEM software was used to test the hypotheses and analyze the data. Osorio developed a model to assess the influence of knowledge in the prevention of existing retail outlet disruptions in their 2017 study. Gardas modeled the GSCM performance indicators in the agro-sector in 2017 using ISM methodology, to establish interrelationships between partial least squares as well as identifying the partial least square with high influential power. Shashi et al. (2018) investigated the dependence of total food supply chain performance on partner performance using a 5-stage performance measurement model.

The analysis employed SEM to demonstrate that the performance of the producer has a positive impact on the performance of the supplier, processor, and distributor. The study proposed a conceptual framework with five components: FCC integration, infrastructure, value addition, stakeholder interest, and partner performance. Pool, Doosti, and Mortazavi used the TOE and TAM as theoretical foundations in their 2018 study to propose a model tested for RFID usage. For testing and analysis, structural equation modeling was used. In their 2020 study, To determine the relationship between the factors facilitating cold chain sustainability, Gunaratane, and Jayaratne used analytical methods such as EFA, CFA, and SEM.

In their 2020 study, Kamble, Gunasekaran, and Gawankar proposed an application framework to identify SC visibility and resources as the primary driving strength for emerging analytics capability and attaining sustainable performance as a result of their research, Kumar, Singh, and Modgil (2020) proposed a theoretical framework for testing using PLS-SEM. The study looked into the role of ICT in agro-food SC and the effect of SCM practices on firm performance. Kumar and others 2020) assessed the tiered interaction among the eleven recognized dimensions that are key enablers of supply chain flexibility (SCF) adoption using interpretive structural modeling (ISM). The personal care industry's driving factors of supply chain flexibility were identified using fuzzy MICMAC. Using the interpretive structure modeling (ISM) method, Prabhakar and Jha (2019) developed a model that describes the interdependence of various green supply chain management enablers (GSCM) in the FMCG sector. The MICMAC analysis can be used to determine the driving and reliant power of enablers. Fuzzy MICMAC and interpretive structural modeling (ISM) were utilized by Gorane and Kant (2013) to identify and establish relationships among supply chain management enablers (SCMEs). Golrizgashti et al.'s (2022) conceptual casual model emphasize customer-supplier interactions as a crucial aspect of implementing total quality management practices and their impact on supply chain performance. Empirical data from the companies under study is gathered using non-parametric SEM/PLS methods. In an empirical study of the FMCG sector in Spain, Gimenez and Ventura (2005) utilized SEM for the analysis of a theoretical model. It examines the connections between production, logistics, and marketing and their relationship to exterior integration. Khan and Yu (2021) investigated the effects of green supply chain practices (GSCPs) on competitive advantage, and economic, environmental, and organizational performance when internal environment management and green information systems were utilized. The hypotheses were tested with PLS-SEM modeling and data from 415 manufacturing companies. Asamoah and others 2021) investigated how an organization's supply chain management (SCM) capabilities

and performance are affected by the use of IOS. SEM was used to analyze data from 193 respondents from various manufacturers and distributors of fast-moving consumer goods. SCM capabilities play a mediatory role and operational supply chain performance are both affected by IOS use, according to the findings.

2.2. 8 SUMMARY OF THE CHAPTER

The key objective of chapter two is to conduct an exploratory study based on relevant literature which helped to recognize research gaps. The various writings were reviewed based on different themes: Literature on understanding the fast-moving consumer goods supply; literature on the SC performance; and literature on the suggestion of solutions. For each theme, the research gaps have been discussed. The chapter also has a section on the theoretical underpinning and how they can contribute to overcoming the issues faced by the sector in distribution. Also, a review of the literature is done on the techniques utilized in the assessment of issues in the logistics distribution of FMCG. The next chapter shall focus on the RM adopted for the study.

CHAPTER III
RESEARCH METHODOLOGY

CHAPTER III

RESEARCH METHODOLOGY

3. OVERVIEW

This section of the report portrays the review's course as well as the techniques utilized in information assortment and examination. Murray and Hughes (2008) state that "methods" refer to the various methods by which data are collected and analyzed, while "methodology" refers to the overall approach to the research process. The layout of the questionnaire has also been extensively discussed, along with the methods applied for gathering data

3.1 PROBLEM STATEMENT

According to McKinsey research, the logistics sector in India accounts for 14% of GDP, significantly higher than in the United States or Europe, where it accounts for 8-9%. Indian competitiveness is harmed by high logistics costs. The reasons attributed to this higher cost of logistics are poor resource optimization and infrastructural challenges. In India, transportation, inventory, and warehousing are the biggest contributor to logistics costs. **Logistics inefficiencies in the FMCG Sector due to lack of digitalization lead to immense loss, decreasing shelf life, higher logistics cost, and reduced profitability.** A key to lowering the operational cost of distribution is comprehending the connection between inventory and transport planning. These inefficiencies will not be eradicated unless identified, measured, and analyzed. Overcoming these issues along with the usage of advanced technologies will help improve the logistics distribution performance leading to a reduction in cost. FMCG products are functional products with low margins but regular demand in the market. Fisher (2007) suggested efficient supply chain is the

best-suited supply chain for functional products. An efficient supply chain is characterized by cost efficiency; hence, all possible efforts be explored to reduce the cost. Transportation and inventory are the major chunks of logistics cost, if these areas are targeted and improvised it could lead to better logistics performance. Hence, there is a great need to measure the inefficiencies related to transport and inventory through digitalization.

For that purpose, to understand how digitalization affects logistics distribution performance, a model has been developed and solutions are suggested for overcoming the issues leading to inefficiencies in the distribution of fast-moving consumer goods.

3.2 RESEARCH DESIGN

The term "research" refers to the "systematic and scientific search for relevant information on a specific topic." According to Kothari (2019), research configuration is defined as the "assembly of conditions for data collection and analysis in a way that aims to combine relevance to the research purpose with economy in procedure." According to Fagade (2011), reliant upon the objective of the study, it can be put into three categories: exploratory, descriptive, or explanatory. The exploratory study is used to investigate and explore the problem-relevant areas. This technique thus provides a brief understanding of the relevant area and is primarily used to arrive at the study's objectives. The purpose of descriptive research is to depict and analyze the characteristics of people, events, or situations. Explanatory studies focus on a problem or situation to help explain and establish causal relationships between variables. The research approach can be qualitative or quantitative, depending on the techniques used for data collection and analysis. In quantitative research, questionnaires are used as data collection

techniques and methods for data analysis that use or produce numerical data. Quantitative research, according to Bell and Bryman (2007), is a deductive approach to research that involves the testing of hypotheses. In contrast, qualitative research does not use statistical techniques or any other form of quantification to arrive at its conclusions. As a result, qualitative research is an inductive approach to research in which the research is primarily exploratory and the emphasis is on theory generation. Contextual investigations or semi-organized interviews are two methods for gathering information for qualitative methodology. In the current study, an exploratory study was used to investigate a problem area such as challenges in the distribution of fast-moving consumer goods. Descriptive research was used to analyze the issues and challenges, as well as the extent to which they exist in the transportation and warehousing of fast-moving consumer goods. To establish a causal relationship between the issues and the logistics distribution performance, an explanatory approach was used. Thus, rather than using a single approach, a combination of these approaches was used in the study to provide a synergistic and systematic view of the research problem. The nature of this study is quantitative. This research is quantitative in nature. Fig 3.1 displays the Research Process below while Fig 3.2 presents the Schematic flow diagram.

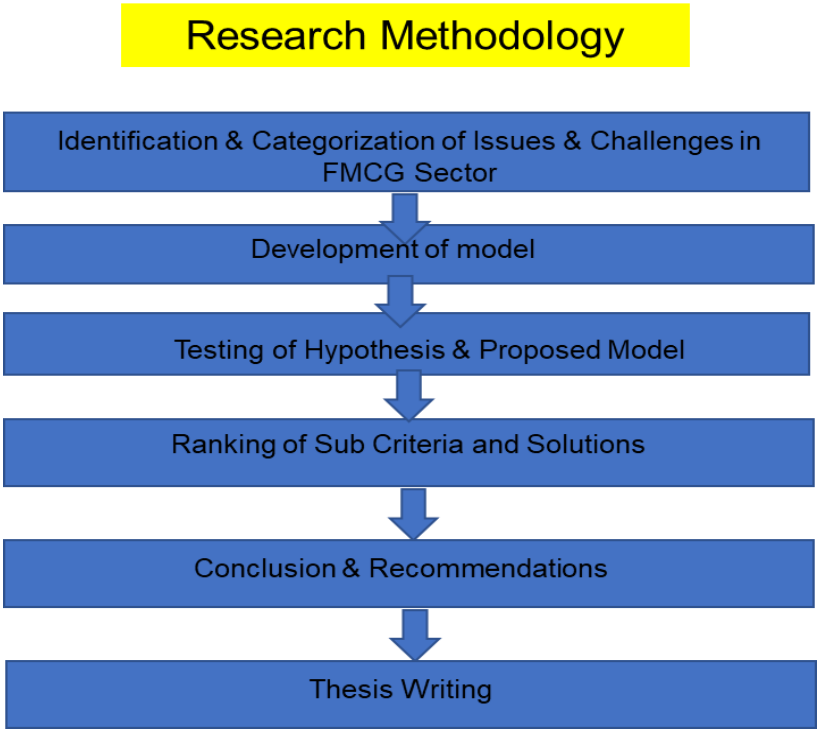

Figure 3.1 Research Process Flow

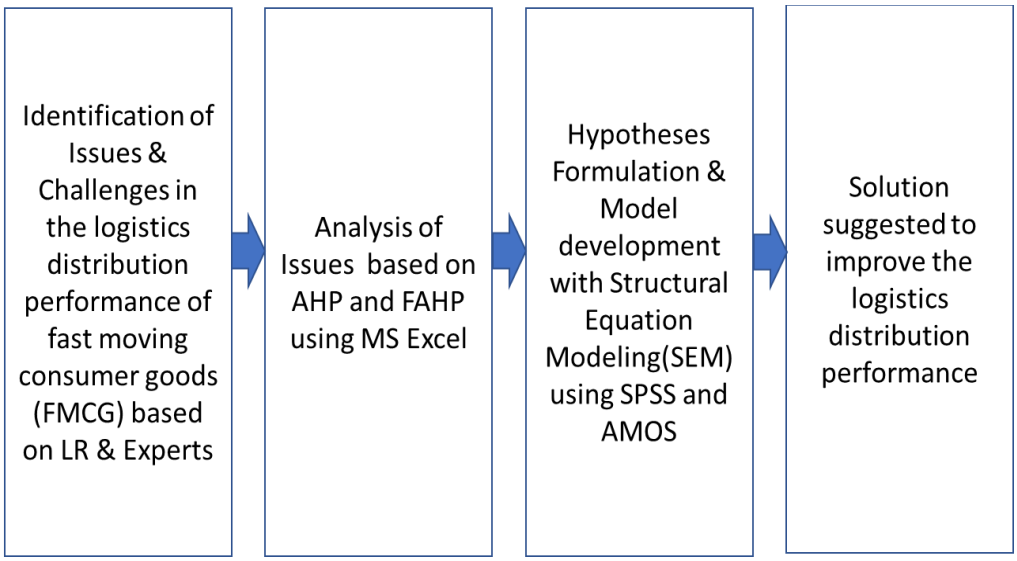

Figure 3.2 Schematic Flow Diagram

Step 1:

The study aids in understanding the SC for consumer goods that move fast while identifying issues that may arise from a variety of sources. Secondary data was obtained from published reports/journals/articles/papers or other sources such as Nestle India Ltd, Dabur India Ltd, Kuehne-Nagel Pvt Ltd, and many others. To identify various issues in the distribution of fast-moving consumer goods, techniques such as expert interviews, questionnaires, analysis of available literature and survey reports, analysis of researchers' and consultants' reports, and field visits were used. The sources mentioned in the study were used to identify key categories and sub-categories of issues. The issues have been classified into the following categories:

- Lack of Coordination and Integration
- Infrastructure Issues
- Challenges associated with outsourcing
- Transport Inefficiencies
- Inventory & Forecast related issues
- Warehouse Inefficiencies
- Technological Issues

Step 2:

The significance of the issues was determined by domain experts based on their importance and influence on logistics distribution performance. Experts have confirmed that transportation and warehouse management are critical areas that must be prioritized to find the subfactors that cause inefficiency and can be targeted to improve the distribution of consumer goods that move quickly.

Step 3:

Structured Equation Modeling (SEM), a multi-variate method, was used to analyze the critical issues that are culminating in poor logistics distribution performance for fast-moving consumer goods. Hypotheses were tested using SEM, and the relevance of these issues on distribution performance was determined. The proposed model was thus tested in order to arrive at the final model.

Step 4:

This step suggests ways to resolve issues in logistics distribution performance. Solutions include the use of information technology, both digital and non-digital solutions, to achieve improved logistics distribution performance. The solutions are prioritized using MCDM methods and Fuzzy TOPSIS to gain a clear understanding of the preference and usefulness of the strategies and solutions in improving logistics distribution performance.

3.3 RESEARCH METHODOLOGY

The steps taken to achieve Research Objectives 1 and 2 are outlined below in brief:

3.3.1 RM FOR RESEARCH OBJECTIVE 1

❖ Exploratory research was conducted to better understand the FMCG sector and identify problems.

❖ Expert interviews, field visits, and a literature review were used to collect data.

Steps for RO1:

• Detailed Literature Review

• Unstructured interviews with FMCG professionals

• Questionnaire preparation based on LR and unstructured interviews

• 5-point Likert Scale was used for questionnaire preparation.

•Questionnaire was tested with 8 people (3 academicians, 5 FMCG Supply Chain professionals)

• Finalize Questionnaire

3.3.2 RM FOR RESEARCH OBJECTIVE 2

❖ Descriptive Research was conducted to analyze the identified issues.

❖ Data collection was done using Survey Questionnaire using google forms.

❖ Purposive sampling technique used

❖ Sample Size = 256 (as shown in table 4.1)

❖ Data Analysis done by application of FAHP using MS Excel and Structured Equation Modeling (SEM) with the help of IBM SPSS Version 22.0 and AMOS Version 27 software.

Steps for RO2:

- Administering Questionnaires to the respondents
- Expert consultation for collecting responses on the significance of issues w.r.t logistics distribution performance
- Reliability test of the Questionnaire responses using Cronbach Alpha
- Testing of Model Fit
- Development of Final Model
- Hypotheses Testing

3.4 CONCEPTUAL MODEL PROPOSED

According to Hair, Black, Babin, Anderson, & Tatham (2008), the model-building approach is centered on a clearly defined research strategy that begins with a conceptual model outlining the relationships that will be investigated. The dependent and independent concepts are defined and supported with the assistance of a literature survey for the development of theoretical constructs in the conceptual model, which is merely a simple representation of the relationships that will be studied.

An approach to multivariate statistical analysis known as structural equation modeling is used to examine structural relationships. After being conceptually defined, the empirical issues of the model were addressed, and a specific multivariate technique will be used to achieve the research's goal. The structural relationship between measured variables and latent constructs is examined using this method, which is a combination of factor analysis and multiple regression analysis.

The variables will be identified for the constructs namely; transport and warehouse optimization and the data will be collected from the expert panel likewise, executives and managers as stated in the sampling frame. The internal consistency of the variables will be checked with the help of reliability analysis. Thereafter, the validity check will be performed by using the factor analysis method. Finally, the conceptual model will be tested using structural equation modeling (SEM) with the software, AMOS. Further, suggestions and recommendations will be presented based on the output.

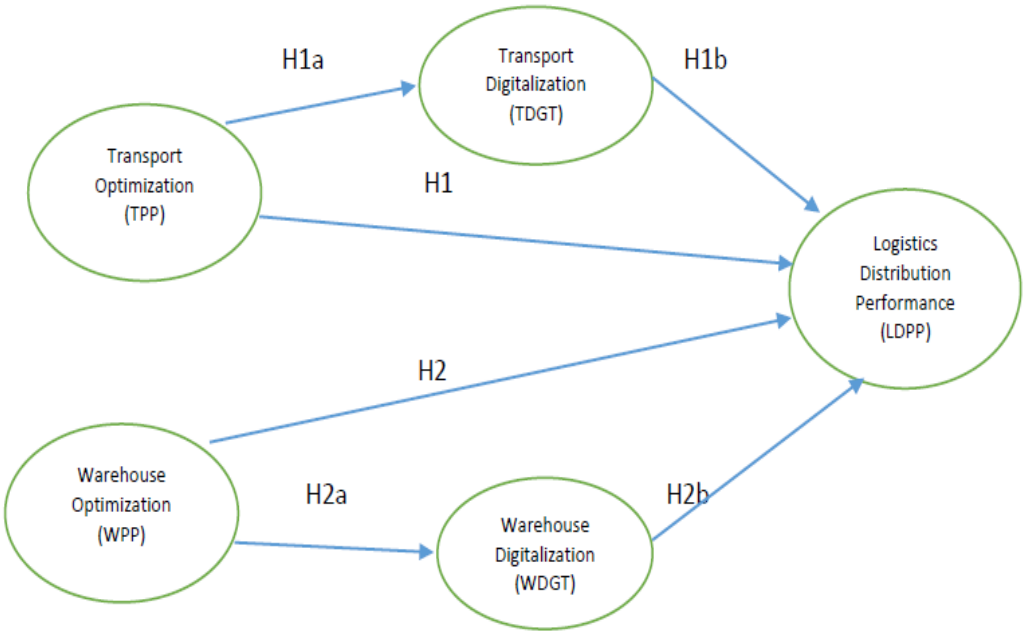

Fig 3.7 Conceptual model

3.5 RESEARCH HYPOTHESES

The following hypotheses were formed based on LR (refer to chapter 2) and the identification of issues in the distribution of fast-moving consumer goods at the warehouse and transportation levels.

