

# **A STUDY ON THE EFFICIENCY OF INVENTORY TRACKING USING WIRELESS TECHNOLOGY AT MAHINDRA LOGISTICS Pvt Ltd.**

Submitted in partial fulfillment of the requirements for the award of

**MASTER OF BUSINESS ADMINISTRATION**

**JEYA SURYA P**

**41410145**



**SCHOOL OF MANAGEMENT STUDIES**

## **SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY  
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade “A” by NAAC I 12B Status by UGC I Approved by  
AICTE Jeppiaar Nagar, RAJIV GANDHI SALAI, CHENNAI - 600 119**

**MAY 2023**



# **SATHYABAMA**

INSTITUTE OF SCIENCE AND TECHNOLOGY  
(DEEMED TO BE UNIVERSITY)

Accredited with "A" grade by NAAC I 12B Status by UGC I Approved by AICTE  
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai – 600 119

[www.sathyabama.ac.in](http://www.sathyabama.ac.in)

**SCHOOL OF MANAGEMENT STUDIES**

## **BONA FIDE CERTIFICATE**

This is to certify that this Project Report is the bonafide work of  
**JEYA SURYA P (41410145)** who has done the Project work entitled "**A  
STUDY ON THE EFFICIENCY OF INVENTORY TRACKING USING  
WIRELESS TECHNOLOGY AT MAHINDRA LOGISTICS Pvt Ltd.**

under my supervision from December 2022 to April 2023.

Dr. JOHN PAUL M

SELVAM R  
HUMAN RESOURCE OFFICER,  
MAHINDRA LOGISTICS

Internal Guide

External Guide

**Dean – School of Management Studies**

SCHOOL OF MANAGEMENT STUDIES  
**SATHYABAMA**  
INSTITUTE OF SCIENCE AND TECHNOLOGY  
(Deemed to be University)  
Jeppiaar Nagar, Rajiv Gandhi Salai,  
Chennai-600 119

Submitted for Viva voce Examination held on 06/05/2023

Internal Examiner

External Examiner



**Mahindra Logistics Ltd**  
Mahindra Tower Ground  
Floor  
17/18, Pattulous  
Road Chennai-600  
002

**To Whom so Ever It May Concern**

This is certify that Student Jeya Surya P Taking Industrial Training in our company in the Month of Dec'22 to April'23. His Registration number is 202120046. He attended the training session with Store & line Feeding life cycle .



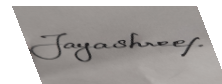
All the best for your future .

## **DECLARATION**

I **JEYA SURYA P (41410145)** hereby declare that the Project Report entitled **“A STUDY ON THE EFFICIENCY OF INVENTORY TRACKING USING WIRELESS TECHNOLOGY AT MAHINDRA LOGISTICS Pvt Ltd”** done by me under the guidance of is submitted in partial fulfillment of the requirements for the award of Master of Business Administrative degree.

**DATE:06/05/2023**

**PLACE:Chennai**

A handwritten signature in cursive script, appearing to read "Jeyashree", is written on a small, light-colored rectangular piece of paper.

**JEYA SURYA P**

## ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my sincere thanks to **Dr. G. BHUVANESWARI, Ph.D., MBA.** Dean, School of Business Administration and **Dr. A. PALANI, M.Com, M Phil., PhD, MBA.** Head, School of Business Administration for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Dr. JOHN PAUL. M** for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the School of Business Administration who were helpful in many ways for the completion of the project.

**JEYA SURYA P**

## INDEX

| CHAPTER | TITLE                              | PAGE NO |
|---------|------------------------------------|---------|
|         | ACKNOWLEDGEMENT                    | v       |
|         | ABSTRACT                           | vii     |
|         | LIST OF TABLES                     | viii    |
|         | LIST OF CHARTS                     | ix      |
| I       | INTRODUCTION                       | 2       |
|         | INDUSTRIAL PROFILE                 | 3       |
|         | COMPANY PROFILE                    | 13      |
|         | OBJECTIVES OF THE STUDY            | 17      |
|         | NEED FOR THE STUDY                 | 17      |
|         | SCOPE OF THE STUDY                 | 18      |
|         | LIMITATIONS OF THE STUDY           | 18      |
| II      | REVIEW OF LITERATURE               | 19      |
| III     | RESEARCH METHODOLOGY               | 44      |
| IV      | ANALYSIS AND INTERPRETATIONS       | 47      |
| V       | FINIDINGS OF THE STUDY             | 81      |
|         | SUGGESTIONS AND<br>RECOMMENDATIONS | 85      |
|         | CONCLUSION                         | 86      |
|         | ANNEXURE                           |         |
|         | i. QUESTIONNAIRE                   | 87      |
|         | ii. BIBLIOGRAPHY                   | 93      |

## **ABSTRACT**

Wireless systems are becoming more common as wireless technology evolves. Many authors argue that wireless systems can provide advantages and value to organisations, such as increased efficiency and effectiveness. Literature also shows that wireless systems especially wireless suits companies within the logistics industry. However, some authors also highlight disadvantages regarding these solutions, for example insufficient security.

The purpose of this report is to analyze the efficiencies and need for wireless technology for organisations regarding usage of wireless systems in a warehouse setting, and the factors that have an influence over this modern system.

This purpose is fulfilled with the aid of a qualitative study at Mahindra Logistics Pvt Ltd in Chennai, where a number of respondents were interviewed. The study began with a literature study covering different aspects of wireless systems and technology. The literature study was used to construct an interview guide, and also as a foundation for the analysis.

The empirical study shows that the wireless system at Mahindra Logistics Pvt Ltd provides value to their organizations at both the operational and management level. The effectiveness and efficiency in the daily work increases and the system generates accurate information that forms a good foundation for the decision-making process. The study also shows that precautions need to be taken when using a wireless system, since today's organizations become very dependent on the system.