H1: Transportation Optimization (TPP) will positively influence Logistics Distribution Performance (LDPP).

H2: Warehouse Optimization (WPP) will positively influence Logistics Distribution Performance (LDPP).

H1a: Transport digitalization (TDGT) will have a mediating effect on Logistics Distribution Performance (LDPP).

H1b: Transport digitalization (TDGT) will positively influence Logistics Distribution Performance (LDPP).

H2a: Warehouse digitalization (WDGT) will have a mediating effect on Logistics Distribution Performance (LDPP).

H2b: Warehouse digitalization (WDGT) will positively influence Logistics Distribution Performance (LDPP)

3.6 DATA COLLECTION

The accomplishment or failure of research is frequently determined by data and its collection. As a result, it is critical to select an appropriate methodology for data collection. In the current study, information is gathered from both primary and secondary sources. The data came from sources including primary as well as secondary. Auxiliary information was accumulated from peer-checked on articles distributed in renowned administration diaries like the *Journal of Retailing, Benchmarking: An International Journal, Supply Chain Management: An International Journal, International Journal of Retail & Distribution Management, International Journal of Productivity and Performance Management, Journal of Enterprise Information Management, International Journal of Logistics Management, Facilities; Journal of Business and Industrial Marketing*. Data was primarily collected from primary sources using a questionnaire that utilized the variables discovered during the literature research.

More than 500 questionnaires were circulated, and 300 responses were received, with 44 surveys being removed owing to missing information. In total, 256 questionnaires were analyzed. The response rate is significantly higher, making it

a better representation of the population that was sampled. The data from the questionnaire were transferred automatically to an Excel document, where they were manually entered into a database maintained by SPSS (SPSS Inc.). Standard data validation and authentication (such as range, distribution, and missing value prototype) were carried out.

3.7 QUESTIONNAIRE AS SURVEY INSTRUMENT

3.7.1 DEVELOPMENT OF SURVEY QUESTIONNAIRE

The conception of the questionnaire was more an act of art than science. The questionnaire should include standardized questions to operationalize the constructs for measurement, resulting in consistency in the responses of different people (Martin, 2006). When creating a questionnaire, consider the sequence of questions, the phrasing of both questions and response categories, the technique used to administer the questionnaire, and the introduction and explanation of the survey.

The primary goal of the ongoing review is to identify issues and their implications for the logistics distribution performance of fast-moving consumer goods. For FMCG to deliver positive outcomes, the issues must be resolved not only at the firm level but also at the warehouse and transportation levels. With the objectives in mind, questionnaires were developed to conduct a survey and provide qualified feedback.

A five-point Likert scale (Strongly disagree-1, disagree-2, Neutral-3, Agree-4, Strongly agree-5) was used to develop the questionnaire for a broader scope check on relevance. Closed-ended questions that were short and easy to process were mostly used, but there were some open-ended questions as well for detailed responses or a wide range of responses. According to the literature, a five-point scale seems to be less perplexing and increases response rates (Babakus and Mangold, 1992; Devlin et al., 1993; Hayes, 1992). The "frustration level" of

respondents was decreased while also improving response quality and rate using a 5-point Likert-type scale (Babakus and Mangold 1992). However, some researchers have noted that five-point scales have higher reliability levels (Jenkins & Taber, 1977)· It became possible to compare reliability coefficients with other research using five-point Likert Scales, which was one of the factors that led to the decision to use a five-point scale rather than a seven-point scale. F. Saleh, C. Ryan, and others (1991).

Three academicians and five respondents from FMCG firms provided feedback on the questionnaire's face and content validity. As a result, both the syntax and semantics of the questionnaire language were improved, as well as the presentation of the questions, making the questionnaire design more suitable for exactness in responses. The questionnaire was designed to be aligned with the hypotheses as well as to avoid any biased opinions while maintaining their relevance.

Section I: General Information of the respondents

• This segment was centered on getting the general information of the respondent like name, gender age, education level, area of work, and relevant experience in the field.

• Nominal category scale was used for collecting the relevant information

Section II: Questions pertaining to Transportation Performance

• This section collected responses on various transportation performance parameters using a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree).

Section III: Questions pertaining to Warehouse Performance

• This section collected responses on various warehouse performance parameters using a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree).

Section IV: Questions pertaining to the Use of Digital Technologies

• This section collected responses on various digitalization parameters using a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree).

Section IV: Questions pertaining to the improvement of Logistics Distribution Performance through digitalization.

• This section collected responses based on the impact of various digital tools on logistics distribution performance parameters using a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree).

3.8 ADMINISTERING OF SURVEY QUESTIONNAIRE FOR COLLECTION OF RESPONSES

Just as developing a questionnaire is important, so is administering a questionnaire to ensure that the survey's objectives are met to obtain precise research data. The consistency of the questionnaire was maintained, and reliability and statistical techniques were also used for analysis. The consistency of a measurement procedure is known as its reliability, and indices of reliability are the degree to which the scores delivered by estimation methodology are reproducible (Oliver, 2000).

3.9 SAMPLING

The sampling strategy and sample size are determined by the review's objectives and the availability of resources. A sample, which is a subset of the population, is chosen so that it can represent a larger population, and the sample's representativeness is determined by the sampling methodology, sample size, and response rate (Acharya, 2013). A sample design is a method for extracting a sample from a universe or population. As a result, it is the researcher's method for selecting items for the sample. The sample design must be used to determine the sample size or the number of items that should be included in the sample. Data collection should come after the sample design has been determined. Sampling approaches are classified into two types: those that use a probability approach and those that do not. The probability approach refers to samples chosen in such a way that each representative of the population has an equal chance of being included, whereas non-probability sample selection is done based on the researcher's judgment. The law of Statistical Regularity is followed in this type of statistical design, which means that the characteristics and composition of the randomly selected sample will be the same as that of the population.

Non-probability samples are distinguished by the fact that sample selection is based on subjective judgments. They are also known as purposive sampling, deliberate sampling, and judgment sampling. Because there is no specific basis for estimating the likelihood of including each item in the sample, items may be selected with the expectation that the small sample will be representative of the entire population. However, there is a risk of bias or personal elements in non-probability sampling designs. As a result, sufficient care and consideration must be given to minimize the error or bias that may occur in the sampling technique chosen. When the researcher has a specific reason for interest in particular members of the sample population or applies his or her judgment as to which type of respondent will be able to provide the best information regarding the objectives under study, the non-probability sampling technique is used. Furthermore, in exploratory research

situations where the analyst is attempting to determine the existence or non-existence of a problem, non-probability can be a practical approach. However, the technique should be used with caution because its application increases the uncertainty or bias in using a sample to represent the population.

It is critical to select a sample from the relevant sector because each sector faces unique issues and challenges. Only by selecting a sample from the specific sector relevant to the study will the researcher be able to obtain specific feedback and thus fill gaps through research findings for that sector. In such a sector-specific study, respondents must be chosen in such a way that their knowledge and experience in the relevant sector are taken into account. This will aid in the precise identification of areas that have yet to be sufficiently explored and are problematic. Respondents for this study were drawn from various players in the logistics distribution of fast-moving consumer goods. They were chosen because they have the knowledge and experience needed to effectively identify areas rife with challenges and problems. As a result, respondents are selected using the purposive sampling method based on their alignment with the research objectives and their role and scope in the distribution of fast-moving consumer goods.

3.9.1 TARGET POPULATION

Individuals with extensive knowledge, expertise, and competency in transportation and warehousing, particularly in the fast-moving consumer goods sector, were selected as respondents for this study. In light of the fact that the research focuses on logistics and distribution performance, it is essential to first comprehend the various players involved in the physical distribution of FMCG products and then solicit their opinions.

3.9.2 SAMPLING UNITS & TECHNIQUES

For the study, the strategy of sampling was non-probability sampling. Purposive sampling is considered the method for the collection of information. Purposive sampling is selected as the data has been collected only from personnel engaged in the distribution of fast-moving consumer goods. The responses are collected from the personnel who has experience in handling the distribution of FMCG products, especially people dealing with areas of transportation and warehousing like logistics executives, transport managers, warehouse managers, senior managers, IT managers, etc. who possess at least 2 years of experience.

3.10 SAMPLE SIZE

The sample frame was designed to specifically target managers, senior officials, and executives who are involved in the distribution function, either directly or indirectly. They were chosen because, while they are well-versed in their businesses' internal operations, they are not well-versed in the outside world. They are also aware of how supply chain activities like logistics and inventory management are doing.

Because sample size has a significant impact on the statistical techniques used, it must be carefully considered (Hair, 2007). The suggested sample size for a population of 10,000 is 370, or 3.7 percent of the population (Krejcie & Morgan, 1970). Previous studies on apparel manufacturers that used a similar data collection method had sample sizes ranging from 118 in (Priyadarshi's, 1996) to 246 in (Lin, Kincade, & Warfield, 1995). Response rates range from 32.5 percent to 48 percent (ZuHone & Morganozky, 1995). (Kincade, Cassill, & Williamson, 1993). According to guidelines as suggested by Kline (2005, 2015) and Comrey (1992) for SEM, the sample size of 100 is small, 100-200 is medium and 300 is a good sample size. As per Malhotra (2020), if the constructs are less than equal to 5, and

independent variable under each construct is greater than equal to 3, and the variable commonalities are greater than 0.5 then the minimum sample requirement for SEM is 200. As a general rule, there should be at least 10 times the number of perceptions as the number of independent factors to be analyzed. Before conducting factor analysis, there were 23 independent variables, hence sample size was estimated to be 10*23=230. Also, since SEM is the main technique employed for hypotheses testing and model development, 230 was considered a good sample size but in the present study our sample size is 256 which was above 230 and it meets the requirements of the SEM technique. We have checked the minimum sample size requirement for our study with four constructs and 23 variables through Daniel Soper Calculator. The minimum sample size thus obtained is 180. (Refer to Fig 3.13).

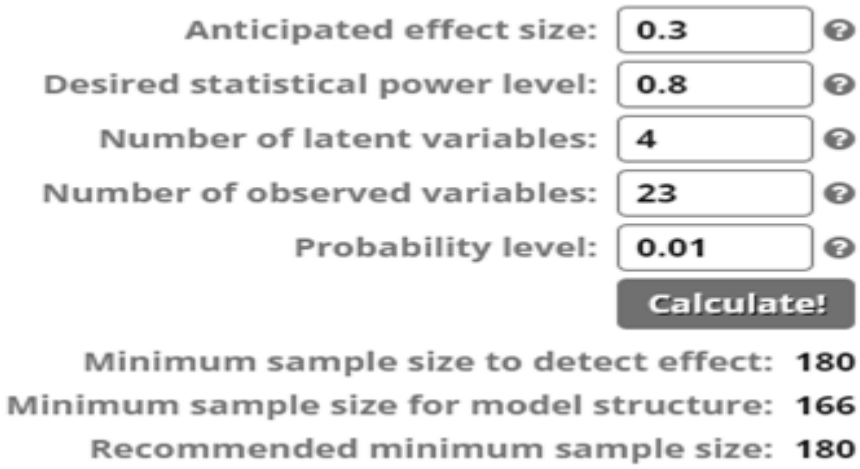

Fig 3.13 Sample size calculation using Danier Soper Calculator

Source:www.danielsoper.com

The final survey questionnaires were prepared and responses were collected to check the relevance of the questionnaire on a five-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree).

3.11 PROPOSED RESEARCH METHODS AND TECHNIQUES

A thorough analysis of data was performed aiming to achieve the desired result. Alternative techniques were used to review and evaluate collected data in order to achieve the goals and provide responses to RQs. The subsequent chapters of the thesis present both the findings and the methods used to evaluate the collected data.

3.11.1 STRUCTURAL EQUATION MODELLING

Structural equation modeling, a Multi-Criteria Decision Making (MCDM) technique, was used to analyze issues in order to improve logistics distribution performance. The multivariate analysis technique is a statistical technique for analyzing structurally related relationships. SEM is a multi-step procedure that includes Factor analysis and numerous Regression tests. It employs latent constructs and demonstrates their relationship to observed variables. Researchers prefer the analysis technique because it can estimate multiple and interconnected dependencies in a single analysis. SEM models are classified into two types:

(1) Measurement models explain the theory and indicate the number of factors, the relationship between various indicators and the factors, and the relationships among indicator errors.

(2) Structural models depict the relationship between endogenous and exogenous variables, as well as how the various factors interact with one another. Before estimating and interpreting the structural relationships between latent variables, an acceptable measurement model must be established.

Latent variables can be endogenous or exogenous. An endogenous variable is the result of one or more model variables and is thus synonymous with dependent, criterion, or outcome variables. An exogenous variable, on the other hand, is not

caused by any other variable and is therefore referred to as an independent, predictor, or causal variable. SEM is also known as causal modeling because the proposed causal relationships are tested using this technique.

The SEM technique is based on the following assumptions:

1. Linearity: Endogenous and exogenous variables must be related linearly.

2. Sequence: The relationship between endogenous and exogenous variables should be one of cause and effect, with the cause coming before the event.

3. Multivariate normal distribution: For normal and multivariate distributions, the maximum likelihood method and the Chi-square test can show a large difference due to multivariate normality showing small changes.

4. Non-spurious relationship: The observed covariance in the relationship must be true.

5. Sample size: In general, the sample size in the SEM model should be 10 to 20 times as many cases as there are variables.

6. Data: SEM makes use of interval data.

7. Model identification: Under-identified models are not considered. Models are either over-identified, or estimated parameters must be smaller than equations.

8. Uncorrelated error terms: The error terms and other variable error terms are assumed to be uncorrelated.

9. Outliers: The presence of outliers in the dataset should be avoided because they reduce the model's significance.

According to Suhr D. (2006), the SEM analysis proceeds as follows:

• To support the model specification, the research literature, and relevant theory must be reviewed.

• Equations, diagrams, and so on must be used to specify the model.

• The model must be specified using equations, diagrams, and so on.

• The model must be identified.

• The measures of variables represented in the model must be chosen.

• Data must be gathered.

• It is necessary to conduct preliminary descriptive statistics.

• Parameters in the model must be estimated.

The goodness-of-fit indices evaluate how well the model-implied relationships match the observed relationships in sample data (Brown, 2012). Any of the following indices can be used to assess model fit: badness of fit, i.e. Chi-square, RMSEA, with lower values indicating a better fit; and goodness of fit, i.e. CFI, GFI, TLI, with values that are higher indicating an improved fit. Once the model has been determined to be a good fit, the specific elements must be tested for fit. A small fit is indicated when the standardized path coefficients are less than 10; a medium fit is indicated when the values are around 30; and a large fit is indicated when the values are greater than 50. Prior to conducting data analysis using the SEM technique, it is critical to developing a theoretical model.

3.11.1.1 STEPS OF STRUCTURAL EQUATION MODELLING

1. Identify Individual Constructs The constructs must be theoretically defined. CFA is appropriate for testing measurement models.

2. Create an overall measurement model- also known as a path analysis that includes connections between endogenous and exogenous factors. The premise of the estimation hypothesis is that latent constructs cause indicators and the presence of uncorrelated error terms within estimated factors.

3. Design review to generate observational results- To reduce the likelihood of an identification problem, the researcher must specify the model and design the study.

4. Assess Measurement Model Validity- CFA is assessing the measurement model where the result is associated with the constructs' validity.

5. Specify Structural Model- Structural paths are drawn between constructs using single-headed arrows to address the conjectured underlying connection between the constructs, reflecting on the cause-and-effect relationship.

6. Examine Structural Model Validity- The researcher examines structural model validity in this final step.

To be considered a well-fitting model, the chi-square value must be insignificant, and at least one of the steady fit indices (GFI, TLI, CFI, AGFI, and so on) and one of the disagreeableness of fit indices (RMSEA, RMR, SRMR, and so on) must meet the predefined criteria.

3.11.2 FUZZY AHP

As per the classical set theory, an element's membership is represented by a set of binary terms 1 or 0, which represent True or False. Zadeh (1975) created the Fuzzy logic to manage vulnerability and uncertainty in the dynamic decision-making process. A fuzzy set is a superset of a classical set that allows for real unit intervals between 0 and 1.

The degree of membership is the spectrum of values between 0 and 1 that is employed to depict continuous assessment. Fuzzy logic is based on human reasoning that everything cannot be classified as 1s or 0s and that there may be values somewhere between. Numerous kinds of membership functions are used in fuzzy theory, such as triangular, sigmoid, trapezoidal, and orthogonal, but the triangular membership function is the one most widely used by researchers. TFN

(l,m,n) is a common representation of the triangular fuzzy number N, where l represents a lower value, m represents a medium value, and n represents a higher value, thus l m n. Because of subjective assessment and the use of linguistics, AHP is imprecise (Raghuvanshi, 2018).

The fuzzy AHP method can address AHP's imprecision by depicting one criterion's performance over another more accurately and logically (Kashav, 2022). Because expert opinions are involved, the decision-making process is more effective. Fuzzy set theory is combined with AHP to address the issue of subjective or ambiguous sets of data that cannot be dealt with using a deterministic model (Hamzeh, 2019).

The Triangular fuzzy scale (refer to Table 22) is used to represent the importance level according to the experts. A diagrammatic representation of the process is exhibited in Appendix VII., The stages. followed in FAHP technique have been given below:

Stage 1 - The pairwise comparison matrix determined in Step 1 of the AHP method was used hereafter ensuring the consistency of the expert judgments.

Stage 2 - The values were then replaced with the corresponding TFNs.

Stage 3 - Geometric mean of the fuzzy weights is then estimated.

Stage 4 - Defuzzification was done to arrive at the relative non-fuzzy load of every model (Mi) and then standardized loads of every rule (Ni) were estimated.

Based on the values of Ni, rankings were ascertained. Mi was determined by considering the normalization of fuzzy numbers and Ni by utilizing the non-fuzzy Mis.

3.11.3 FUZZY TOPSIS

In 1981, Hwang and Yoon introduced TOPSIS and the method was stretched, through the application of Fuzzy logic using TFNs, into Fuzzy TOPSIS by Chen and Hwang in 1992. The method is based on the distance of the solution from the ideal solution. According to TOPSIS, the ideal solution and the negative ideal solution are the two types of solutions. The solution consisting of all of the ideal values for the criteria being maximal benefits solution is known as the ideal solution whereas the solution consisting of the worst values of the criteria being minimal benefits solution is known as the negative ideal solution (adapted from Jothimani & Sarmah, 2014). Hence, while selecting an alternative, the one nearest to the best arrangement and farthest from the negative ideal course of action is the ideal choice. Hence, the final ranking is attained by estimating the closeness coefficient values of the different solutions. The steps for executing the FTOPSIS method are given below (adapted from Shoar, 2019; Nădăban, 2016):

Step 1 Compute the aggregated fuzzy ratings for alternatives and the aggregated fuzzy weights for criteria Inputs are collected from the experts. The data inputs are then found using the mean value and are then represented in a decision-matrix format utilizing the nine-point scale.

Step 2 Determine the normalized fuzzy decision matrix Conversion of the decision matrix to its normalized format is done by converting the crisp values into triangular fuzzy numbers. Amongst various issues considered for deciding the level of importance or usefulness of the solution, each issue is categorized into either Benefit type or Cost (non-beneficial) type. For the beneficial criteria, the maximum of the upper value is considered of the TFNs (l,m,u) and the l, m, u values of each cell of that criteria are divided by that maximum value. While for nonbeneficial criteria, the minimum of the lower value is considered of the TFNs (l,m,u), and the minimum value is divided by the l, m, u values of each cell of that criteria.

Step 3 Compute WNFDM Matrix is computed by calculating the products of values in normalized fuzzy decision-matrix and weights assigned to the criteria.

Step 4 Compute the Fuzzy Positive Ideal Solution (FPIS) and Fuzzy Negative Ideal Solution (FNIS) and the distance from each alternative to the FPIS and the FNIS Considering each criterion, the maximum TFN and the minimum TFN are considered. Thereafter, the FPIS is determined by considering the gap from the maximum TFN, and the FNIS is determined by considering the gap from the minimum TFN. The formula considered for both (in excel) is SQRT((1/3)*(POWER(a1-a2,2)+POWER(b1-b2,2)+POWER(c1-c2,2)+…..)). Thereafter, the di* (FPIS) and di- (FNIS) are determined for each solution.

Step 5 Compute the closeness coefficient CCi for each alternative the relative closeness to the ideal solution is determined by using the formula di-/(di* + di-).

Step 6 Rank the alternatives Rank the solutions based on the preference order by considering the alternative with the highest closeness value as the topmost rank and the alternative with the lowest closeness value at the bottom position.

3.11.4 SENSITIVITY ANALYSIS

Sensitivity analysis is performed to examine the consistency and reliability of the applied framework. By making changes to the weight of specific criteria, variation can be seen in the final ranking of the alternatives (Vishwakarma, 2019; Yadav, Garg & Luthra, 2021). To attain this, nine iterations are performed. The value of the solution possessing maximum weight is substituted while the other solutions' weight remains the same. Thereafter ranks are considered for all the criteria. Sensitivity analysis aims to achieve the goal of determining how a change in criteria weight results in changes in the rankings of the alternatives. This way the rankings obtained from statistical techniques and the selection of the alternative can be confirmed (Chen, 2010).

3.12 CHAPTER SUMMARY

This chapter included a detailed discussion of the methodology used to achieve the research objectives. The technique for collecting data and analyzing it using various methods was explained. This chapter describes in detail the various methods used to analyze the issues, including SEM and Fuzzy TOPSIS. The following chapter illustrates the application of the SEM technique to issues in the logistics distribution of fast-moving consumer goods, and the outcomes obtained as a result of utilizing this strategy are deliberated in detail in the succeeding sections.

CHAPTER IV
DATA ANALYSIS
AND
FINDINGS

CHAPTER IV

DATA ANALYSIS & FINDINGS

4. OVERVIEW

This section shows a preliminary assessment of information gathered from various survey participants and industry practitioners like warehouse managers and transport managers, logistics managers, etc. who have direct or indirect involvement in the distribution of FMCG products along with academicians. The data analysis is carried out using SPSS 22.0, AMOS 27.0, and MS Excel, and the findings are presented. Reliability and validity tests, SEM with CFA, AHP, FAHP, and Fuzzy TOPSIS are some of the statistical methods and instruments used for the data analysis. The analysis conducted is in the following sequence:

1. Using structural equation modeling to verify the final model's goodness-of-fit and hypotheses;
2. Using AHP and FAHP to rank the Issues and their subcategories.
3. The use of fuzzy TOPSIS to rate digital solutions

4.1 PHASE I: IDENTIFICATION OF ISSUES LEADING TO INEFFICIENCY IN LOGISTICS DISTRIBUTION PERFORMANCE - MAIN CATEGORIES AND SUB-CATEGORIES

To identify issues existing in the distribution of fast-moving consumer goods. Literature was reviewed exhaustively to comprehend the presence of issues leading to poor performance of logistics distribution. The categories and sub-categories of the issues, which influence/impact the distribution performance have been gathered

from existing studies and relevant feedback from domain experts including industry 256 experts and academicians.

4.1.1 INITIAL LIST OF ISSUES AND THEIR SUB-CRITERIA

The initially identified list of categories and sub-categories of issues is illustrated in Chapter 2. The identified issues have been grouped into seven categories: Lack of Coordination and Integration, Infrastructure, Challenges associated with outsourcing, Transport inefficiencies, Inventory, and Forecast related issues, Warehouse inefficiencies, and Technological Issues.

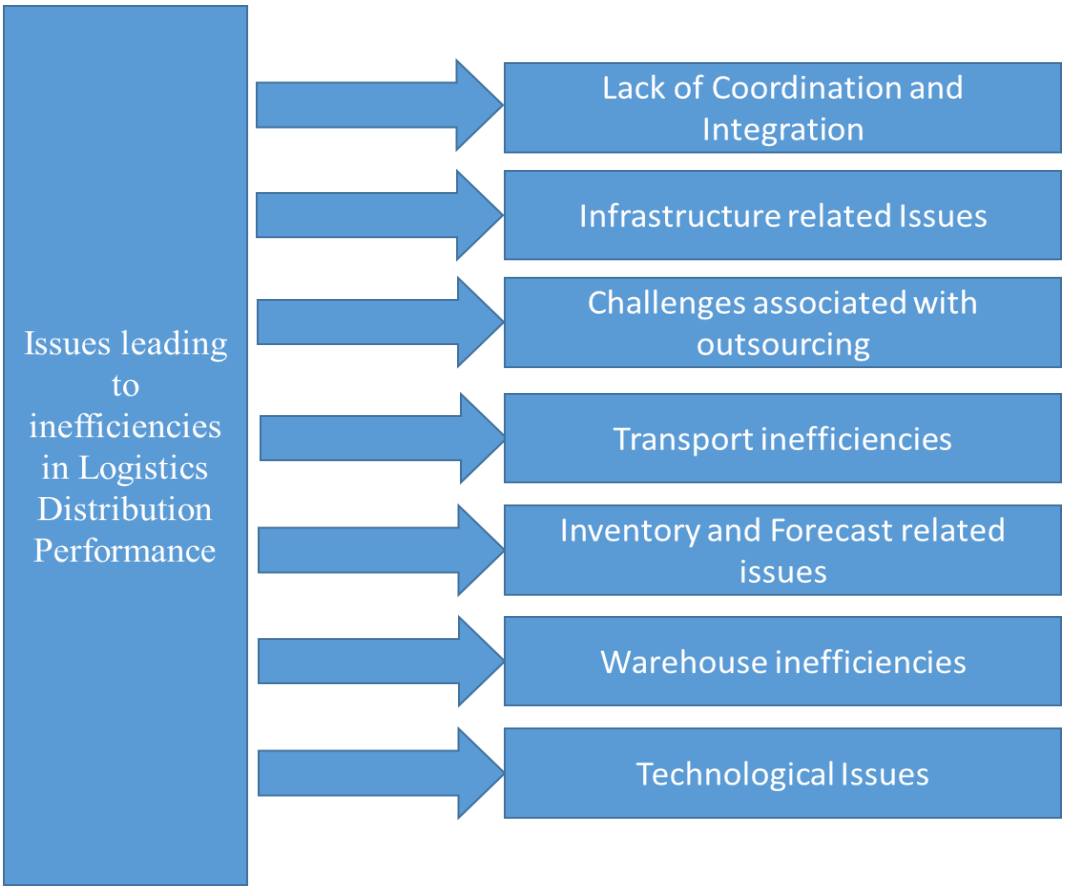

Figure 4.1: Issues leading to inefficiencies in Logistics distribution performance

4.1.2. FINAL LIST OF ISSUES AND THEIR SUB-CRITERIA

The Expert's inputs have been taken about the acknowledged criteria and sub-criteria obtained from the exhaustive literature review. The experts have confirmed two criteria to be the most important pertaining to the physical distribution of fast-moving consumer goods i.e. optimization of transportation performance (TPP) and optimization of warehouse performance (WPP) with five and six sub-criteria respectively and improvement in these areas can significantly improve the logistics distribution performance of fast moving consumer goods. Hence these two criteria have been taken along with the digitalization (DGT) and logistics distribution performance (LDPP) with six sub-criteria each.

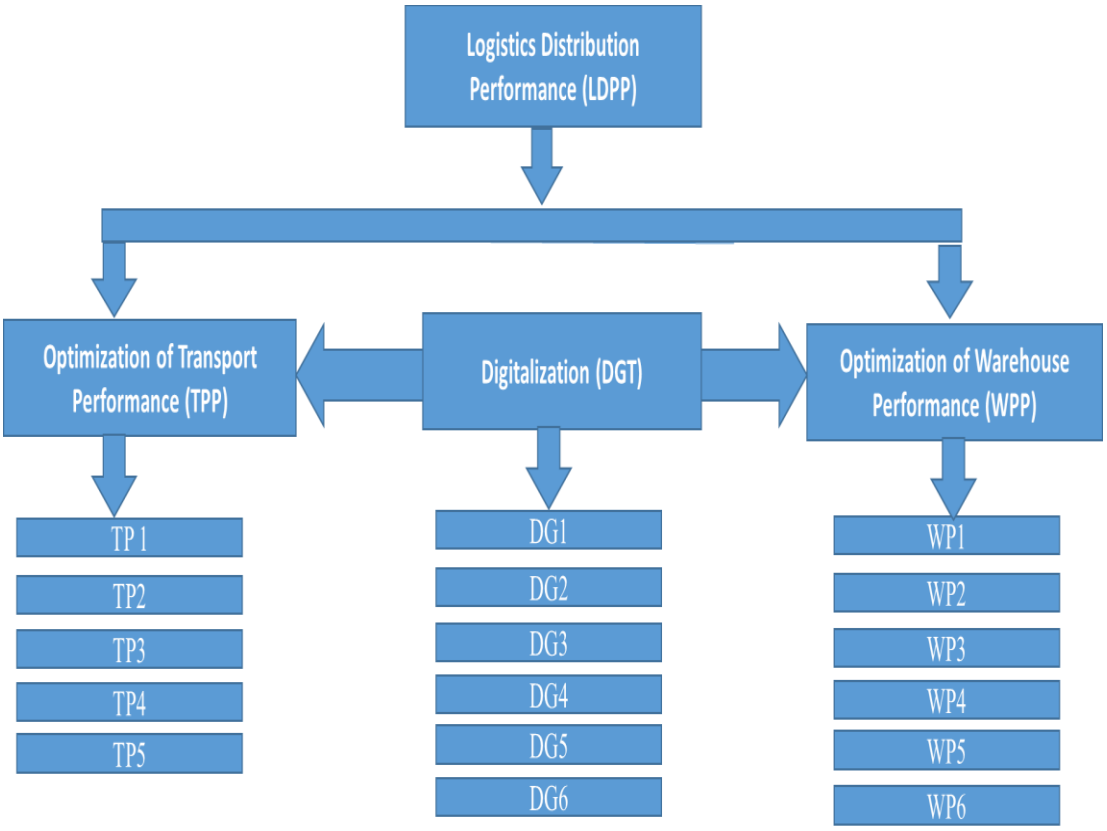

Figure 4.2: Graphical representation of constructs identified

4.2 SAMPLING

The sample frame was created to specifically target managers, senior officials, and executives who are directly or indirectly involved in the physical distribution function like transport managers, warehouse executives/managers, demand planners, etc. They were chosen because they are knowledgeable about their companies' internal operations. They are also aware of the status of supply chain activities such as logistics and inventory management.

More than 500 questionnaires were circulated, and 300 responses were received, with 55 surveys being removed owing to missing information. In total, 256 questionnaires were analyzed. The response rate is significantly higher, making it a better representation of the population that was sampled. The data from the questionnaire were transferred automatically to an Excel document, where they were manually entered into a database maintained by SPSS (SPSS Inc.). Standard information confirmation and verification were done (for example Range, circulation, and missing worth model).

4.2.1 DEMOGRAPHIC PROFILING

4.2.1.1 SAMPLE ATTRIBUTES

This section exhibits the segment qualities of the survey participants. The demographic profile of the responders is shown in Table 15. Out of 256 participants who responded, Males made up 67 %, while females made up 33 percent. The majority of respondents were employed full-time, with 53% in the 30–40 years age group and 47% in the 40–60 year age group. The majority of those who responded were from the fast-moving consumer products industry and were aware of the elements that affect logistics distribution performance.

The survey was undertaken all over India among personnel employed in the distribution of FMCG products, either directly or indirectly. The participants in this study are professionals with extensive knowledge, expertise, and proficiency in their field.

Table 15: Demographic profile of respondents

Variable	Categories	Response %
Gender	Male	67
	Female	33
Age Group	20-40 yrs	53
	41-60 yrs	47
Experience	0-10 yrs	55
	11-15 yrs	30
	15+ yrs	15

This analysis is also represented graphically; graphs such as the pie chart were specifically used to analyze and provide a pictorial representation of the data. The profile of respondent's w.r.t to gender and age group is represented in Fig 4.3 and Fig 4.4 respectively.