## LIST OF TABLES

| <b>TABLE NO.</b> | <b>TITLE</b>                                                                                                       | <b>PAGE NO</b> |
|------------------|--------------------------------------------------------------------------------------------------------------------|----------------|
| 1                | In-house SCM                                                                                                       | 47             |
| 2                | Inventory management system                                                                                        | 48             |
| 3                | Wireless technologies to lower inventory                                                                           | 49             |
| 4                | Wireless technologies for competitive advantage                                                                    | 50             |
| 5                | Wireless technology to increase visibility                                                                         | 51             |
| 6                | Wireless technology reduce operation cost                                                                          | 52             |
| 7                | Wireless technology reduce order cycle                                                                             | 53             |
| 8                | Prerequisite for SCM initiative                                                                                    | 54             |
| 9                | Experience in supply chain management                                                                              | 56             |
| 10               | Wireless technology implementation in Mahindra Logistics Pvt Ltd                                                   | 57             |
| 11               | Prevention of pilferage and counterfeiting stock                                                                   | 59             |
| 12               | Wireless enhance customer experience                                                                               | 60             |
| 13               | Wireless technology is a trend setter in SCM                                                                       | 61             |
| 14               | Wireless helpful in increasing asset efficiency                                                                    | 62             |
| 15               | Wireless increase corporate control over mechanisms                                                                | 63             |
| 16               | Increase in organization revenue after implementation of wireless                                                  | 64             |
| 17               | Barriers to implement wireless technologies                                                                        | 65             |
| 18               | Expected growth of wireless technologies in next 5 years                                                           | 68             |
| 19               | Adoption of wireless technology reduces cost                                                                       | 69             |
| 20               | Level of satisfaction with the impact of wireless technology on warehouse management of Mahindra Logistics Pvt Ltd | 70             |
| 21               | Chi-square                                                                                                         | 71             |
| 22               | One way ANOVA                                                                                                      | 76             |
| 23               | Correlation                                                                                                        | 79             |

## LIST OF CHARTS

| <b>TABLE NO.</b> | <b>TITLE</b>                                                                                                       | <b>PAGE NO</b> |
|------------------|--------------------------------------------------------------------------------------------------------------------|----------------|
| 1                | In-house SCM                                                                                                       | 47             |
| 2                | Inventory management system                                                                                        | 48             |
| 3                | Wireless technologies to lower inventory                                                                           | 49             |
| 4                | Wireless technologies for competitive advantage                                                                    | 50             |
| 5                | Wireless technology to increase visibility                                                                         | 51             |
| 6                | Wireless technology reduce operation cost                                                                          | 52             |
| 7                | Wireless technology reduce order cycle                                                                             | 53             |
| 8                | Prerequisite for SCM initiative                                                                                    | 56             |
| 9                | Experience in supply chain management                                                                              | 57             |
| 10               | Wireless technology implementation in Mahindra Logistics Pvt Ltd                                                   | 59             |
| 11               | Prevention of pilferage and counterfeiting stock                                                                   | 60             |
| 12               | Wireless enhance customer experience                                                                               | 61             |
| 13               | Wireless technology is a trend setter in SCM                                                                       | 62             |
| 14               | Wireless helpful in increasing asset efficiency                                                                    | 63             |
| 15               | Wireless increase corporate control over mechanisms                                                                | 64             |
| 16               | Increase in organization revenue after implementation of wireless                                                  | 65             |
| 17               | Barriers to implement wireless technologies                                                                        | 67             |
| 18               | Expected growth of wireless technologies in next 5 years                                                           | 68             |
| 19               | Adoption of wireless technology reduces cost                                                                       | 69             |
| 20               | Level of satisfaction with the impact of wireless technology on warehouse management of Mahindra Logistics Pvt Ltd | 70             |
| 21               | Chi-square                                                                                                         | 71             |
| 22               | One way ANOVA                                                                                                      | 76             |
| 23               | Correlation                                                                                                        | 79             |

**A STUDY ON THE EFFICIENCY OF  
INVENTORY TRACKING USING WIRELESS  
TECHNOLOGY AT MAHINDRA LOGISTICS  
Pvt ltd**

# **CHAPTER 1**

## **1.1 INTRODUCTION OF THE STUDY**

The purpose of an effective supply chain is to have complete coordination of the flow of material and information from suppliers to the end users. The supply chain should be able to seamlessly connect supply, planning manufacturing and distribution operations and provide visibility across the supply network, thereby enabling rapid decision making and optimal execution. Supply chain management is the process of improving the flow of material, information and money through the entire supply chain from the supplier to the final customer.

The traditional supply chain which was supply driven has been replaced by a demand driven chain. The increasing competition as a result of globalization, decreasing consumer loyalty and shrinking time to introduce and market the product is forcing companies to become more and more efficient in managing their operation. Currently barcodes are used in supply management system for tracking the flow of material through supply chain. However barcodes have certain limitation such as line - of - sight read capability only, limited information, inability to identify individual produces and inability to be read inside containers. Radio frequency identification (RFID) tags have the capability to address these concerns. Moreover RFID tags can facilitate automatic audit the inventory and prevent pilferage from warehouses and retail outlets, thereby providing accurate inventory.

A total of 125 employees were selected with an attempt to cover a wide cross section of the Mahindra Logistics Pvt Ltd. Simple random sampling method is used in this study for data collection. Primary data was collected with the help

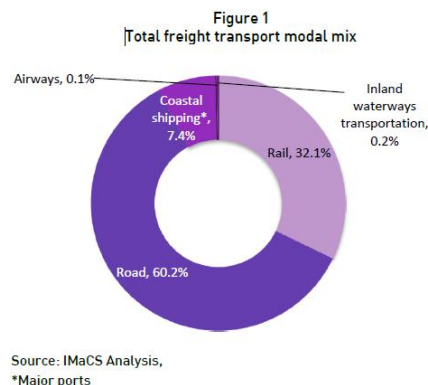
of a Questionnaire. A detailed questionnaire was prepared for which data is collected from 125 employees of Mahindra Logistics Pvt Ltd in Chennai. Secondary data was collected by external sources like books, newspapers and journals; new age sources like the internet. Some White papers and articles were also referred to get an insight on the working of wireless Technology. Access to different articles with respect to wireless technology on the internet enabled to gather some useful information and facts about the same.

## 1.2 INDUSTRY PROFILE

The Indian logistics industry was valued at an estimated US\$ 385 billion in 2014-15. It has grown at a CAGR of over 16 per cent over the last five years. The industry comprises the following main segments:

- Freight and passenger transportation via road, rail, air and water
- Warehousing and cold-storage

The contribution from the movement of goods including freight transportation and storage is about 90 per cent. Aggregate freight traffic is estimated at about 2-2.3 trillion tonnekilometres. Road dominates the mode of freight transport mix and constitutes about 60 per cent of the total freight traffic. Rail and coastal shipping account for about 32 per cent and 7 per cent, respectively, while the share of inland waterways transportation and air is less than 1 per cent each.