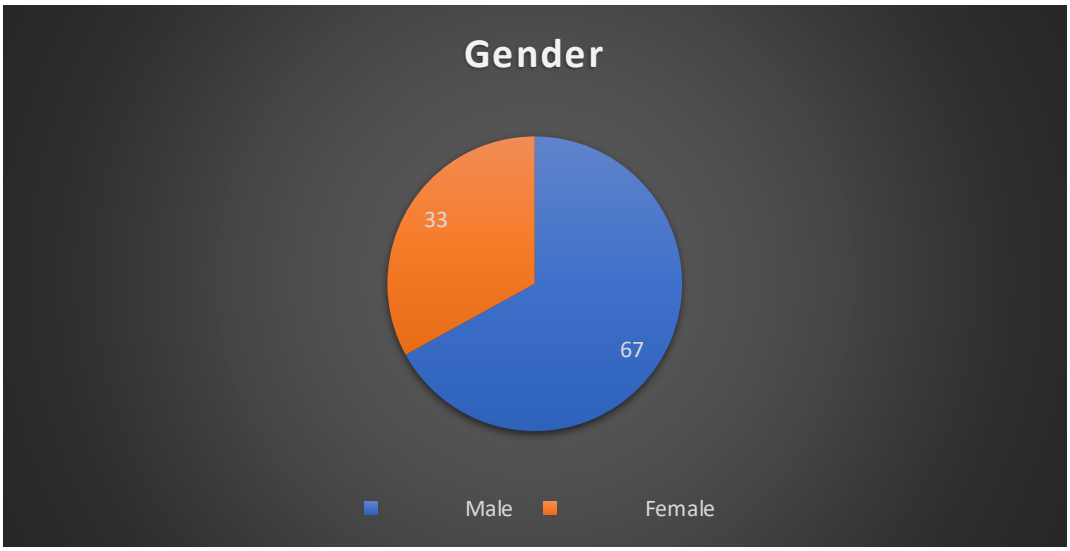

Figure 4.3: Percentage of respondent's w.r.t gender

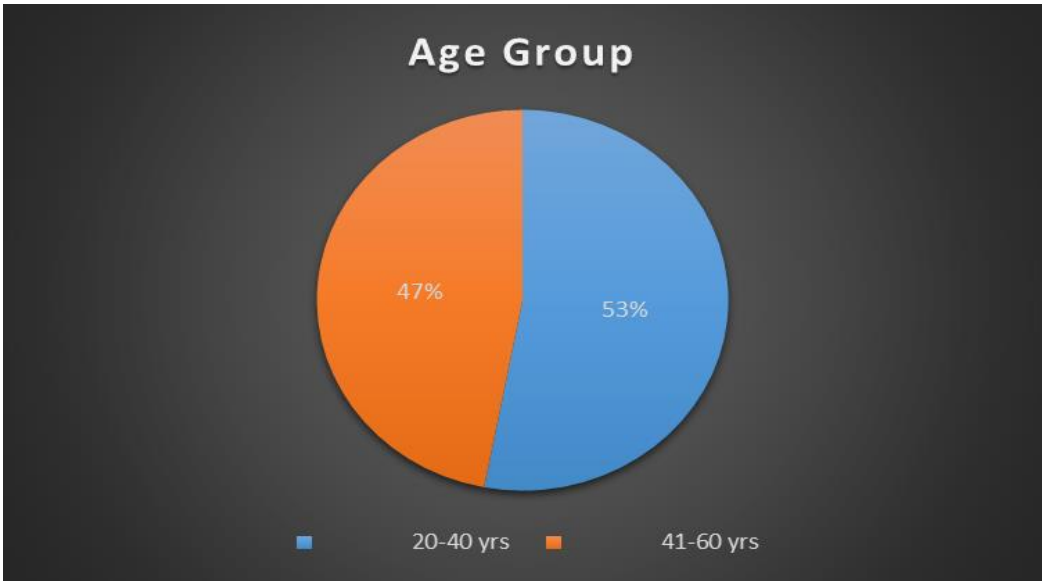

Figure 4.4: Percentage of respondent's w.r.t. age

The respondent's profile is critical for understanding the respondent's level of experience. The experience suggests that the dependability and nature of the input provided are reliable. The respondent profile in terms of years of experience is depicted in figure 4.5.

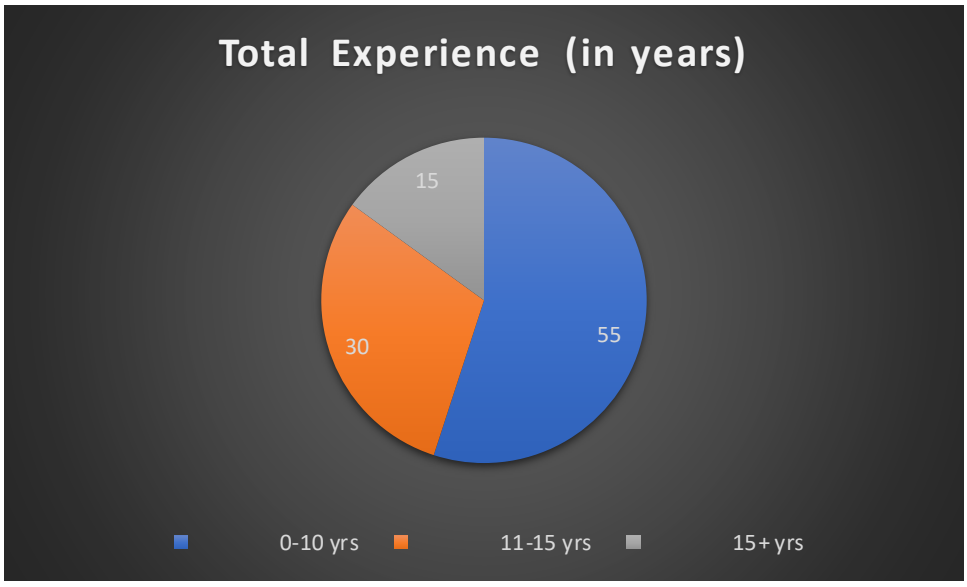

Figure 4.5: Percentage of respondent's w.r.t. experience (in years)

4.2.2 SAMPLING ADEQUACY ANALYSIS

The sample size is determined by the research method employed, the model's complexity in terms of the number of factors employed, the availability of time and resources, the completion rate, and the sample size employed in previous studies (Memon, 2020). As a result, the method of gathering information takes precedence over focusing on indiscriminately gathering more information to increase the sample size.

4.2.3 THE INSTRUMENT

The primary goals of statistical analysis in this study were to identify the important parameters impacting fast-moving consumer goods (FMCG) logistics distribution performance and to construct a model to examine the influence of digitalization on logistics distribution performance.

The survey is organized into four parts, each of which examines one of the study's five hypotheses. The first section captures the individual personal details/demographic information like name, work experience, gender, age, education, etc. pertaining to respondents. The subsequent section covers five items pertaining to Transportation performance (TPP). The third sections include items related to Warehouse performance (WPP). The fourth section captures the role of digitalization (DGT) in improving transportation and warehouse performance. The fifth section captures items related to logistics distribution performance (LDPP). All of the items in Sections 2–5 were rated on a five-point Likert scale, with 1 representing strongly disagree and 5 representing strongly agree (represented by 5). After performing an elaborative review of the literature on the subject, the items for the study concepts were created. Expert advice was obtained to confirm the content

validity of the items. Two industry professionals and two academic experts were reached out for their expertise on the content of these items. A few unclear questions were polished, sentences were clarified, some questions were reordered, some questions with the same meaning were deleted, and a few pertinent items were added. The feedback was quite beneficial in terms of making the questionnaire more concise and specific to the intended goal. Items were finally included to reflect respective study concepts after necessary revisions as indicated by experts.

4.3 DATA COLLECTION

The purpose of the data collection was to focus on approximately 48 Indian fast-moving consumer goods companies with a turnover of more than INR 100 million. The data has been collected from different parts of the country from all major states including Haryana, Himachal Pradesh, Delhi, Uttar Pradesh (Northern Zone), Maharashtra (Western Zone), Karnataka & Andhra Pradesh (Southern Zone)etc. The detail of the region wise response is given in figure 4.6. There were over 500 questionnaires distributed, 300 responses were received, and 44 surveys were discarded due to missing data. 256 questionnaires were examined altogether. The response rate is significantly higher, making it a better representation of the population that was sampled. The data from the questionnaire were transferred automatically to an Excel document, where they were manually entered into a database maintained by SPSS (SPSS Inc.). Standard data validation and authentication (such as range, distribution, and missing value prototype) were carried out. In this quantitative research study, closed-ended questions on a self-administered questionnaire were used to collect data. Each of the participating organizations' internal mail systems was used to distribute the surveys to respondents. Participation in the study was entirely voluntary and unremunerated. The worker completed the questionnaire during their working hours. To ensure that

the proposed speculative endlessly model fit was right, the gained information was exposed to SEM examination on AMOS 27.0.

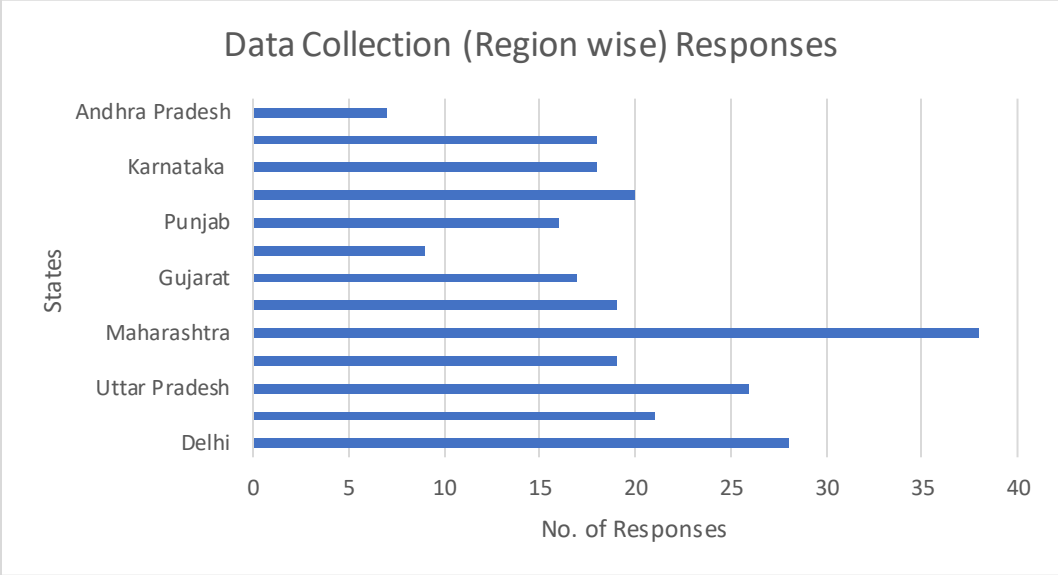

Figure 4.6: Region wise Responses

4.3.1 RELIABILITY

The consistency of the data - set is analyzed to determine the reliability of the constructs in the fast-moving consumer goods logistics distribution. Reliability refers to the consistency with which the values measure the desired aspect. The standard error of measurement and the reliability coefficient are the two most important reliability statistics (Cronbach alpha). Cronbach's alpha is considered reliable when it is between 0.6 and 0.7, and it is considered good when it is greater than 0.7 (Sekaran, 2003). Overall reliability, as well as construct consistency and reliability, are determined by calculating using composite reliability (CR) (Hair, 2010). A reliability coefficient is an absolute number that ranges from 0.0 to 1.0, with 0.0 indicating total inconsistency and 1.0 indicating absolute consistency. The

greater the quantification standard error, the higher the value of the reliability coefficient. The higher the value of the reliability coefficient, the lower the value of the standard error of measurement. The reliability coefficients are said to be acceptable if they are between 0.7 and 0.9. To assess reliability, both alpha value and CR can be used. Cronbach's alpha was tested as a measure of the study idea reliability, and the value for each scale was determined to be above the specified threshold values, as shown in Table 16.

Table 46: Reliability, composite reliability and standard factor loading of the items

Table 16				
Reliability, composite reliability and standard factor loading of the items				
Construct	**Items**	**Standardized Weights**	**CR**	**Cronbach Alpha**
Transport Performance	TP1	0.807	0.943	0.941
	TP2	0.89		
	TP3	0.92		
	TP4	0.936		
	TP5	0.82		
Warehouse Performance	WP1	0.626	0.908	0.907
	WP2	0.847		
	WP3	0.77		
	WP4	0.758		
	WP5	0.847		
	WP6	0.869		
Digitalization	DG1	0.698	0.899	0.894
	DG2	0.849		
	DG3	0.894		
	DG4	0.763		
	DG5	0.807		
	DG6	0.61		
	LDP1	0.76	0.928	0.927

Logistics Distribution Performance	LDP2	0.877		
	LDP3	0.85		
	LDP4	0.879		
	LDP5	0.801		
	LDP6	0.789		

As can be seen in Table 16, loadings of all the sub-criteria on their respective factors are above 0.50 with most of the variables having loadings above 0.70. Thus, as the sub-criteria load well onto the factors it can be interpreted that the sub-criteria sufficiently explain the variables. Also, the reliability of all the key categories is within 0.7 - 0.9 which indicates internal consistency i.e. the items sufficiently explained the key category. The Composite Reliability of all constructs when combined (i.e. 23 variables considered together) was estimated to be 0.919 (>0.80) which indicates that all constructs when combined together are giving good results. This is an indication of the suitability of the dataset. Hence, the constructs and their sub-criteria as presented in table 16 can be considered for further analysis of data to obtain the desired objectives. An explanation of the key constructs is given below:

4.3.1.1 TRANSPORT PERFORMANCE OPTIMIZATION (TPP)

The performance of transportation is critical in the supply chain management of fast-moving consumer goods. On-time delivery (TP1)-0.80, better visibility of in-transit vehicles (TP2)-0.89, timely loading/unloading at the docks (TP3)-0.92, fewer unplanned stops made by the driver (TP4)-0.94, automated vehicle scheduling (TP5)-0.82 are the final chosen items that loaded well (as shown in the above table 16). The Cronbach alpha value for the Transport Performance optimization was estimated to be 0.941, which is a good value in terms of the construct's consistency and reliability. It is therefore 94.1% reliable.

4.3.1.2 WAREHOUSE PERFORMANCE OPTIMIZATION (WPP)

Improved overall warehouse performance is an essential element of fast-moving consumer goods supply chain management. Better inventory tracking within the warehouse (WP1)-0.63, proper documentation (WP2)-0.85, faster putaways and picking (WP3)-0.77, Better storage and material handling (WP4)-0.76, picking accuracies (WP5)-0.85 and effective order processing (WP5)-0.87 are the final selected items that loaded well (as shown in the above table). The Warehouse Performance optimization's Cronbach alpha value was estimated to be 0.901, which is a good value in terms of the construct's consistency and reliability. As a result, it is 90.1% reliable.

4.3.1.3 DIGITALIZATION (DGT)

Digitalization has transformed different spheres of business and is needed to enable more transparent and efficient solutions. A literature review and expert recommendations have revealed a number of digital solutions that are significant for enhancing distribution performance. The following digital tools have been identified and considered for this study: The use of bar codes improves real-time information sharing. (DG1)-0.70, Vehicle tracking system (VTS) improves transportation visibility (DG2)-0.85, Enterprise Resource Planning (ERP), and Electronic Data Interchange (EDI) software improves coordination and integration among logistics partners. (DG3)-0.89, Transport Management Software (TMS) improves transportation performance. (DG4)-0.76, Vehicle capacity utilization software improves transportation performance. (DG5)-0.80, Warehouse Management System (WMS) improves picking accuracy. (DG6)-0.61, are the final selected items that loaded well (as shown in the above table). The digitalization Cronbach alpha value was estimated to be 0.894, which is a good value in terms of the construct's consistency and reliability. As a result, it is 89.4% reliable.

4.3.1.4. LOGISTICS DISTRIBUTION PERFORMANCE (LDPP)

Logistics distribution performance can be considered a part of the larger supply chain concept or organizational performance. Gleason and Barnum differentiated between effectiveness and efficiency. They defined effectiveness as "the extent to which an objective was met," while efficiency was defined as "the extent to which resources were used economically." Simply put, efficiency refers to "doing things correctly," whereas effectiveness refers to "doing the right thing" (Chow et al, 1994). The factors influencing logistics distribution performance in the context of FMCG distribution considered here are: promised lead time (LDP1)-0.76, delivery rush orders when needed (LDP2)-0.88, promised inventory availability (LDP3)-0.85, damage-free deliveries (LDP4)-0.88, processing of accurate orders (LDP5)-0.80, to customers, and total delivery cost optimization (LDP6)-0.79. These are the final items that loaded successfully (as shown in above table 16). The Cronbach alpha value for digitalization was estimated to be 0.927, which is a good value in terms of the construct's consistency and reliability. As a result, it is 92.7% trustworthy.

4.4 COMMON METHOD BIAS

Common method bias should not always be a major problem; For instance, it is generally accepted that common method bias increases the number of variables relationships. There is a possibility of a common method bias because the study relied on self-reported data (Podsakoff et al., 2003). To lessen the problem, Harman's method was used to get rid of these biases. All free and subordinate factors were additionally exposed to exploratory element investigation (EFA) using the head part examination. Common Method Bias (CMB) occurs when a single component accounts for an excessive amount of variance. However, our analysis shows that CMB does not pose a significant threat to our findings given that the

development of a single component accounted for approximately 16% of the variance.

4.5 PHASE II ANALYSIS OF ISSUES USING SEM AND AHP/FAHP

To investigate identified issues in the transportation and warehouse management of fast-moving consumer goods in relation to their impact on logistics distribution performance.

Structural Equation Modelling was used to analyze the issues. The multivariate analysis technique, which is a statistical technique, aids in the analysis of structurally related relationships. SEM, a multivariate technique, employs theory and research in model specification and takes measurement errors into account (Suhr, 2006). Relationships between variables can be explained appropriately because it is an effective technique for estimating interrelated and multiple dependence while analyzing. A model depicts the relationships between variables. Nunkoo (2012) claims that SEM is best suited for confirmatory modeling to evaluate a substantive theory with empirical data using a hypothesized model. Finally, the issues and their sub-categories are prioritized using the AHP/FAHP strategy to offer a clear understanding of the issue ranking.

4.5.1 STRUCTURAL EQUATION MODELING (SEM)

The steps taken to analyze data that use SEM are as follows:

Stage I: The creation of a conceptual model was developed based on a literature review and expert suggestions, as shown in Chapter 3.

Stage II Measurement Model Construction The measurement model is created using Path Analysis.

The following steps are involved in this stage:

Step 1: Perform a Reliability Test.

The test of reliability refers to how consistent and stable data is in measuring what it is supposed to measure. Cronbach's alpha was calculated to be 0.926 for the information under consideration (refer to Table 16). It indicated that the data was consistent enough for further analysis.

Step 2: Determine the endogenous and exogenous variables.

In its data analysis technique, structural equation modeling employs exogenous and endogenous variables. Exogenous variables are those that are independent of other variables, whereas endogenous variables are those that are influenced by the presence of other variables. There is one endogenous variable in the current study, logistics distribution performance (LDPP), and two exogenous variables, warehouse performance optimization (WPP) and transport performance optimization (TPP).

Step 3: Identify Latent and Observed Variables

A manifest variable can be easily observed and estimated, whereas a latent variable cannot be easily observed and estimated. The use of latent factors increases the complexity of a SEM model because all of the items in the survey instrument and corresponding measured responses are used to evaluate the latent variable or factor. Logistics distribution performance (LDPP), warehouse performance optimization (WPP), transportation performance optimization (TPP), and digitalization are the study's latent variables (DGT).

Step 4: Develop the measurement model

Following the identification of latent and observed variables and the application of the Confirmatory Factor analysis technique, the measurement model is developed.

Step 5: Testing for Reliability, Validity, and Model fit measures

According to Sekaran (2003), a value of that is considered reliable when it is between 0.6 and 0.7, and a value of Cronbach's is considered good when it is greater than 0.7. Cronbach's alpha was greater than 0.7 and close to 0.9 for the latent constructs, as shown in Table 16. This is an indication of the constructs' reliability, implying that the latent constructs are sufficiently explained. To ensure that there are no validity issues, convergent, and discriminant validity must be determined. While convergent validity ensures construct validity, discriminant validity ensures validity in relation to other model constructs. Model fit measures are then applied to determine whether or not the model is a good fit. GFI, TLI, Normed chi-square, and RMSEA were employed for this study. Only after the model fit is indicated is the next step taken.

4.5.2 ANALYSIS OF ISSUES USING AHP / FUZZY AHP

The main stage in the usage of the Analytic Hierarchy Process is the breakdown of the entire issue into a hierarchical design. Therefore, a progressive construction is assembled where the objective is set at a level I; standards at level II; sub-rules at level III; and options at level IV.

In our study, the goal is the logistics distribution performance and hence is placed at a level I; the criteria are the Issues and so placed at level II: the sub-criteria of the various issues are displayed at level III and finally, the solutions are at level IV. So, the study identified two main issues: Warehouse performance and transport performance. Transport performance has 5 sub-criteria on the other hand Warehouse performance has 6 sub-criteria.

The experts performed pair-wise comparisons for the major categories of issues using the Saaty scale for AHP. Following that, AHP steps are performed on the data involving two issues and their sub-categories to obtain normalized weights and CR, which when found to be less than 1.0, a fuzzy logic process, i.e. Fuzzy AHP, is applied. The researcher was able to arrive at fuzzified and de-fuzzified normalized

weights for the issues and their sub-categories using Fuzzy AHP, based on which the rankings, local and global (for the sub-category) were determined.

4.6 PHASE III DEVELOPMENT OF FINAL MODEL AND SUGGESTION OF SOLUTIONS

The proposed hypotheses are tested in this phase, and the final model is developed. SEM was used for hypotheses testing and model development. Following that, solutions are proposed based on the survey of writing and ideas from respondents. Finally, solutions to the problems are prioritized and recommended. The following are the steps taken during this phase:

4.6.1. HYPOTHESIS TESTING AND FINAL MODEL DEVELOPMENT

The Structural model is developed in this phase, and seven proposed hypotheses are tested for significance using the CR and the p-value. With a p-value of 0.05 (significance level), i.e. 95% level of confidence, and a CR value greater than 1.96, the hypotheses are said to be supported, indicating that the exogenous variable has a significant influence on the endogenous variable.

4.6.2 IDENTIFICATION AND CATEGORIZATION OF SOLUTIONS INTO DIGITAL AND NON-DIGITAL

Solutions are identified based on expert input and a review of the literature. They are then classified as either digital solutions or non-digital solutions. This is done in the interest of the decision-makers and to provide more clarity regarding the solutions' implementation. Furthermore, further assessment of solutions based solely on their classification will not yield reliable and feasible results. As a result, categorizing into the two categories yields more reliable and feasible results, allowing for the execution of a suitable solution to address the desired issues.

4.6.3 PRIORITIZATION OF DIGITAL AND NON-DIGITAL SOLUTIONS

Separately, digital and non-digital solutions are prioritized based on their priority in attempting to resolve the identified issues. Fuzzy TOPSIS is used to rank the solutions for resolving the issues for prioritization.

4.7 SENSITIVITY ANALYSIS: ANALYZING THE ROBUSTNESS OF RANKINGS OF ISSUES

The MADM (multi-attribute decision-making) models are commonly used for evaluating, ranking, and selecting alternatives from a set of alternatives based on the importance assigned to each alternative. The data used by MADM models is not very stable and is also subject to change (Alinezhad, 2011). As a result, performing sensitivity analysis can assist in making the right decision. Thus, sensitivity analysis was used in the existing study to emphasize the aftereffect of changes in standard loads on the final rankings. The consistency of the rankings obtained demonstrates the reliability of the rankings determined, indicating a robust framework. To ensure the reliability and robustness of the results obtained, sensitivity analysis was performed on the rankings determined for the Issues as well as the solutions, digital solutions, and non-digital solutions.

4.8 DEVELOPMENT OF THE MEASUREMENT MODEL

SEM has hence applied in two stages: the first measurement model to identify the relationship between observed and latent variables and the second structural model to examine the strength between the exogenous and endogenous variables. The primary model (structural model) and the estimation model (measurement model) together structure the whole underlying structural equation model. The measuring model demonstrates the relationship between an item and its latent variable.

Utilizing convergent and discriminant validity, the model is assessed (Kumar, 2020).

Validity requires studying the right thing, just as reliability refers to studying the right way (Collis & Hussey 2013; Saunders et al. 2009). Because the empirical data is primarily gathered from various executives and managers, there is a possibility of subjectivity, which could reduce the study's validity. To address this both convergent and discriminant validity was determined. To demonstrate the convergent validity of its constructs, the average variance extracted, or AVE, metric's value must be greater than or equal to 0.5. (Fornell, 1981). Cronbach's alpha and CR are used to evaluate the internal consistency of constructs (composite reliability). Ranges between 0.70 and 0.95 are included in the acceptable range of values. (Hair, 2014). According to Gotz (2010), discriminant validity illustrates how distinct the constructs are from one another and how one construct will have a higher variance in its variables than other constructs. To ascertain the discriminant validity, the square root of AVE is contrasted with the correlation among latent variables. To address multicollinearity, measurement model was tested and correlation and estimate were found out between the variables. The discriminant validity is tested with microstat tool. The result has shown that there is no issue of multicollinearity exist as all the values are falling between 0 to 1. Confirmatory factor analysis was used with AMOS version 27.0 to establish concept validity and reliability with both convergent and discriminant validity taken into account.

In this study, the measurement model consists of four constructs, namely, Transport performance optimization (TPP), Warehouse Performance optimization (WPP), Logistics distribution performance (LDPP), and Digitalization (DGT). In terms of validity, an AMOS measurement model was used, and the results showed that all study scales had both discriminant and convergent validity. The phrase "the degree to which indicators accurately measure what it is supposed to accomplish, what they are designed to measure, and lastly the measurement should be right and

accurate" has been used to describe validity (Hair, 1998). To determine the exactness and correctness of indicators, validity assessments, including discriminant and convergent validity, are carried out.

In general, the degree to which a given construct's variables has a large proportion of variation is referred to as convergent validity (Hair et al., 2010). Using standard regression weights, convergent validity can be determined. Standard factor loading (standard regression weight) estimates demonstrate that the indicator variables significantly represent the latent variables. (Hair et al.,) The standard factor loading should never be less than 0.50. 2010). As can be seen in Table 1, the observed variable has a standard factor loading of 0.75 to 0.95. It indicates that the measured variables conform to the latent variable or construct and are acceptable; Consequently, convergent validity ought to be verified.

The degree to which a construct differs from other constructs is measured using discriminant validity (Hair et al., 2010). There are two ways to assess the discriminant validity. First, theoretically, distinct construct evaluations should not be highly correlated (Trochim, 2006). Second, the square root of the average extracted variance (AVE) should be greater than the correlation between constructs, as specific construct AVEs are always greater than construct ASVs. As can be seen in Table 17, the particular constructs' AVE is greater than their ASV. (See Table 17) The normalized factor load and the AVE values were broken down to evaluate convergent validity. The high legitimacy of the factors and builds is exhibited by the way that all standardized component loads and AVE values were more unmistakable than the recommended worth of 0.5. Discriminant validity is maintained because the AVE values are higher than the matching squared value. The independence of the variables in the measurement model is represented by a low correlation between the constructs, which is desirable. Table 17 displays the specific constructs' AVEs that are greater than ASV.

Table 17: Convergent and discriminant Validity

Table 17				
Convergent and discriminant Validity				
Construct	**Items**	**AVE**	**ASV**	**P**
Transport Performance	TP1	0.767	0.230	***
	TP2			***
	TP3			***
	TP4			***
	TP5			
Warehouse Performance	WP1	0.624	0.1686	***
	WP2			***
	WP3			***
	WP4			***
	WP5			***
	WP6			
Digitalisation	DG1	0.602	0.198	***
	DG2			***
	DG3			***
	DG4			***
	DG5			***
	DG6			
Logistics Distribution Performance	LDP1	0.684	0.239	***
	LDP2			***
	LDP3			***
	LDP4			***
	LDP5			***
	LDP6			
Note : *p<0.05, **p<0.01, ***p<0.001				

4.8.1 THE MEASUREMENT MODEL & MODEL FITNESS

Utilizing AMOS 27.0, The measurement model is evaluated using a confirmatory factor analysis (CFA). It is essential to examine the measurement model's validity

and dependability prior to examining the structural model's interrelationships (Fornell and Lacker, 1981; 2006 Ifinedo).

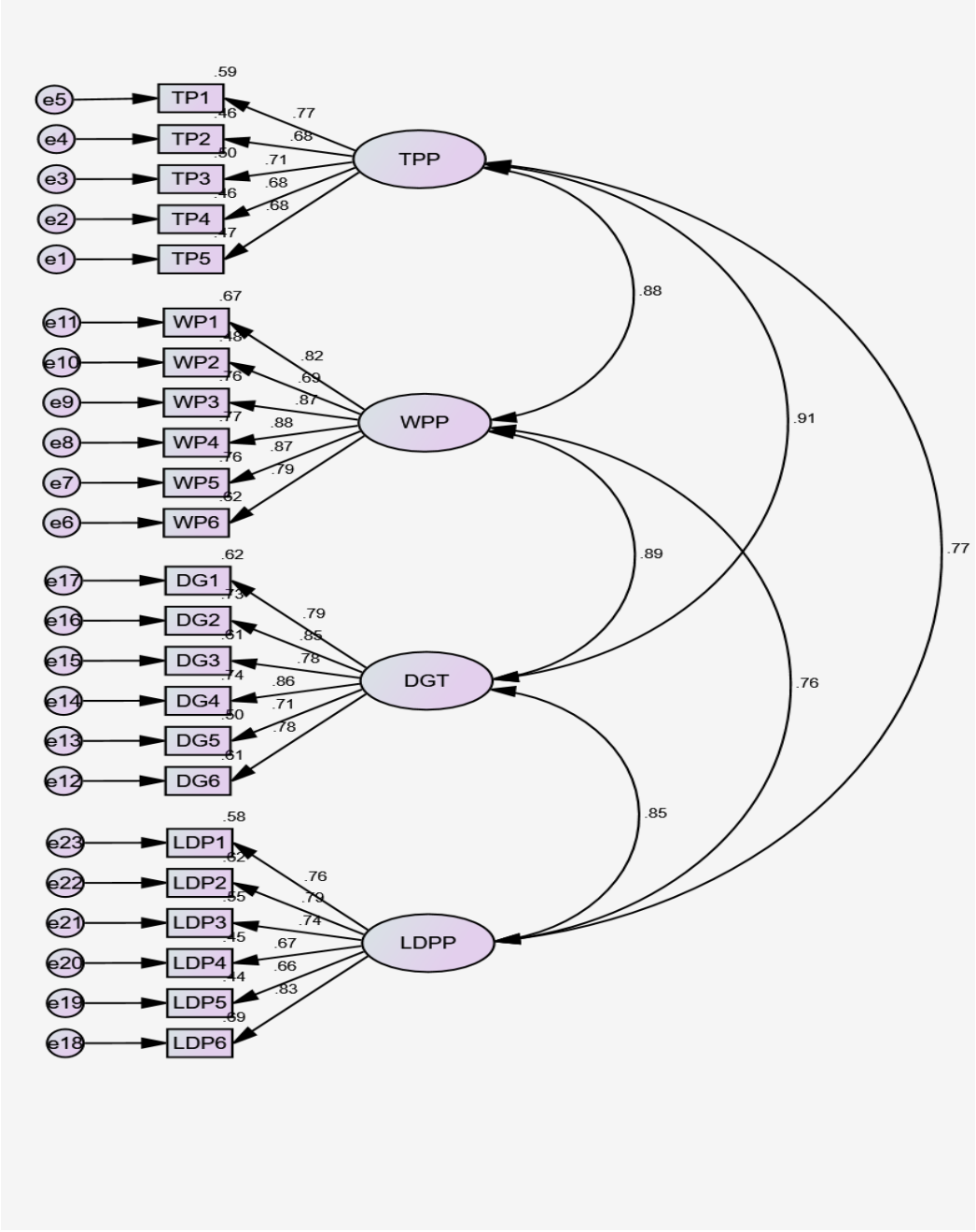

Fig 4.8 Measurement Model

Various indices, such as the Tucker Lewis index (TLI), root mean square of error approximation (RMSEA), comparative fit index (CFI), the goodness of fit index (GFI), normed fit index (NFI), and 2010). To establish an acceptable fit with the data, the allowable respective values of 2 /df should be less than 3, the CFI, GFI, NFI, and TLI should be close to or greater than 0.9, and the RMSEA should always be less than 0.08 (Gefen and Straub, 2000). Table 18 provides a summary of the measurement model's goodness-of-fit indices. We can use SEM to test the structural model because Table 18 clearly demonstrates that the measurement model predicts a good fit.

Table 18: Summary of goodness-of-fit indices for the measurement model

Table 18

Summary of goodness-of-fit indices for the measurement model

Model fit index	χ 2 /df	CFI	GFI	NFI	TLI	RMSEA
Model fit index	2.994	0.935	0.863	0.906	0.927	0.072

CFI, comparative fit index; GFI, the goodness of fit index; NFI, normed fit index; TLI, Tucker Lewis index; RMSEA, root mean square error approximation

4.9 DEVELOPMENT OF STRUCTURAL MODEL & MODEL FITNESS

SEM was utilized to evaluate the underlying model to look at the conjectured calculated research model. SEM is a technique better than the other techniques used in statistics like multiple regression analysis. Based on two criteria, the assessment of the structural model is done. The absolute fit measures exhibit the link between

predicted and actual covariance matrices (Koops, 2002). The goodness-of-fit for the model, which is judged to be moderately satisfactory, is exhibited in Table 19. The final analysis of the structural model fitting result is presented in the table.

Table 19: Summary of goodness-of-fit indices for Structural Model

Table 19

Summary of goodness-of-fit indices for Structural Model

Model fit index	χ 2 /df	CFI	GFI	NFI	TLI	RMSEA
Model fit index	3.587	0.943	0.883	0.922	0.933	0.082

CFI, comparative fit index; GFI, goodness of fit index; NFI, normed fit index; TLI, Tucker Lewis index; RMSEA, root mean square error approximation

They were within the acceptable range: χ2 ratio CMIN/DF = 3.587 (is < 5.0) p= 0.00; GFI = 0.883; RMSEA = 0.082. As a result, we can move forward with our investigation of the hypotheses described in our model. The level of significance (α) has been set at 0.05. In a multiple regression analysis, standardization of the coefficient is generally determined to identify which exogenous variables more influence endogenous variables. The R2 is squared multiple correlations determined to analyze the strength of the projected model. Figure 3.7 depicts the structural model.

4.10 HYPOTHESES TESTING

Path coefficient and hypotheses result from the Maximum likelihood estimation method were utilized for testing hypotheses along with path coefficients at the pre-decided level of significance. The path (structural) model is presented in Fig 3.7. The table shows the structural model's properties (standardized path coefficients (β), standard error, critical ratio, and hypotheses outcome). The summary of the

results is presented in Table 20 presenting significance level, β-value, and t-values. At a value above 1.96, the path coefficient is taken to be significant. As per the results

Table 20: Summary of testing

Table 20						
Summary of testing						
Hypotheses		Structural Relationship	St. Est (β)	Unst.Est (β)	P	Result
H1	Total Effect	TPP---LDPP	0.37	0.41	***	Supported
	Direct Effect	TPP---LDPP	0.26	0.3	***	
H2	Total Effect	WPP---LDPP	0.45	0.35	***	Supported
	Direct Effect	WPP---LDPP	0.41	0.33	***	
H1a		TPP---TDGT	0.53	0.55	***	Supported
H1b		TDGT--LDPP	0.06	0.03	***	Supported
H2a		WPP--WDGT	0.33	0.21	***	Supported
H2b		WDGT--LDPP	0.24	0.2	***	Supported

H1($\beta = 0.494$, $p < 0.05$), H5 ($\beta = 0.193$, $p < 0.05$), H6 ($\beta = 0.261$, $p < 0.05$) and H7 ($\beta = 0.134$, $p < 0.05$) have a significant relationship and thus are accepted. On the other hand, H2 ($\beta = 0.088$, $p > 0.05$), H3 ($\beta = -0.049$, $p > 0.05$), and H4 ($\beta = 0.019$, $p > 0.05$) have an insignificant relationship and hence are not supported. The final model of the study is presented in Fig 5.3. Table 20 presents the outcome of hypothesis testing, where β coefficients represent the relationship of influencing factors.