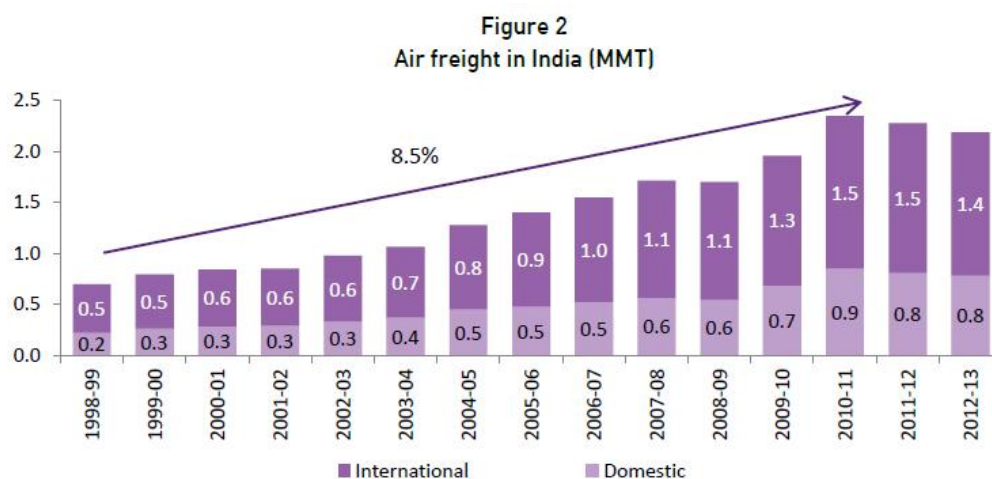


Warehousing comprises industrial and agricultural storage. Of the total warehousing space of about 1,800 million sqft, the industrial and agricultural segments constitute about 86 per cent and 14 per cent, respectively. Government organisations including Food Corporation of India, Central Warehousing Corporation and the state warehousing corporations account for about two-thirds of the agricultural warehousing segment<sup>1</sup>. Warehousing also includes cold storage, comprising over 5,300 units; most of which are concentrated in the states of Uttar Pradesh, Punjab and West Bengal. According to the Ministry of Agriculture, at present, the cold chain capacity is about 9 million tonnes.

## FREIGHT MOVEMENT

### Air transport

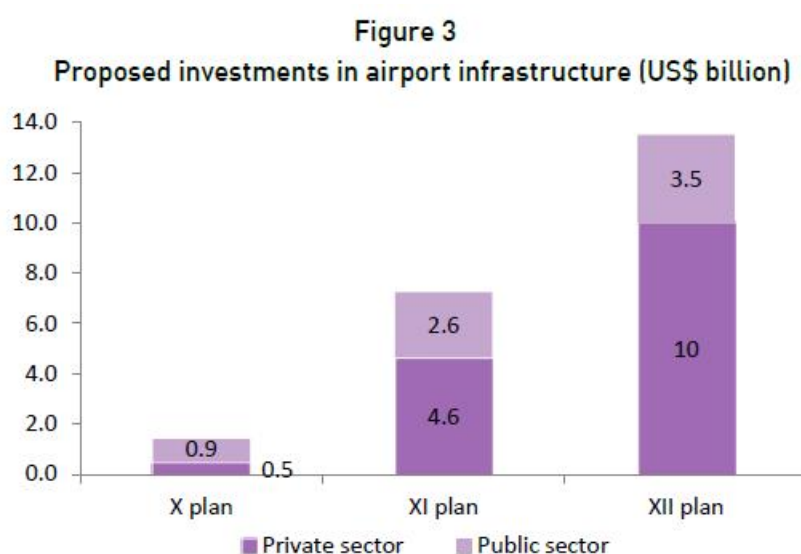
Air cargo volume grew at a compound annual growth rate (CAGR) of about 8.5 per cent from 0.7 MMT in 1998-99 to 2.2 MMT in 2012-13. International traffic accounts for about 64 per cent of the total air cargo traffic and domestic cargo accounts for the remaining 36 per cent. Between 1998-99 and 2012-13, domestic and international cargos have grown at a CAGR of 10.4 per cent and 7.6 per cent, respectively. Expanding cargo-handling infrastructure at airports, demand for speedy delivery, greater trade and commerce and increase in the number of flights operating – are some of the key reasons for this growth.



Source: CMIE; IMaCS Analysis

Future growth in international cargo traffic is expected to be fuelled by trade agreements, especially, with the Asia-Pacific region, and trade in sectors like electronics, garments and pharmaceuticals. Growth in domestic cargo traffic is expected to be led by expansion of industrial activity beyond existing centres. Investments in airport and logistics infrastructure are also expected to drive demand of air cargo.

**Proposed investments and private sector participation:** For developing airport infrastructure, the government has proposed an investment of US\$ 13.5 billion<sup>2</sup> in the Twelfth Five-Year Plan period, which is almost double of that proposed in the Eleventh Five-Year Plan. This would include building and expanding cargo terminals. The private sector's contribution is expected to be 74.1 per cent.



Source: Planning Commission of India

Some of the projects included in the investment plan are as follows:

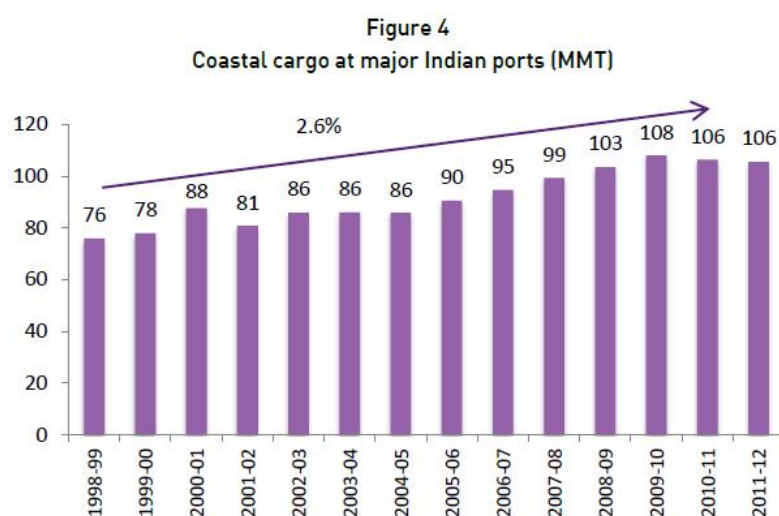
- Ongoing modernisation of the metro-airports - Kolkata and Chennai.
- Modernisation of 35 non-metro airports, of which, 20 are complete and 15 are ongoing.
- Development of air-freight stations (AFS)

For example, Container Corporation of India and Cargo Service Centre India Private Limited have announced plans to set up an AFS at Mulund in Mumbai. Container Corporation of India also plans to develop AFSs in Ahmedabad, Pune and other major locations.

## Water transport

Shipping routes through coasts and inland waterways are primarily used for transportation of bulk freight. India possesses about 14,400 km of inland waterways. Over 3,600 km are navigable by large vessels, of which about 55 per cent is being used. To exploit the potential of this mode of transport, six national waterways have been declared; three of which are operational while three are being developed.

In 2012-13, the estimated cargo movement via inland waterways was at around 89 million tonnes. The coastal-cargo traffic at major Indian ports has grown at a CAGR of about 2.6 per cent from 76 MMT in 1998-99 to 106 MMT in 2011-12. The freight via water is expected to grow further in the light of the Maritime Agenda 2010-2020, increasing contribution from non-major ports and growing focus on ports on the east coast.



Source: CMIE; IMaCS Analysis

Overall cargo traffic has increased at non-major ports at a CAGR of about 19 per cent in the 14 years since 1998, indicating strong growth potential for these ports in the coming years; especially as the infrastructure improves.

**Proposed investments and private sector participation:** In January 2011, the Government of India launched the Maritime Agenda, 2010-2020, to increase the total port capacity. The salient features of the agenda are as follows:

- It envisages an investment of US\$ 57.4 billion in a phased manner to create a total port capacity of around 3,200 MMT. The non-major and major ports are expected to contribute 61 per cent and 29 per cent of the proposed investment, respectively.
- Capacity expansion by way of construction of new berths and jetties is likely to account for 65 per cent of the total outlay. Other support works such as connectivity works, channel deepening and equipment are likely to account for 35 per cent of the total outlay.
- In particular, the government aims to create an additional cargo handling capacity of around 900 MMT at ports along the East coast through an investment of about US\$ 22.5 billion.
- The funding of the projects under Maritime Agenda is to come, largely, from the private sector. The private sector is expected to contribute 66 per cent and 98 per cent of the total investments in major and non-major ports, respectively.
- The number of scheduled public-private partnership projects (PPP) in the maritime sector has significantly gone up from around 12 in the year 2008-09 to 29 in 2012-13.
- The projects in the construction phase include container terminal expansion and development of thermal coal and copper concentrate handling facility at V.O. Chidambaranar Port.

- Some projects in pipeline include container terminal expansion, modernisation of iron ore handling complex and installation of mechanised handling facilities at Vishakhapatnam port.

## Rail transport

Rail freight segment contributes over 60 per cent to the total rail revenue. Freight movement via railways has grown at a CAGR of around 5.1 per cent from 794 million tonnes in 2007-08 to 969 million tonnes in 2011-12. As per the Railway Budget 2013-14, the government targeted freight volume of 1,047 million tonnes in 2013-14.

**Table 1**  
**Rail freight traffic**

| Year    | Tonnes (million) | Tonne kilometres* (million) | Lead (km) |
|---------|------------------|-----------------------------|-----------|
| 2007-08 | 794              | 521,371                     | 657       |
| 2008-09 | 833              | 551,448                     | 662       |
| 2009-10 | 888              | 600,548                     | 676       |
| 2010-11 | 922              | 625,723                     | 679       |
| 2011-12 | 969              | 667,607                     | 689       |

Source: Ministry of Railways; IMaCS Analysis

\*Tonne-kilometre represents transport of one tonne of goods over a kilometre.

\*Lead refers to the average distance to which freight was transported.

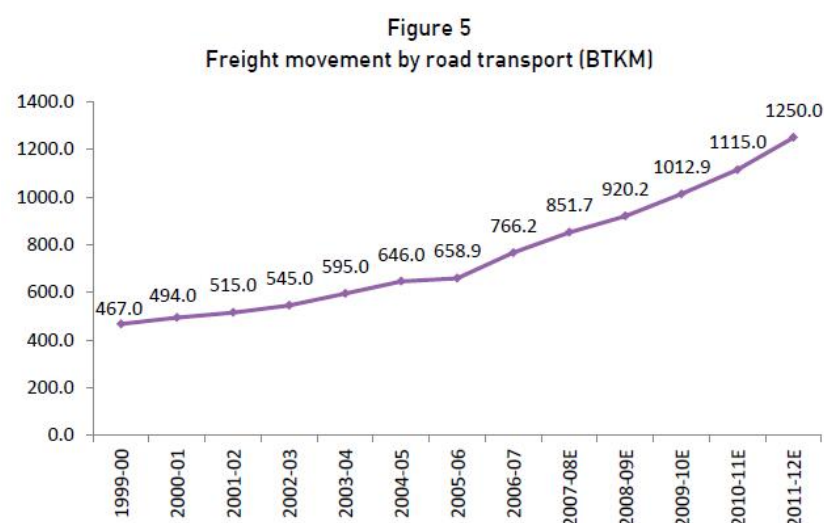
**Development of dedicated rail freight corridors:** Dedicated Freight Corridor Corporation of India Limited (DFCCIL) was founded in 2006 by the Government of India to undertake planning, development and operation of the dedicated freight corridors to lower unit cost of transportation to urban centres. The project involves the construction of two corridors in the west and east, spanning a total length of about 3,300 km. Post the completion of the DFC project in 2016-17, DFCCIL expects freight traffic via the DFCs to increase from 140 MMT in 2016-17 to 182 MMT in 2021-22.

**Private sector participation:** The government has recently launched the 'Policy for participative models in rail connectivity and capacity augmentation projects', to attract private capital for accelerated construction

of rail infrastructure. As per the new policy, private players are allowed to construct and own private rail lines connecting ports, large mines, logistics parks or other similar industries or cluster of industries, which handle goods traffic for multiple consignors or consignees. As per the Rail Budget 2013, US\$ 20 billion of the overall US\$ 104 billion proposed investment in the 12<sup>th</sup> Five Year Plan would be mobilised through the PPP route. Private sector participation is likely to result in additional transport capacity of railways, and reduced traffic congestion at ports and roads.

## Roads transport

Unlike other modes of transport, roads address the demand for goods to cities as well as remote areas of the country. Since 1999-2000, road freight has increased from 467 billion tonnekilometres (BTKM) to 1,250 BTKM in 2011-12, at a CAGR of 8.6 per cent. It is estimated to have grown to 1,315 BTKM for 2012-13. According to the Ministry of Road Transport and Highways, road freight is expected to reach 1,835 BTKMs by 2016-17.



Source: Road Transport Year Book, Ministry of Road Transport and Highways;  
MaCS Analysis  
E-estimated

**Development of national highways:** National highways account for more than 40 per cent of the total road traffic. In the 12th Five-Year Plan period, the Government of India has set a target to construct 36,632 km of national highways in the period 2012-17, i.e., 2.65 times the target set in the previous plan period. Launched in 1998, the National Highways Development Programme (NHDP) aims to develop 50,000 km of National Highways by 2015 in seven phases and with an investment of US\$ 600 billion. Once completed, this is expected to further fuel the demand for road transport.

### **Warehousing and cold storage**

The warehousing market is highly fragmented with organised players holding only about 8 per cent of the total warehousing space in India; which indicates tremendous opportunity. Demand for modern warehouses is on the increase. They are equipped with tall designs, modular racking systems, palletisation and use of automation systems.

**Establishment of free-trade warehousing zones:** As per the government's initiative of setting up free trade warehousing zones (FTWZ), several free trade zones have been established across the country with the objective of facilitating trade of goods and services in free currency. FTWZs offer a single window solution for multiple logistics activities, with particular focus on trade flow. Several new FTWZs are being set up by logistics players. For example, in 2012, DHL announced plans to set up three new FTWZs.