4.10.1 MEDIATION ANALYSIS

The path theory assumed that there were three structural paths: one that led from TPP to LDPP without any mediating variables, and the second one came from WPP to LDPP. TPP, TDGT, and LDPP provide support for the significant mediation; However, as shown in Table 21, the other meditational path, namely WPP----WDGT----LDPP, is found to be insignificant.

Table 21: Mediation Analysis

Mediating Effect	In the relationship of	Sobel Test	P	Result
TDGT	TPP-----LDPP	0.4196	***	Supported
WDGT	WPP----LDPP	0.0817	***	Supported

4.10.2 TEST OF TOTAL EFFECT

From TPP to LDPP in the first structural path (without mediating variables). ($\beta = 0.37$, $p < 0.001$), the overall effect was found to be significant. In a similar fashion, WPP-LDPP (without mediating variables). ($\beta = 0.45$, $p < 0.001$), the overall effect was found to be significant.

4.10.3 TEST OF DIRECT EFFECT

Now, the model was run with mediating variable, the standardized path coefficient (β) from TPP----LDPP was reduced by a non-trivial amount ($\beta = 0.37–0.26$), and similarly WPP---LDPP was reduced by ($\beta = 0.45–0.41$), though still significant; thus, the partial mediation was supported (Baron and Kenny, 1986). Hypothesis H1 proposed that TPP is positively affecting the LDPP and WPP is positively LDPP. Hence, the result of the structural equation model provided support for H1 & H2 hypotheses.

4.11 AHP AND FAHP: RANKING OF SUBCATEGORIES OF ISSUES

AHP is a method of MCDM that takes into account both the quantitative and qualitative aspects of an independent direction course. The scale of relative importance and hierarchical structure of sub-categories is presented in the preceding chapters.

4.11.1 MEASURE OF CONSISTENCY AND RANKING USING AHP

The pair-wise comparison was done by the experts for Transportation and Warehouse performance subcategories by assigning the Saaty scale for AHP. Table 22 presents the TFNs (Triangular Fuzzy Numbers) used for evaluating the sub-categories of the issues.

Table 22: Importance level

Preference rating	**TFNs**
Equal Importance	(1,1,1)
Low Importance	(2,3,4)
Average Importance	(4,5,6)
High Importance	(6,7,8)
Very High Importance	(7,9,9)

The normalized pairwise comparison matrix was determined for the sub-categories of the issues 'Transport Performance' and 'Warehouse Performance' and Tables 23 & 24 exhibit the normalized comparison values for each sub-category respectively.

Table 23: Normalized Weights in AHP for Transport Performance Optimization

TP	**TP1**	**TP2**	**TP3**	**TP4**	**TP5**

TP1	**0.5028**	**0.4744**	**0.3134**	**0.6718**	**0.7807**
TP2	**0.0718**	**0.0678**	**0.1045**	**0.0448**	**0.0520**
TP3	**0.0559**	**0.0226**	**0.0348**	**0.0269**	**0.0372**
TP4	**0.1006**	**0.2033**	**0.1741**	**0.1344**	**0.0867**
TP5	**0.1676**	**0.3389**	**0.2437**	**0.4031**	**0.2602**

Source: AHP analysis

Table 24: Normalized Weights in AHP for Warehouse Performance Optimization

WP	**WP1**	**WP2**	**WP3**	**WP4**	**WP5**
WP1	**0.4128**	**0.3052**	**0.4517**	**0.5085**	**0.4620**
WP2	**0.0459**	**0.0339**	**0.0301**	**0.0363**	**0.0308**
WP3	**0.0826**	**0.1017**	**0.0903**	**0.0847**	**0.0770**
WP4	**0.2064**	**0.2374**	**0.2710**	**0.2542**	**0.3080**
WP5	**0.1376**	**0.1695**	**0.1807**	**0.1271**	**0.1540**
WP6	**0.0590**	**0.0678**	**0.0452**	**0.0508**	**0.0513**

Source: AHP analysis

The coefficient vector for criteria weights for the sub-category issues of Transportation performance is determined and presented in Table 25.

Table 25: Weights and corresponding 'TP' Ranks

TP Sub-category		Barrier Weight	Rank
TP1		**5.4554**	**1**
TP2		**5.0297**	**5**
TP3		**5.0926**	**4**
TP4		**5.2035**	**3**
TP5		**5.4318**	**2**

Source: AHP analysis

λ max was estimated to be 5.4554, the Consistency Index (CI) is 0.060 and the Consistency Ratio (CR) for 5 sub-category issues was calculated to be 0.054. As the value of CR is less than 0.10, the suitability of data is indicated.

Table 26:'WP' Weights and corresponding Ranks

WP Sub-category	Barrier Weight	Rank
WP1	**6.1117**	**1**
WP2	**6.0266**	**5**
WP3	**6.0408**	**4**
WP4	**6.0984**	**2**
WP5	**6.0586**	**3**
WP6	**6.0130**	**6**

Source: AHP analysis

Similarly for Warehouse performance, λ max was estimated to be 6.058, Consistency Index (CI) is 0.011 and the Consistency Ratio (CR) for 6 sub-category issues was calculated to be 0.009. As the value of CR is less than 0.10, the suitability of data is indicated. The normalized weights for the sub-categories were calculated and appropriately exhibited in Tables 25 & 26.

4.11.2 RANKING USING FUZZY AHP METHOD

The pair-wise comparison was done by the experts for sub-category issues by considering the TFNs for Fuzzy AHP as presented in Table 27 for Transportation Performance and Table 28 for Warehouse Performance.

Table 27: 'TP' Fuzzy Weights of Geometric Means-wl, wm, and wn

TP Sub-category	w_l	w_m	w_u	M_i	N_i	Rank
TP1	**0.3521**	**0.5100**	**0.7079**	**0.5233**	**0.5001**	**1**
TP2	**0.0442**	**0.0636**	**0.0970**	**0.0683**	**0.0652**	**4**
TP3	**0.0248**	**0.0329**	**0.0485**	**0.0354**	**0.0338**	**5**
TP4	**0.0883**	**0.1296**	**0.1986**	**0.1388**	**0.1327**	**3**
TP5	**0.1808**	**0.2638**	**0.3971**	**0.2806**	**0.2681**	**2**

Source: FAHP analysis

Table 28:'WP' Fuzzy Weights of Geometric Means - wl, wm, and wn

WP Sub-category	w_l	w_m	w_u	M_i	N_i	Rank
WP1	**0.2412**	**0.4134**	**0.6608**	**0.4384**	**0.3971**	**1**
WP2	**0.0220**	**0.0334**	**0.0589**	**0.0381**	**0.0345**	**6**
WP3	**0.0503**	**0.0899**	**0.1699**	**0.1034**	**0.0936**	**4**
WP4	**0.1452**	**0.2554**	**0.4581**	**0.2862**	**0.2592**	**2**
WP5	**0.0855**	**0.1537**	**0.2886**	**0.1759**	**0.1594**	**3**
WP6	**0.0317**	**0.0541**	**0.1001**	**0.0620**	**0.0561**	**5**

Source: FAHP analysis

In view of the analysis, the sequence of final ranks with the application of the FAHP method is

WP1>WP4>WP5>WP3>WP6>WP2

4.11.3 COMPARISON OF THE RANKINGS OBTAINED FROM AHP AND FAHP APPROACHES

On prioritizing the sub-issues in fast-moving consumer goods using AHP/FAHP approaches, a comparison in outcomes of the two approaches has been presented in table 29.

Table 29: Sub-Criteria Weight Ranks for AHP and FAHP

Sub-category	For AHP Method	For FAHP Method

TP		
TP1	**1**	**1**
TP2	**5**	**4**
TP3	**4**	**5**
TP4	**3**	**3**
TP5	**2**	**2**
WP		
WP1	**1**	**1**
WP2	**5**	**6**
WP3	**4**	**4**
WP4	**2**	**2**
WP5	**3**	**3**
WP6	**6**	**5**

Source: AHP and FAHP analysis

Spearman's correlation coefficient value is determined between the two rankings obtained from the AHP method and FAHP method. A higher value indicates the consistency of results i.e rankings in this case. Table 30 presents the Correlation value and the level at which the difference exists between the two methods.

Table 30: Rank Correlation with the p-value

Sub-category	Sample 1	Sample 2	*N*	Correlation	*P*-value
TP	**RANK 1(AHP)**	**RANK 2 (FAHP)**	**5**	**0.900**	**0.037**
WP	**RANK 1(AHP)**	**RANK 2 (FAHP)**	**6**	**0.943**	**0.005**

4.11.4 FINAL RANKING OF SUB-CRITERIA

The final ranking of sub-criteria for TP- Transportation performance optimization and WP- Warehouse performance optimization are depicted below in table 31. The table shows the ranking is found to be quite consistent with both the AHP and FAHP approaches.

Table 31: Potential sub-categories in Sequence

Ranks	Sub-Criteria
1	**TP1**
5,4	**TP2**
4,5	**TP3**
3	**TP4**
2	**TP5**
Ranks	**Sub-Criteria**

1	**WP1**
5,6	**WP2**
4	**WP3**
2	**WP4**
3	**WP5**
6,5	**WP6**

Source: AHP and Fuzzy AHP analysis.

4.12 PRIORITIZATION OF THE SOLUTIONS TO OVERCOME POOR LOGISTICS DISTRIBUTION ISSUES

The prioritization of the arrangements proposed to mitigate the issues of logistics distribution is conducted by applying the FTOPSIS method. This has been done for ease of comparison and understanding of the solutions for the purpose of implementation by the decision-makers and firm owners.

4.12 .1 FTOPSIS FOR SOLUTIONS – DIGITALIZATION

Table 32: Potential sub-categories in Sequence

	di*	di-	Closeness coefficient	Rank
DGT1	**0.766**	**6.399**	**0.89**	**1**
DGT2	**1.770**	**5.211**	**0.75**	**2**
DGT3	**4.016**	**3.200**	**0.44**	**3**

DGT4	**4.053**	**2.891**	**0.42**	**4**
DGT5	**4.819**	**2.346**	**0.33**	**5**
DGT6	**5.823**	**1.157**	**0.17**	**6**

Source: FTOPSIS

4.13 SENSITIVITY ANALYSIS OF THE PRIORITIZED SOLUTIONS

The utilization of Sensitivity Analysis is finished to look at the consistency and trustworthiness of the applied structure. By making changes to the weight of specific criteria, variation can be seen in the final ranking of the alternatives (Vishwakarma, 2019; Yadav, Garg & Luthra, 2021). To attain this, nine iterations have been conducted as exhibited in Table 33. The solution value possessing maximum weight is substituted while the other solutions' weight remains the same. Thereafter ranks are considered for all the solutions. The sensitivity analysis result is graphically represented in Fig 13. This study categorized six solutions and out of these six the highly ranked solution is the 'Transport Management Software (TMS) improves transportation performance' (DGT1). The rest of the solutions may be affected by a small change in the weighting of a highly ranked solution (see Table 33)

Table 5: Sensitivity analysis of solutions with "DGT" solutions

Solutions	**Normalized DG1=0.298**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
DGT1	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
DGT2	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**

DGT3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**4**	**3**	**3**
DGT4	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**3**	**4**	**4**
DGT5	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
DGT6	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**

Source: Sensitivity Analysis

For addressing the fluctuations among variables this research applied sensitivity analysis. Therefore, highly ranked solution weightage can be changed from 0.298 (DG1) to 0.298*0.9, 0.298*0.8…. 0.298*0.1 with values taken to three decimal places (see Table 32, 33, and Figure 13).

The ranking obtained by Fuzzy Topsis for the Digitalization is in the order given below-

DGT1> DGT2> DGT3> DGT4> DGT5> DGT6

Also for Transportation Performance Transport Management System (TMS) i.e. TDGT1 holds the highest rank followed by Vehicle Tracking System (VTS) i.e. TDGT2 and then the Vehicle Capacity Utilization tools i.e TDGT3.

TDGT1>TDGT2>TDGT3

Similarly for Warehouse Performance Warehouse Management System (WMS) i.e. WDGT4 has the highest rank followed by the Use of Barcodes & RFID i.e. WDGT5 and then the Use of ERP & EDI tools i.e. WDGT6.

WDGT4> WDGT5> WDGT6

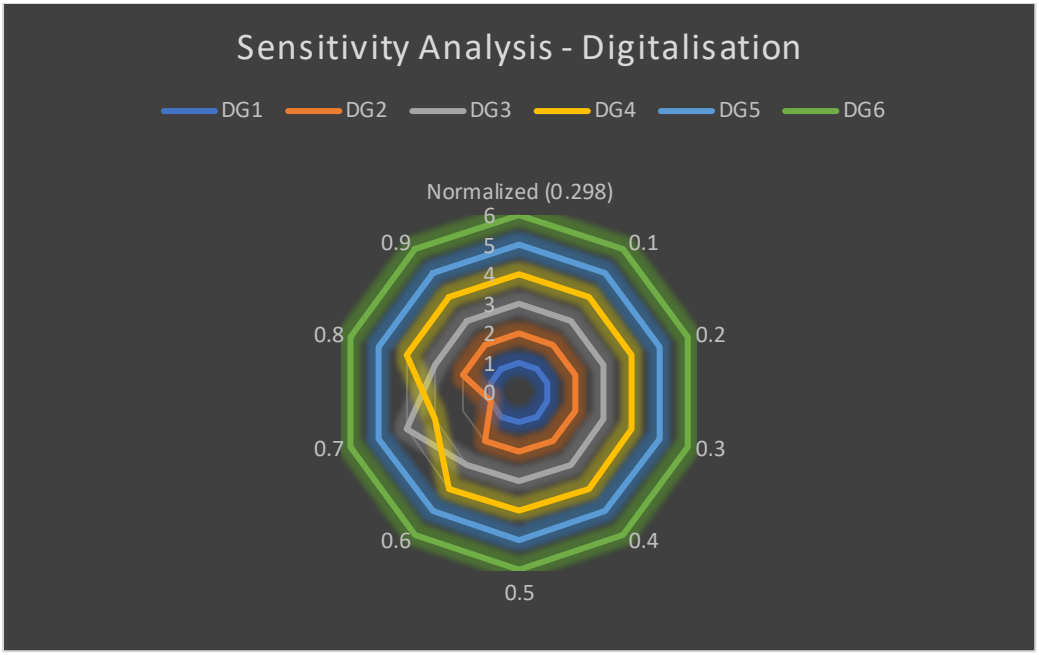

Figure 13. Results of sensitivity analysis for solutions

4.14 CHAPTER SUMMARY

This section depicts a segment examination of the responses gathered from the distribution's various respondents. Furthermore, the dependability of the information is introduced, as is the importance assigned to the various issues by the respondents. This chapter also includes the identification of main and sub-criteria, as well as descriptive statistics and reliability estimates. The results of common method bias tests are also presented to ensure that there is no bias in response collection due to the survey instrument used. The following chapter will present additional data analysis.

CHAPTER V
DISCUSSION

CHAPTER V

DISCUSSION

5. OVERVIEW

This section provides an in-depth summary of the investigation outlined in this study. The primary outcomes and inferences have been thoroughly presented. The chapter also displays the study's contributions to the literature, as well as suggestive solutions derived from the study's findings. Arguments regarding review impediments and future scope are also highlighted.

The overarching goal of this investigation was to gain insights into the issues that exist in the physical distribution of fast-moving consumer goods (FMCG), their impact on logistics distribution performance, the prioritization of sub-issues, digital solutions, and the suggestion of solutions for identified issues. The formulated hypotheses were tested and a final model was developed using Structural Equation Modeling, an MCDM method. The focus was on FMCG players operating in India because this sector has a significant role to play in India's GDP today and is characterized by very thin margins. However, the presence of various issues in the identified warehouse and transportation activities has not only hampered logistics distribution performance but has also resulted in massive losses and wastage. This is truly a source of concern for the diverse stakeholders of the FMCG supply chain, as it is impeding the growth and economic benefits that could otherwise be realized.

Based on the limited literature available and expert opinion, it is possible to conclude that the fast-moving consumer goods (FMCG) distribution is plagued by a number of issues that are seriously affecting its performance. As a result, existing literature and meetings with FMCG stakeholders helped to identify a set of

classifications and sub-classifications of issues, which were then analyzed using the structural equation modeling technique.