At present, India has a cold chain capacity of around 9 million tonnes. The demand for additional cold storage capacity is expected to be about 15 million tonnes by the end of 12th Five-Year Plan period. It is expected that with the opening up of foreign direct investment (FDI) in multi-brand retail, organised

food retailers would demand significant enhancements in cold chain and distribution infrastructure.

In order to encourage investments in cold storage infrastructure, the government has announced several policy measures, such as granting accelerated depreciation benefits for imported equipment and greater public-private partnerships. The National Centre for Cold Chain Development has been established to strengthen the cold storage infrastructure. To meet higher demand, several logistics companies have set up subsidiaries in the cold chain management business. Some examples of the same are as follows:

- Container Corporation of India has a 100 per cent subsidiary, Fresh and Healthy Enterprises (FHEL), which is engaged in cold chain management. Its clients include Walmart, More, Big Bazaar, Mother Dairy and Big Apple.
- Gateway Distriparks Limited entered the cold chain logistics business through its subsidiary, Snowman Frozen Foods Limited, as a joint venture with Mitsubishi Group of Japan.

## **LOGISTICS INDUSTRY GROWTH DRIVERS**

**Rapid industrial growth:** Rapid growth in industries such as automobiles, pharmaceuticals, fast-moving consumer goods (FMCG) and retail has significantly increased the demand for movement of consumer and capital goods across the country, from entry ports to manufacturing or distribution locations or from manufacturers and distributors to consumers and exit ports.

The volume of freight traffic is positively related to the GDP of the country. Therefore, as the GDP increases, the volume goods' movement is expected to increase through all modes. During the period from 2007-2012, the agriculture

and manufacturing GDP have increased from US\$ 263.6 billion to US\$ 290.7 billion at constant prices. The corresponding increase in freight traffic was from 1.3 trillion tonnekilometres (TTK) to 2.1 TTK.

### **Globalisation:**

With the growing integration of India's economy with the world, the country's total trade has grown at a CAGR of about 20 per cent from US\$ 57 billion in 1997-98 to US\$ 862 billion in 2012-13. The initiative to construct a trilateral highway connecting India, Myanmar and Thailand represents an important step in the establishment of connectivity between India and Southeast Asian countries. The highway is expected to be operational in the year 2015-16 and is likely to boost trade ties of India with other countries.

The increase in international trade has effected corresponding growth in cross-border freight traffic, thereby, adding to demand for logistics services.

### **Government initiatives:**

The Government of India has initiated several policy measures and programmes to attract investments in developing the logistics infrastructure of the country. Some of the key reforms undertaken by the Government of India include the following:

**FDI regulations:** The government allows 100 per cent FDI under the automatic route for all logistics services, except air cargo and courier services. For air transport services including air cargo services, the limit was increased from 49 per cent to 74 per cent in 2008. Also, FDI of up to 100 per cent is permitted for courier services, subject to Foreign Investment Promotion Board (FIPB) approval.

## **Greater investments in development of logistics infrastructure:**

The government has significantly increased the investment allocated for the development of logistics infrastructure including ports, airports, national highways, logistics parks, freight stations and corridors.

## **Private sector partnerships:**

Several measures have been undertaken by the Government of India to encourage private sector participation in the logistics industry across all modes. These measures include increasing targeted contributions of private players in the investments set aside for the development of logistics infrastructure, tax exemptions and duty free imports. Apart from speeding up capacity creation, this is also aimed towards incorporating latest technologies and better management practices.

## **1.3 COMPANY PROFILE**



Mahindra Logistics is a leading 3PL service provider in India, offering end-to-end logistics solutions to various industries. The company was incorporated in 2007 as a division of the Mahindra Group and was later spun off as a separate company in 2011. Mahindra Logistics has a strong presence

in India with operations in over 300 locations and partnerships with over 500 transporters.

#### Services:

Mahindra Logistics provides a range of logistics services to its customers, including:

**Transportation:** The company provides transportation services for both domestic and international markets, with a fleet of over 1,300 vehicles and partnerships with various transporters across India.

**Warehousing:** Mahindra Logistics operates over 1.5 million square feet of warehousing space across India, equipped with modern technologies such as warehouse management systems and automated material handling equipment.

**In-factory logistics:** The company provides in-factory logistics solutions to its customers, including material handling, line feeding, and sequencing.

**Value-added services:** Mahindra Logistics offers value-added services such as packaging, kitting, and assembly, as well as customs clearance and freight forwarding services for international shipments.

#### Market presence:

Mahindra Logistics has a diverse customer base across various industries, including automotive, engineering, consumer goods, e-commerce, and pharma. The automotive sector is the company's largest segment, accounting

for around 50% of its revenue. Some of the key customers of Mahindra Logistics include Tata Motors, Bosch, and Godrej.

#### Financial performance:

In FY2020-21, Mahindra Logistics reported a revenue of INR 3,911 crores, a growth of 7% over the previous year. The company's EBITDA for the year was INR 253 crores, a growth of 29% over the previous year. Mahindra Logistics has a strong balance sheet, with a debt-to-equity ratio of 0.1 and cash reserves of INR 240 crores as of March 31, 2021.

#### Leadership:

Mahindra Logistics is led by a team of experienced professionals, including Pirojshaw Sarkari as CEO and Zhooben Bhiwandiwalla as President. The company has a strong focus on innovation and customer-centricity, and has been recognized for its efforts in these areas with several awards, including the CII Supply Chain and Logistics Excellence (SCALE) Award and the Frost & Sullivan Indian Warehousing and Logistics Industry Excellence Award.

Mahindra Logistics is a leading 3PL service provider in India with a strong market presence and financial performance. The company's diverse service offerings, customer base, and focus on innovation make it well-positioned to capitalize on the growing demand for logistics services in India and beyond.

## MISSION

RISE TO BE A

₹10000 crores

LOGISTICS SERVICE PROVIDER BY FY 2026

Delivering exceptional customer experience through differentiated, technology-enabled solutions. Be among the 10 most-admired global logistics companies by the year 2030

To provide best-in-class logistics and supply chain management solutions to its customers, while also creating value for its stakeholders. The company aims to achieve this by leveraging its expertise, technology, and innovation to deliver customized and scalable solutions that meet the unique needs of each customer. Mahindra Logistics is committed to building long-term partnerships with its customers, suppliers, and employees based on mutual trust, respect, and transparency. Additionally, the company strives to operate with the highest standards of ethics, safety, and sustainability, while also contributing to the economic and social development of the communities it serves.