However, simply identifying the problems is insufficient. As a result, the purpose of this section is to present strategies and solutions for dealing with issues that affect the distribution performance of fast-moving consumer goods. The Fuzzy TOPSIS method is used to conduct solution prioritization by ranking the solutions based on their usefulness in resolving the issues. The fuzzy environment used in the study lends to the suitability of an integrated decision-support system (Prakash, 2016). The issues must be resolved to overcome improved logistics distribution performance of fast-moving consumer goods, resulting in lower losses. The presence of critical issues causes a slew of performance issues, which eventually leads to higher distribution costs.

5.1 FINDINGS OF THE STUDY

Using primary and secondary data sources, the current state of the FMCG sector and physical distribution issues in India were investigated. The issues were identified from the literature, and the issues that are critical to poor logistics distribution performance were chosen based on expert opinion. The experts agreed that transportation performance optimization and warehouse performance optimization are the most important components that contribute the most to distribution performance. These two areas can be improved further through the use of digitalization. Using structural equation modeling, the hypotheses were created and tested. The sub-issues under warehouse optimization, transport optimization, and digitalization were prioritized using AHP, and FAHP and further confirmed with the sensitivity analysis. Given below are findings in light of the analysis of

information directed in this review: The ranking of sub-categories of Transport optimization issue was as follows (in descending order):

Transportation sub-issues: On-Time delivery (transit adherence) (TP1) > Automated vehicle scheduling (TP5) > Lesser unplanned stops (TP4) > Timely loading and unloading at docks (TP3) > Better visibility of in-transit vehicles (TP2).

As per the AHP, the highest ranking to subcategories under transport optimization has been given to on-time delivery (TP1) of shipments which is very important for proper planning of inventory and providing better service level to customers followed by automatic scheduling of vehicles (TP5) as in most of the organization it is done manually which is a time-consuming process and it can lead to delayed placements of vehicles which increases the overall lead time. The third rank has been assigned to lesser unplanned stops (TP4) made by the driver on the way, this happens when there is poor or altogether no tracking of vehicles, with proper vehicle tracking, this factor can be avoided and has a direct impact on transit delays through GPS technology/vehicle tracking system(VTS). The fourth rank is attributed to the timely loading and unloading (TP3) of FMCG goods at the docks in various facilities (Factories or warehouses), this is very important for the turnaround time (TAT) of vehicles and has a direct impact on customer's lead time. The fifth rank has been given to the visibility of in-transit vehicles (TP2) which can be provided through advance shipping notification (ASN) and tracking technologies. Interestingly, broadly similar ranks have been obtained through Fuzzy AHP also with slight deviation (refer to table 29).

Similarly, the AHP ranking of sub-categories of the Warehouse optimization issue was as follows (in descending order):

Warehouse sub-issues Better inventory tracking within the warehouse (WP1) > Better storage and material handling (WP5) > Effective order processing (WP4) >

Proper documentation (WP2) > Faster putaways and picking (WP3) > Picking accuracies (WP6).

The top ranking has been assigned to better inventory tracking (WP1) which is the biggest contributor to warehouse performance it can be achieved through digital tools like a warehouse management system (WMS) followed by Better storage of and material handling (WP5) which makes the process faster, it can be done through automation. The third rank and fourth ranks are assigned to effective order processing (WP4) and proper documentation (WP2), which can be improved with different modules of enterprise resource planning (ERP) tools. Also, the fifth rank is attributed to faster putaway and picking (WP3) and the sixth rank is assigned to picking accuracies (WP6)

5.2 PRIORITIZATION OF THE SOLUTIONS TO OVERCOME THE DISTRIBUTION ISSUES

To summarize, the findings show that initiatives aimed at improving warehouse and transportation digitalization can boost logistics distribution performance. According to the findings, the majority of respondents agree that transportation performance optimization (TPP) and warehouse performance optimization (WPP) elements have a positive influence on logistics distribution (LDPP), and their opinions are consistent across job types, gender, and age. These findings are interesting given that firms consider that warehouse and transportation digitization is required to improve the logistics distribution performance of fast-moving consumer goods. TPP, WPP, and LDPP were used to create structural models, with LDPP as the dependent variable and TPP and WPP as the independent variables. Transport digitalization (TDGT) and Warehouse digitalization (WDGT) were also used as mediating variables. The ranking obtained by Fuzzy Topsis for

Digitalization is in the order given below. Further to check the consistency of obtained ranking a sensitivity analysis was also performed.

DGT1> DGT2> DGT3> DGT4> DGT5> DGT6

Or

TDGT1>TDGT2>TDGT3> WDGT4> WDGT5> WDGT6

For Transportation Performance Transport Management System (TMS) i.e. TDGT1 holds the highest rank followed by Vehicle Tracking System (VTS) i.e. TDGT2 and then the Vehicle Capacity Utilization tools i.e TDGT3.

TDGT1>TDGT2>TDGT3

Similarly for Warehouse Performance Warehouse Management System (WMS) i.e. WDGT4 has the highest rank followed by the Use of Barcodes & RFID i.e. WDGT5 and then the Use of EDI tools i.e. WDGT6.

WDGT4> WDGT5> WDGT6

Unidimensionality, reliability, discriminant validity, and convergent validity were all satisfied for all constructs. As a result, they are statistically valid.

The study examines the direct and indirect links between transportation performance optimization (TPP), warehouse performance optimization (WPP), digitization (DGT), and logistics distribution performance (LDPP). We examine the relationship in the model between Warehouse optimization (WPP) and Logistics distribution performance (LDPP) in one structure and transportation optimization and Logistics distribution performance (LDPP) in the other. Also, we proposed the mediating mechanism of warehouse digitalization (WDGT) and transport digitalization (TDGT). The output of the analysis supports the research hypotheses. As a result, we have filled a hole in the existing literature by establishing a link between digitization and logistics distribution performance. Furthermore, we discovered that digitization partially mediates the impact of transportation and warehouse effectiveness on logistics distribution performance.

The current study empirically evaluates and demonstrates that warehouse and transportation efficiency play a significant influence in improving logistics distribution performance. The findings show that embracing digitalization can help FMCG companies enhance their distribution effectiveness. As a result of its importance in distribution performance, organizations that use digital solutions in transportation and warehousing may create higher revenues by making the processes more efficient.

Our findings suggest that management acts as a facilitator when they are convinced of the importance of digitization in boosting distribution performance. To achieve better results, organizations need active employee participation and involvement. Management must motivate employees by giving training and imparting skills to promote awareness as many people engaged in this sector do not have sound knowledge regarding the latest technologies in the distribution domain.

Moldabekova (2021) attempted to draw a link between digital technologies and EU countries' logistical performance. (Toyli et al., 2008) explored the impact of better logistics on financial performance, which in turn affects organizational performance. The current study addresses a gap in previous research by looking at

how warehouse and transportation optimization increases logistics distribution performance through digitalization in these domains.

5.3 SUGGESTED SOLUTIONS TO OVERCOME LOGISTICS DISTRIBUTION INEFFICIENCIES

There are numerous inefficiencies exist especially with the issues related to third-party outsourcing, transportation inefficiencies, and warehouse inefficiencies. The experts have been consulted and the solutions to overcome the inefficiencies that exist in the logistics distribution. The experts have provided insights into the existing inefficiencies. The generalized solutions on the inputs given by experts are suggested below to overcome and mitigate these challenges to improve the logistics distribution performance.

5.3.1 ISSUES RELATED TO THIRD-PARTY CHALLENGES

- Involvement of functional departments for better coordination.
- Designing appropriate key performance indicators (KPIs) to capture inefficiencies.
- Regular Performance Measurement and review based on data to target the inefficiencies.
- Effective 3PL selection strategies should be adopted with an adequate description of service and service levels.
- Efficient Contract Management-Long term Contracts with clear scope, expectations, and service levels.
- Effective and regular training to permanent personnel for a better understanding of tools and processes.

5.3.2 ISSUES RELATED TO TRANSPORTATION INEFFICIENCIES.

- Use of Transport Management Systems (TMS) with advanced features like automatic scheduling of vehicles.
- Use of Industry 4.0 tools like blockchain and other technological tools like Vehicle Tracking Systems (VTS) and vehicle routing software for route optimization.
- Use of Vehicle capacity utilization software for better utilization of trucks in terms of volume and weight.
- Use of information sharing software EDI/ERPs for proper information sharing like advance shipment notification (ASN) feature for proper planning.
- Use of material handling equipment (MHE) and automation for expediting loading/unloading at terminals.
- A relay model should be adopted to address unnecessary delays en-route like unplanned stops.

5.3.3. ISSUES RELATED TO WAREHOUSING INEFFICIENCIES

- Use of Inventory Management software like WMS, and ERP Modules.
- Use of MHEs and automation for loading and unloading and putaways especially at the warehouse premises.
- Use of Layout software and cubical utilization of space for better utilization of space within a warehouse.
- Order processing software with automated picking techniques like wave picking, pick to light, Voice picking, etc.
- Use of RFID and Bar codes etc. for better inventory tracking intra-facility and inter-facilities.

5.4 IMPLICATIONS OF THE FINDINGS

This study has highlighted the importance of transport and warehouse performance and its impact on logistics distribution performance of fast moving consumer goods

(FMCG). It has identified the different variables which has a direct impact on the performance of warehouse and transport performance. The study also tried to establish the model based on the Theory of constraints that how the logistics distribution performance can be improved by improving the performance of warehouse and transportation. The model was tested and the mediating effect of digitalization is checked on the warehouse and transport performance. The result shows that digitalization does have an impact on logistics distribution performance but it is partially mediating in both the cases. Hence it can be concluded that digitalization is important but there are other factors also responsible for improving the warehousing and transportation performance which can further be explored. The performance of logistics distribution in the fast-moving consumer goods (FMCG) sector is influenced by numerous warehousing and transportation activities.

To eliminate bottlenecks in the supply chain, the Theory of Constraints (TOC) is frequently used in the manufacturing industry. In this study, however, the TOC is also used in the physical distribution of fast-moving consumer goods. Similar to how Transaction Cost Economics (TCE) is used in the context of outsourcing to lower transaction costs in supply chain operations. Transaction cost of economics provides and insight about make or buy decisions. In FMCG set up most of the organizations generally outsources their transport and warehousing needs to the third parties known as 3PLs (third party logistics service providers). Due to outsourcing the organization strives toward reducing transaction cost as it is believed that seamless coordination in all of these activities is a critical component. In this study the effect of digitalization is explored in reducing the transaction costs in these two prominent areas to reduce the logistics distribution cost. Organizations are being compelled to evaluate how they may take advantage of digitalization to better manage their supply chain activities due to innovative technical advancements, increased global competitiveness, and fast-changing client needs.

The inherent digital technologies improve responsiveness, through cross-organizational business process collaborations, particularly in the case of demand variations, as well as flexibility in the face of constrained capacity.

5.4.1 THEORETICAL IMPLICATION

Both Theories, Theory, and constraint (TOC) & Transaction cost economics theory (TCE) have been widely used for supply chain efficiency in different studies but in this study, a gap is identified that very limited studies have been carried out in the FMCG sector to improve the logistics distribution performance optimization including primarily the transportation and warehousing. The current study is target this area. The application of TCE and TOC theories in improving the logistics distribution performance of fast-moving consumer goods is the contribution this study has made to these theories. The performance of logistics distribution in the fast-moving consumer goods (FMCG) sector is influenced by numerous warehousing and transportation activities. The above tests (direct and indirect effects) demonstrate that physical distribution is directly affected by transportation and warehousing performance, but that the TPP and WPP have significantly decreased the value of a mediating variable, digitalization, confirming that it has an impact on logistics distribution performance (LDPP). In the context of warehousing use of digital tools improves the tracking and tracing of inventory within the facility, and improves the faster picking, putaways, and order processing. Similarly, in the context of transportation, the performance is dependent on variables like on-time delivery (transit adherence), visibility of in-transit vehicles, timely loading and unloading at docks, lesser unplanned stops, and vehicle scheduling. The performance of warehouse and transportation can be considerably improved by the use of digital tools like the use of Transport Management System (TMS), Vehicle Tracking System (VTS), Vehicle Capacity Utilization software, Warehouse Management System (WMS), use of Barcodes, and Electronic Data Interchange

(EDI). which leads to better utilization of resources and leads to higher productivity and efficiency of warehousing and transportation which is extremely pertinent for logistics distribution performance like ensuring promised lead time, helping in delivering rush orders when needed, ensuring promised inventory availability, and optimizing delivery cost.

5.5 CONCLUSION

In India, the FMCG sector is an emerging and rapidly increasing business sector that has an impact on everyone's life, either directly or indirectly. According to the literature assessment, there are several inefficiencies across the supply chain. Physical distribution suffers the most because it is typically outsourced and handled by third-party logistics (3PL) partners, over whom the company has limited control. According to the literature, several research has been conducted to highlight supply chain inefficiencies, however, there is scarcely any study accessible in India that discusses the impact of digitization in enhancing the physical distribution of consumer goods that are fast-moving (FMCG). The current study's conclusions have noteworthy practical implications, especially with respect to the partners and stakeholders concerning the distribution of fast-moving consumer goods. The presence of the issues and their impact on logistics distribution performance have been agreed upon by industry experts. Such discoveries then provide an opportunity for business partners to understand the current state of these issues. This research gap is addressed in this study. The study reveals poor visibility of in-transit vehicles, loading-unloading delays at docks, manual scheduling of vehicles, inventory tracking within warehouses, poor documentation, slower putaways/picking, picking inaccuracies, slow order processing, etc. are the main factors identified which are leading to inefficiencies in the physical distribution. The categorization of issues into categories and sub-categories will assist all

stakeholders in understanding the nature of the issues and how these issues affect the business. The results obtained can assist the logistics team members in differentiating these issues so that they can focus on and overcome them. This study is intended for all FMCG stakeholders and will thus benefit all in effective decision-making. As a result, it is highly appropriate to state that the study has significant practical implications for the various players involved in the distribution of fast-moving consumer goods. The study's findings will also aid in understanding the importance of the issues and, as a result, in prioritizing which issues to focus on. The issues were evaluated using SEM, or structural equation modeling, which is the best technique for analyzing the collected data. These factors can be addressed with digital tools like ERP, EDI, TMS, etc. which will improve the efficiency of physical distribution.

The importance of digital information exchange in improving physical distribution is highlighted in this research. The findings also offer managerial recommendations for how companies might use digital data to streamline the distribution process.

5.6. LIMITATIONS

Although the researcher fulfilled its purpose and turned into given proof to support the hypotheses of the study, there had been some unavoidable limitations. The COVID-19 situation and the availability of time to collect survey data have limited the scope to a limited number of respondents being considered for this study. The proportion of respondents may not be representative of the actual size of the population. The research was limited to the distribution of fast-moving consumer goods. This study's literature is scarce. As a result, more time has been spent on understanding the FMCG sector and the various issues that plague it. As a result, additional writing on FMCG distribution is required. The focus of this research is

on the physical distribution of fast-moving consumer goods (FMCG) in India. Specific elements such as infrastructure, level of technology advancement, resource availability, and employee expertise may change as geography and products change. Only the most critical variable under each identified component for inefficiencies in the physical distribution of fast-moving consumer items is measured in this study (FMCG). A larger sample size was not considered because the structured equation modeling (SEM) method works best with a sample size ranging from 200 to 300. Other techniques, however, can be used to obtain a larger sample size.

5.7. DIRECTIONS FOR FUTURE RESEARCH

The research undertaken has opened up new research avenues for the future. The findings and challenges of this study would be an excellent starting point for examining the future requirements for the implementation of digital and non-digital solutions in the fast-moving consumer goods distribution system. Other methods and techniques for analyzing and classifying problems can be used in future studies. To generalize the study's findings and replicate them in other regions as well. Other methods, such as case-based reasoning, experiments, and decision tree analysis, can also be used. Future research in this area may look into other approaches such as ANP, PROMETHEE, TISM, and so on. Because the study's measures are limited to only the most critical variable under each identified factor for inefficiency, subsequent studies may look at measures for additional factors. A comparable analysis might also be conducted in other geographical regions or compared to the supply chains of developed countries. A comparable analysis might be conducted for the supply chain of adjacent industries such as consumer durables, pharmaceutical cold chains, and food and beverage industries.