- Website :<https://mahindralogistics.com>
- Industries : Logistics & supply chain management
- Company size : 162 employees
- Headquarters :CHENNAI,TAMIL NADU
- Type :Privately Held

## **1.4. OBJECTIVES OF THE STUDY**

### **Primary Objective**

To study the usefulness of wireless technology in tracing materials in warehouses at Mahindra Logistics Pvt Ltd

### **Secondary Objectives**

- ❖ To understand the present method of materials tracing adopted in Mahindra Logistics Pvt Ltd' warehouses, Chennai
- ❖ To analyze the functions of both manual and automated systems and to study their individual pros and cons
- ❖ To provide a complete solution to organizations using wireless technology in tracing and handling cargo

## **1.5 NEED FOR THE STUDY**

The aim of technology is to make human life more secure, safe, and easy and provide entertainment. The purpose of this thesis is to present advantages and disadvantages for an organization regarding usage of wireless systems in a warehouse setting, and the factors that have an influence over these

advantages and disadvantages. Hence the recommendations provide information about the proper use of technology while considering the precautions that should be considered while adopting these technologies

## **1.6 SCOPE OF THE STUDY**

The scope of the study conducted focuses on the wireless technology used in Mahindra Logistics Pvt Ltd to enhance the supply chain operations. The effectiveness of wireless technology can be analyzed from the factors like familiarity, ease of use. Importance of workflow application, flexibility, and tenure reliability, importance of information, effectiveness of the various modules, performance, utilization rate, satisfaction and rate of success are also assessed using wireless technology for tracing goods. This study is limited to Mahindra Logistics Pvt Ltd, Chennai

## **1.7 LIMITATION OF THE STUDY**

- In order to achieve the objectives of the study and answer the questions posed, the study had to overcome a series of difficulties and obstacles related to the subject of the study, therefore the respondents are collected from the machine operators of the company.
- In addition, believe that any information related to their company inside is confidential and should not be shared with others, the data collected for the study is fully on primary data given by the respondents.
- In the case of primary data, there is a chance of personal bias. So the accuracy may not be true.

## CHAPTER 2

### 2.1 REVIEW OF LITERATURE

**Shenk (1996)** tells us that Soviet policy governing information transmission had left Estonia's communication infrastructure in disarray. Yet, as **Dyer-Witheford (1999)** shares, only a decade after Soviet occupation finally ended in the Baltic region, the latest communication technologies have allowed Estonia to leapfrog into a new and modern economic paradigm. While the leap has been largely successful, Estonia's emergence from Soviet control has presented challenges previously unknown within their state run market cooperatives.

**Kruse (1999)** points out that one of these challenges has been how to maximize an antiquated telecommunication infrastructure using scarce resources spread across disparate industries each in desperate need of modernization. The question Estonia faced was whether to invest in patches to existing communication systems, built upon a decaying legacy system of hard-wired telecommunications - a very expensive proposition - (**Hulten&Mollery, 1997**) or to re-engineer the country's communication infrastructure using state-of-the-art wireless technology, a decision which would have far-reaching impact on business, consumers and policy-makers (**Radosevic, 1997**).

In the spirit of shrugging off all that represented Soviet domination, Estonia, as well as many other Central and Eastern European Countries, embraced wireless technology as the de facto choice for paving the way into the next thousand years of communication. While perhaps cloaked in nationalism, **Bruce (1999)** sees the decision to eschew Soviet fixed line telecommunications in favor of wireless

connectivity to have placed Estonia in excellent stead both technologically and economically as the region begins its foray into liberalization and market competition.

Given that Estonia wishes to present a compelling case for inclusion in the European Union (EU), advantaging all the good that comes from membership in an organized economic and political collective, **Clemens (2001)** favors the Estonian decision to represent itself as free from any ties to the totalitarian regime which once exerted complete control over an artificially supported market. The decision illustrates the level of commitment that Estonia has to the future of Europe and their role in it. The choice of a primarily wireless communications base is just one component of Estonia's push toward modernization and economic inclusion, yet it is significant as it represents not only a breaking from the past, but an understanding of the requirements for future economic participation with the European Union (UNDP, 2002).

This paper will address the key issues of research to date surrounding wireless communication with respect to Estonia. It will evaluate the meaning of infrastructure and how that meaning can be applied within the context of Estonia's decision to move toward a wireless communication platform, assess the literature discussing the lead up to Estonia's decision to cut the wires to the Soviet Union, and present a critical overview of industry research addressing wireless offerings deployed in Estonia, specifically addressing various authors' opinions on the implications of wireless technology in Estonia and the infrastructural considerations this new technology will bring to bear as it becomes more prevalent .

This paper will attempt to answer the questions, “What do researchers feel are the infrastructural considerations surrounding Estonia’s decision to move to a wireless platform,” “How does contemporary literature treat Estonia’s decision to focus on wireless technology as a communication platform,” and “What do the authorities in the field feel are the challenges of wireless communications infrastructure in Estonia?” The reasons for these questions center around the economic considerations of jettisoning an existing infrastructure in favor of state-of-the art technology and the implications this decision has not only on the communications industry in Estonia, but on the vast number of industries communications touches and impacts.

Wireless technology is held out as the new gold standard for communications, differentiating this millennium from the last. This paper will offer a comparison among the literature that speaks to wireless telecommunications technology, as well as provide an overview of the research surrounding telecommunication infrastructural change specific to Estonia. These topics are important as Estonia attempts to balance not only national interests against EU inclusion - their choice for telecommunication representing but one of the numerous factors weighed in the EU committee requirements - but most important as the country attempts to layout a framework for telecommunications taking into account today’s needs, budgetary considerations, and decisions for long term telecommunications infrastructural planning.

We begin with background on telecommunications infrastructure to provide a definition for the basis of discussion. **Star and Bowker (2002)** reference **Star and Ruhleder (1996)** when describing the salient points of infrastructure: that is, that infrastructure is embedded within other structures and technologies; it is

transparent in use, not needing to be reinvented at each use and only becoming evident when it breaks down; that infrastructure can be specific or general in scope; it is a natural component of usage to its initiates but must be learned by outsiders; it links with the past in practices of convention and is modified for future expansion, building upon the strengths and weaknesses of the installed base such that infrastructural changes are limited or enhanced by systems already in place.

This background of infrastructure is important as we consider the issues with which Estonia wrestled concerning infrastructural change in its telecommunication systems. The decision to select a new technology over a current technology with existing infrastructure already in place has resonance beyond the initial decision. **Star and Bowker** cite numerous authors when describing how choices in infrastructure are usually predicated upon choices made in the past, choices which have been indelibly folded into the application of new technology (**Star & Bowker, 2002**).