CHAPTER VI
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APPENDICES

APPENDIX I: QUESTIONNAIRE

Questionnaire					
Dear respondent, My name is Pradeep Chauhan and I am carrying out academic research for my Ph.D. (doctorate) degree on "Analysis & Management of Logistics Distribution Performance in the FMCG Sector". Hence, you are kindly requested to give the necessary information for the research questions. Please be assured that the information acquired shall be used purely for academic purposes only and will be kept strictly confidential. Please indicate your level of agreement or disagreement by using the (√) mark on the appropriate box given corresponding to each statement. Your co-operation and assistance will be highly appreciated. If you need any clarification or information: **Mob. 8077710614** **E-mail-pradeep.chauhan.ddun@gmail.com**					
Section I: **General Information**	Please read each question carefully and make a tick under each value				
Sex	Male		Female		
Age(Yrs.)	Under 25	26-35	36-45	46-55	Above 55
Respondent's position:	Director/VP	Logistics Manager	Warehouse Manager	Transport Manager	other
Organization (Name)					
Qualification	Diploma	Advance Diploma	First Degree	Second Degree & above	
Relevant Work Experience(Yrs.)	Below 5 yrs	5-10 yrs	11-15 yrs	16-20 yrs	21 & above

Section II:	Factors affecting distribution performance				
Transport Optimization/Performance	To what magnitude transport management will have an impact on the company's logistics distribution performance? Please rate the following; Please put the (√) sign for each of the following				
	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
Time delivery (transit adherence) positively affects the transport performance of a company.					
Better visibility of in-transit inventory helps to reduce inventory-holding costs.					
Timely loading/unloading at the docks increases transportation performance.					
Lesser unplanned stops made by drivers decrease transportation performance.					
Automatic Vehicle scheduling decreases transport performance					
Warehouse Optimization/Performance	To what degree does warehouse management have in relation to the distribution performance of fast-moving goods? Please rate the following; Please put the (√) sign for each of the following				
	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
Poor Inventory tracking within the warehouse decreases the warehouse's performance					

Poor documentation decreases warehouse performance					
Slow putaways and picking decrease warehouse performance					
Poor storage and handling decrease warehouse performance					
Picking inaccuracies reduces warehouse performance					
Ineffective order processing decreases warehouse performance					
Underutilization of space decreases warehouse performance.					
Role of Digitalization	To what degree does digitalization have in relation to the distribution performance of fast-moving goods? Please rate the following; Please put the (√) sign for each of the following				
	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
The use of Bar codes increases real-time information sharing.					
Vehicle tracking system (VTS) improves transportation visibility					

ERP and EDI software improve coordination and integration among logistics partners.					
Transport Management Software (TMS) improves transportation performance.					
Vehicle capacity utilization software improves transportation performance.					
Warehouse Management System (WMS) improves picking accuracy.					
Logistics Distribution performance	To what degree do the below factors have in relation to the distribution performance of fast-moving goods? Please rate the following; Please put the (√) sign for each of the following				
	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
Promised lead time					
Rush orders when needed					
Promised inventory availability					
Undamaged deliveries					
Accurate orders					
Availability of delay information					
Total cost delivery					

Safety					

APPENDIX II: QUESTIONNAIRE FOR EXPERT INPUTS FOR MAIN CRITERIA (FOR EXPERTS):

FOR AHP & FAHP ANALYSIS

Please rate the following in terms of relative importance on the following scale

GRADE	SEMANTICS
1	EQUAL IMPORTANCE
3	LOW IMPORTANCE
5	HIGH IMPORTANCE
7	HIGH IMPORTANCE
9	EXTREMELY HIGH IMPORTANCE

1. For Main Criteria (AHP/FAHP)

	TP	WP	DG
TP	1		
WP		1	
DG			1

2. For "TP' Sub Criteria (AHP/FAHP)

	TP1	TP2	TP3	TP4	TP5
TP1	1				
TP2		1			
TP3			1		
TP4				1	
TP5					1

3. For "WP' Sub Criteria (AHP/FAHP)

	WP1	WP2	WP3	WP4	WP5	WP6
WP1	1					
WP2		1				
WP3			1			
WP4				1		
WP5					1	
WP6						1

4. FOR FTOPSIS SOLUTIONS

Please give an appropriate rating based on the usefulness of the solution for the corresponding Issue as per the following scale: 1 - Very Low; 3 - Low; 5 - Average; 7 - High; and 9 - Very High

	WP	TP
DG1		
DG2		
DG3		7
DG4		
DG5		
DG6		

Eg. 7 means DG3 has High Usefulness/Importance for the Transport Optimization

APPENDIX III: ELEMENTS FOR TRANSPORTATION PERFORMANCE

S.No	Transport Performance	Representation
1	On Time delivery (transit adherence) positively affects the transport performance of a company.	TP1
2	Better visibility of in-transit vehicles improves transport performance.	TP2
3	Timely loading/unloading at the docks increases transportation performance.	TP3
4	Lesser unplanned stops made by drivers improve transportation performance.	TP4
5	Automated vehicle scheduling positively affects transport performance	TP5

APPENDIX IV: ELEMENTS FOR WAREHOUSE PERFORMANCE

S.No	Warehouse Performance	Representation
1	Better Inventory tracking within the warehouse improves the warehouse's performance	WP1
2	Proper documentation increases warehouse performance	WP2
3	Faster putaways and picking increase warehouse performance	WP3

4	Effective order processing increases warehouse performance	WP4
5	Better storage and material handling improves warehouse performance	WP5
6	Picking accuracies improve warehouse performance	WP6

APPENDIX V: ELEMENTS FOR LOGISTICS DISTRIBUTION PERFORMANCE

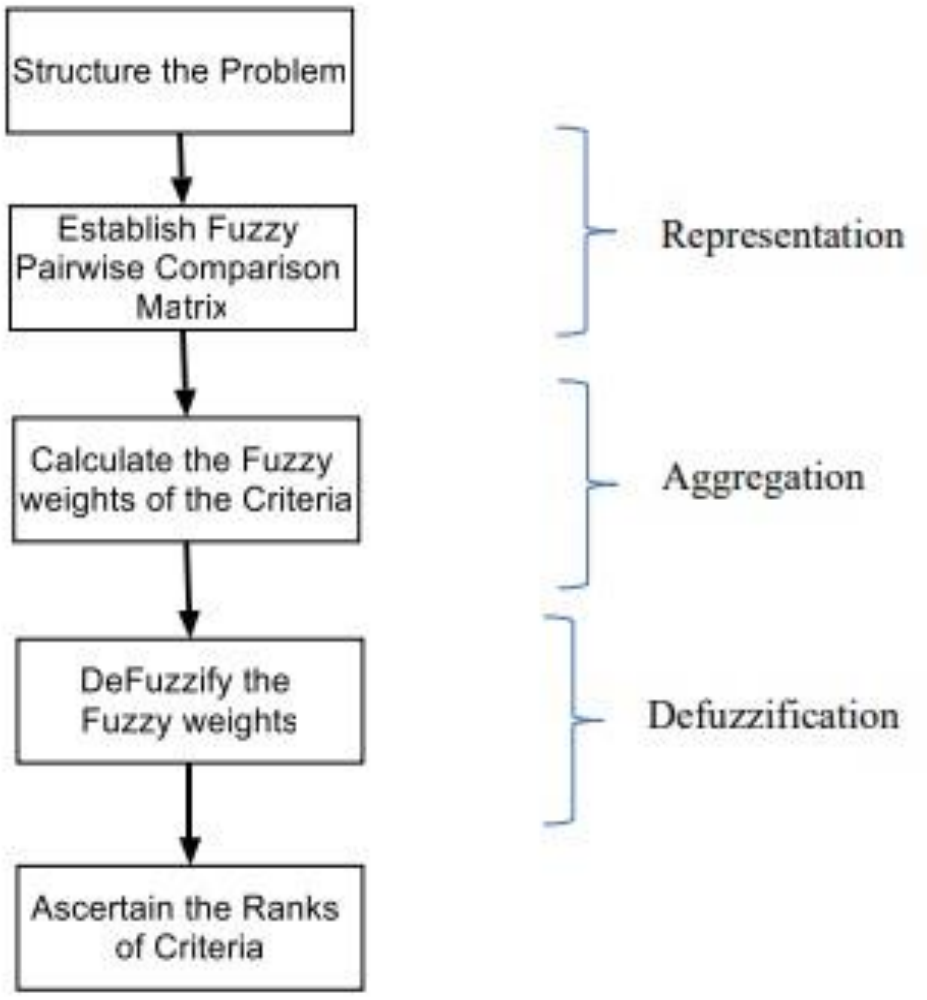
S.No	**Logistics distribution Performance**	**Representation**
1	Transport Performance (TP) and Warehouse Performance(WP) ensure promised lead time	LDP1
2	Transport Performance (TP) and Warehouse Performance(WP) help to deliver rush orders when needed	LDP2
3	Transport Performance (TP) and Warehouse Performance(WP) ensure Promised inventory availability	LDP3
4	Transport Performance (TP) and Warehouse Performance(WP) ensure accurate orders	LDP4
5	Transport Performance (TP) and Warehouse Performance(WP) optimize total delivery cost	LDP5

6	Transport Performance (TP) and Warehouse Performance (WP) improve delayed shipment information to the customer.	LDP6

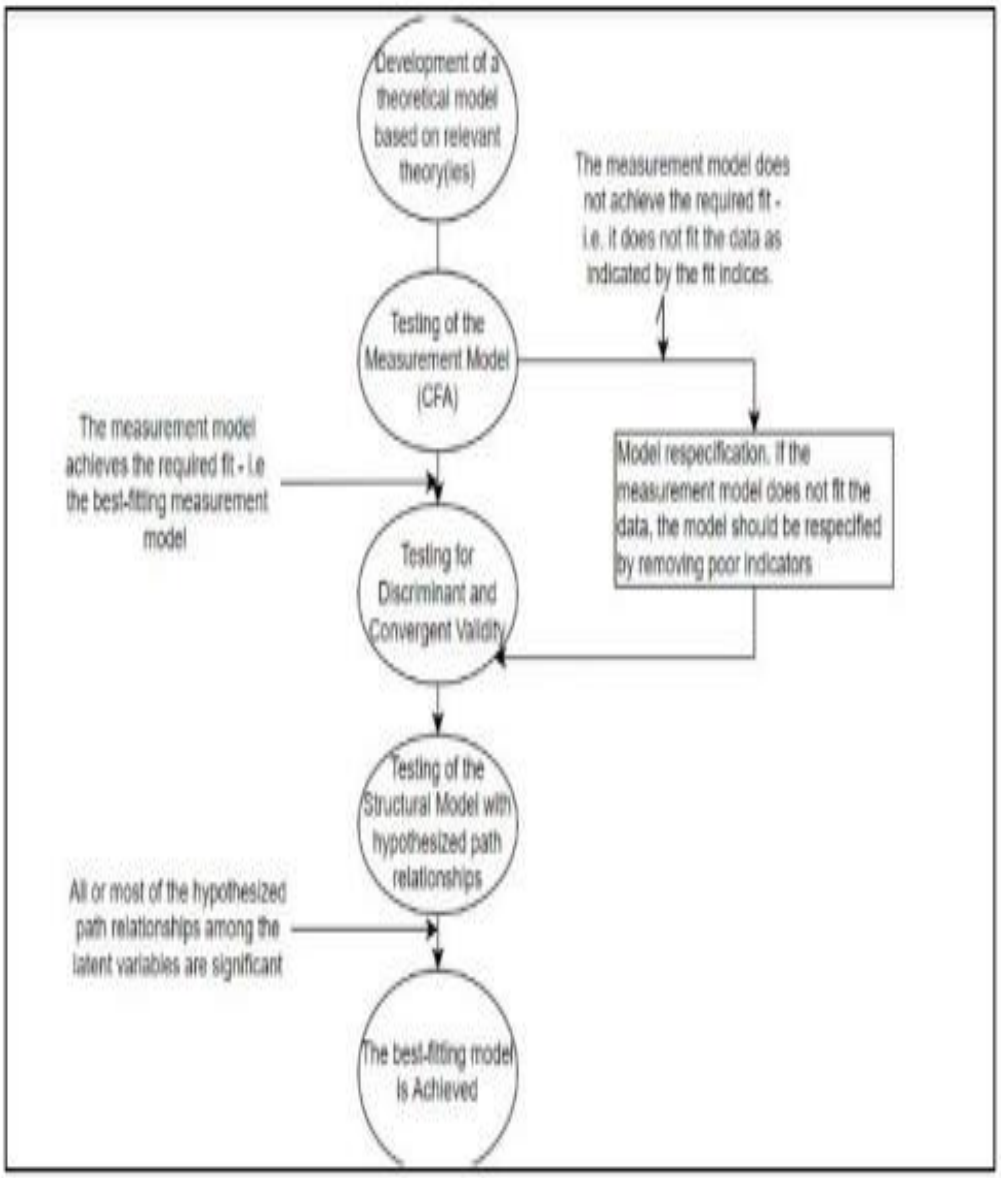
APPENDIX VI: ELEMENTS FOR DIGITALIZATION

S.No	Digitalization	Representation
1	Transport Management Software (TMS) improves transportation performance.	TDGT1
2	Vehicle tracking system (VTS) improves transportation visibility	TDGT2
3	Vehicle capacity utilization software improves transportation performance.	TDGT3
4	Warehouse Management System (WMS) improves picking accuracy.	WDGT1
5	The use of Bar codes increases real-time information sharing.	WDGT2
6	Enterprise Resource Planning (ERP) and Electronic Data Interchange (EDI) software improves coordination and integration among logistics partners	WDGT3

APPENDIX VII: FUZZY AHP PROCESS [adapted from Lin, 2020]



APPENDIX VIII: STEPS IN SEM ANALYSIS [adapted from Nunkoo, 2012]



RESEARCH PUBLICATIONS

1. Research Paper (Accepted for publication)

"Managing the Logistics Distribution Performance using digitalization in the FMCG Sector"

Vision (Sage)

ABDC Journal List-C Category.

2. Research Paper (Published)

"Issues and Challenges in the distribution of FMCG Sector: A Review"

Korea Review of International Studies

ABDC Journal List – C Category

3. Research Paper (Published)

"Role of digitalization in improving the logistics distribution performance"

Empirical Economics Letters

ABDC Journal List – C Category

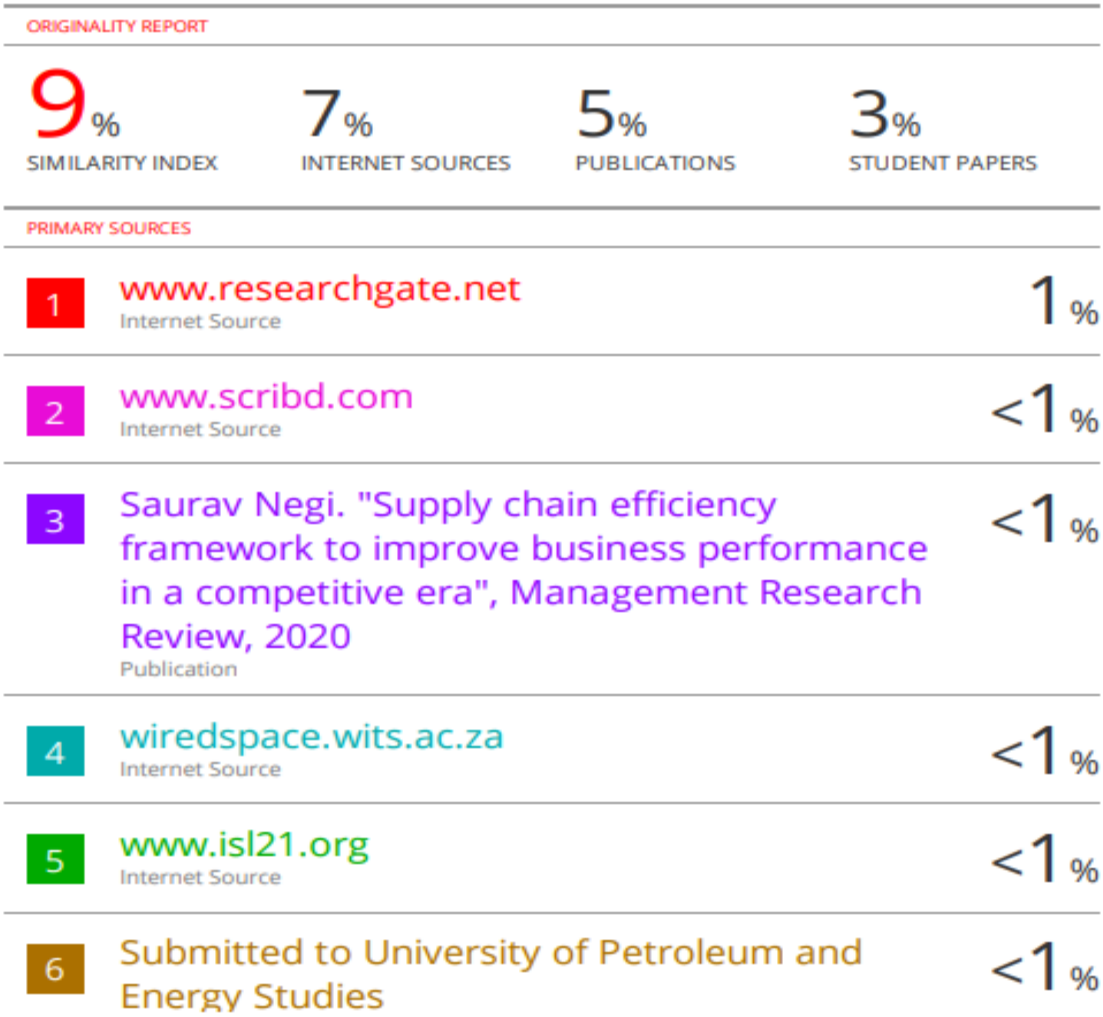
BRIEF BACKGROUND

Name: PRADEEP CHAUHAN

Qualification: MBA with specialization in Logistics & Supply Chain Management

Work Experience: Teaching as an Assistant Professor (SG) at the Domain Cluster department in the field of Logistics & Supply Chain Management in SoB, UPES Kandoli Dehradun. He has worked for more than five years in the area of physical distribution in some of the reputed FMCG companies.

PLAGIARISM REPORT



ORIGINALITY REPORT

9%	7%	5%	3%
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