With respect to infrastructural application, Hughes referenced reverse salient, or that which slows the development of a new infrastructure not specific to the infrastructure itself, i.e. a technological challenge stemming from a political challenge. He contends that the solution to the initial problem, that being one of politics, for example, need not focus on politics at all but can address itself directly to the technology in question (**Hughes, 1983**). This assertion becomes important to a country like Estonia, which finds itself struggling with old paradigms of controlled telecommunications markets yet wishes to move to a liberalized market with a new communication infrastructure, wireless technology, as its springboard. Bowker's concept of infrastructural inversion is important to mention here. In his analysis, **Bowker (1996)** shows us that although remarkable societal change may

appear to come from the product of an age, for example in Estonia's case the wireless cell phone, it is really the infrastructural change, or the technology serving as the underpinnings for the product, which lead to the change which society experiences.

The concept of network externalities amplifies this point. Star and Bowker refer to works by David, **Greenstein, and Rothwell (Star & Bowker, 2002)** illustrating how, as technology is adopted by more and more people, the value of that technology for those who already employ it increases even as its value increases for the late adopters. A simple example used by the authors is that of the telephone. With telephone technology, a network developed which was important to those who adopted its use, and, as more individuals came to adopt the technology, the technology became increasingly more powerful for all its users. That power led to even greater adoption of the technology, and so on, with this exponential growth resulting in powerful network externalities.

The concept of network externalities of wireless communication has had significant impact in Estonia, specifically in the form of Short Messaging Service (SMS). If, for example, only one person were to own a cell phone with SMS, its capabilities could not make nearly the societal impact that a network of consumers with the technology has made, nor would entire industries spring from only a single consumer's use of SMS. In Estonia, the network externalities of SMS can be found at levels of the economy as esoteric as the capital city Tallinn's parking authority. When mobile subscribers need to leave automobiles parked for a time, they enter a number into their cell phone, which, as part of a subscription offered, is tied to the city's parking service.

The number, based on the subscriber's cell phone number and auto license number, is entered into Tallinn's parking service database, along with where the car is parked and beginning at what time. The parking rate is tied to the location. When a meter monitor checks on the subscriber's parking status, she or he would see a mobile parking sticker on the subscriber's windshield. An SMS entry to the parking database by the meter monitor confirms that the subscriber does in fact have a mobile parking license and did register to park; a ticket would be issued otherwise. Subscribers must remember to notify the system with another SMS when they have vacated the parking space, or else the database will continue to charge the subscriber for parking for up to four hours beyond the required time for payment. Tallinn has contracted with Estonia Mobile Telephone, Inc. to manage the parking database and to bill the customers, receiving a portion of the revenues for its services, as a credit-card processor would.

The parking database and SMS service, started in July 2000, in July of 2001 had about 12,000 registered users who either have their wireless provider bill them directly for parking, or who pre-pay for their wireless phone use and apply some of their minutes toward parking **(Dyson, 2001)**.

This example is only one of many highlighting Estonia's leap to embrace wireless technology. Government reports, NGO case studies, industry analysis, and journalistic inquiry have all documented Estonia's rapid acceptance of wireless communications into the infrastructure of society. Still, with the newness of the technology, Estonia grapples with the ever-expanding potential of wireless communications and how to standardize the technology to best meet the needs of Estonia's consumers.

## 2.2 CONCEPTUAL FRAMEWORK OF THE PROJECT

### History

The concept of radio frequency identification (RFID) goes back to the Second World War. Great Britain pioneered the use of radio wave based navigation and identification of friend or foe aircraft for night operations by the Royal Air Force. The military has continued to use more advanced versions of this technology for many applications. More recently, commercial businesses have begun RFID technology for manufacturing and supply chain applications. In the 1980s Compaq Computer started using RFID tags to trace components through the production process. The railroad industry in US has used RFID to track rail cars while the agricultural industry has used tags to track livestock.

### Wireless Data Network Drivers

- **Information access**
- **PDA's**
- **Network computers**
- **Alpha paging, information distribution**
- **Web**
- **Audio and video**



Wireless Communication: The term "RFID" has become a generic and all-encompassing word used to describe communications in which electromagnetic

waves or RF (rather than some form of wire) carry a signal over part or the entire communication path. Common examples of wireless equipment in use today include:

Professional LMR (Land Mobile Radio) and SMR (Specialized Mobile Radio) typically used by business, industrial and Public Safety entities

Consumer Two Way Radio including FRS (Family Radio Service), GMRS (General Mobile Radio Service)

Amateur ("Ham") and Citizens Band ("CB") radios

Consumer and professional Marine VHF radios

Cellular telephones and pagers: provide connectivity for portable and mobile applications, both personal and business.

Global Positioning System (GPS): allows drivers of cars and trucks, captains of boats and ships, and pilots of aircraft to ascertain their location anywhere on earth.

Cordless computer peripherals: the cordless mouse is a common example; keyboards and printers can also be linked to a computer via wireless.

Cordless telephone sets: these are limited-range devices, not to be confused with cell phones.

Satellite television: allows viewers in almost any location to select from hundreds of channels.

Wireless networking (i.e. the various flavors of unlicensed 2.4 GHz WiFi devices) is used to meet a variety of needs. Perhaps the most common use is to connect laptop users who travel from location to location. Another common use is for mobile networks that connect via satellite. A wireless transmission method is a logical choice to network a LAN segment that must frequently change locations. The following situations justify the use of wireless technology:

- To span a distance beyond the capabilities of typical cabling,
- To avoid obstacles such as physical structures, EMI, or RFI,

- To provide a backup communications link in case of normal network failure,
- To link portable or temporary workstations,
- To overcome situations where normal cabling is difficult or financially impractical, or
- To remotely connect mobile users or networks.

Wireless communication may be via:

- radio frequency communication,
- microwave communication, for example long-range line-of-sight via highly directional antennas, or short-range communication, or
- infrared (IR) short-range communication, for example from remote controls or via IRDA,

Applications may involve point-to-point communication, point-to-multipoint communication, broadcasting, cellular networks and other wireless networks.

The term "RFID" should not be confused with the term "cordless", which is generally used to refer to powered electrical or electronic devices that are able to operate from a portable power source (e.g., a battery pack) without any cable or cord to limit the mobility of the cordless device through a connection to the mains power supply. Some cordless devices, such as cordless telephones, are also RFID in the sense that information is transferred from the cordless telephone to the telephone's base unit via some type of wireless communications link. This has caused some disparity in the usage of the term "cordless", for example in Digital Enhanced Cordless Telecommunications.

In the last 50 years, wireless communications industry experienced drastic changes

## Wireless Data Network Drivers

- Information access
- PDAs
- Network computers
- Alpha paging, information distribution
- Web
- Audio and video



driven by many technology innovations.

### What is the interest in RFID?

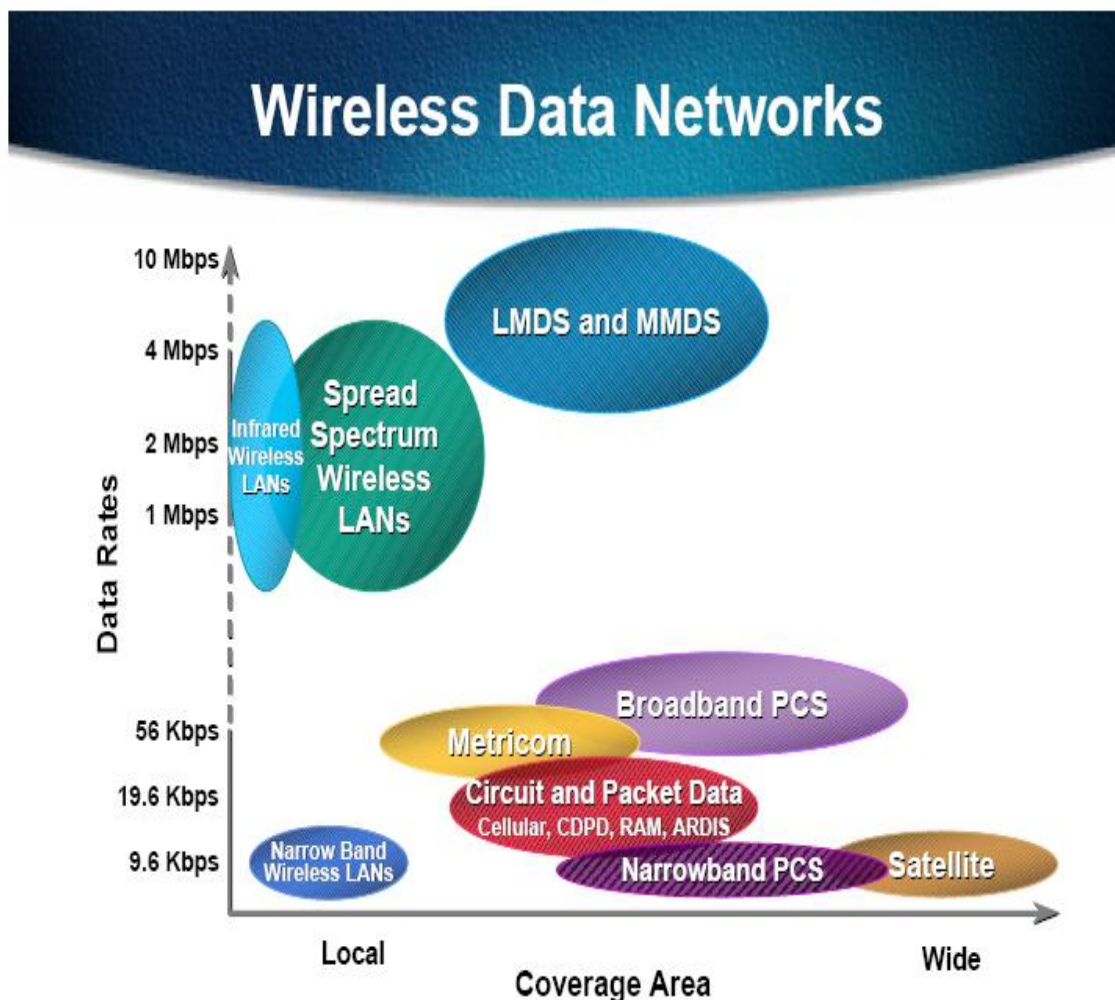
- No more cables...
- Mobility
- Increased productivity
- Competition
- Flexibility
- Many others

### Some wireless Data Solutions:

- Field service—dispatch, parts/order, electronic signature, package tracking
- Public safety—parking enforcement, ambulance-hospital links, anti-theft
- Financial—news, brokerage, pricing
- Telemetry—Health care, vending machines, alarm systems, energy
- Identification—inventory in warehouse and stores, anti-theft

### Emerging and Existing wireless Data technologies:

- RFID LAN: IEEE 802.11, Bluetooth, HomeRF
- Fixed RFID: MMDS, LMDS, satellite dish, microwave, optical
- Mobile RFID: PCS, GSM, CDMA, TDMA

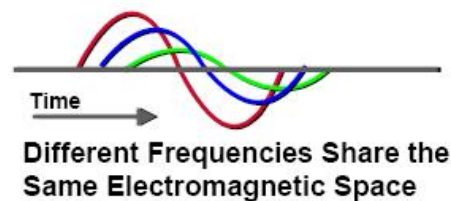
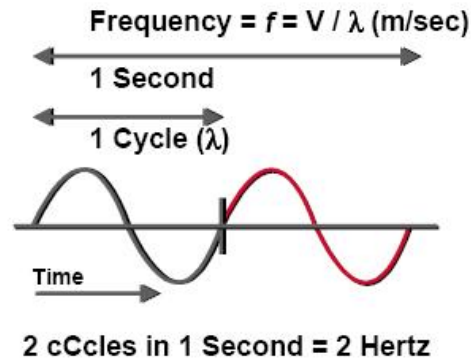


## Introduction to Radio Spectrum:

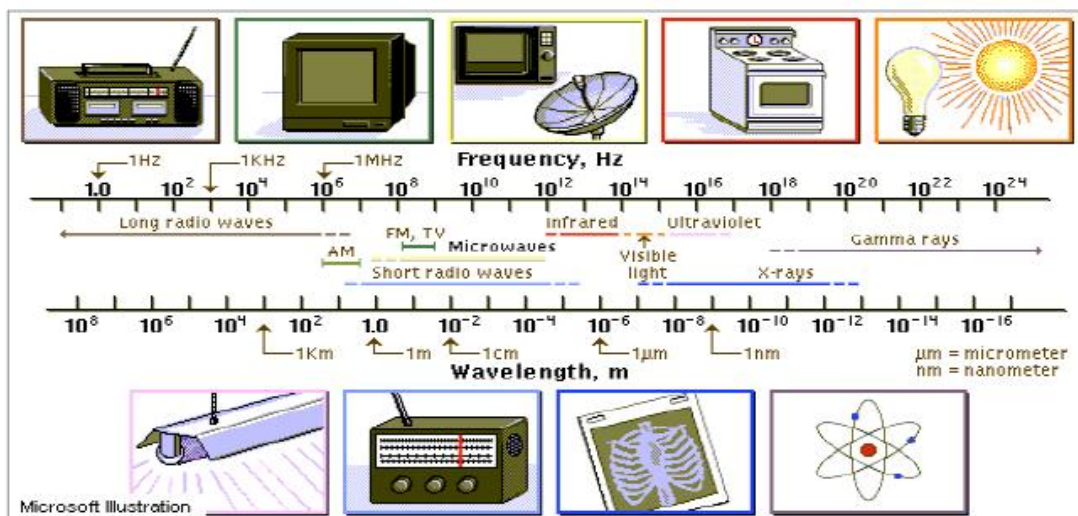
**Radio:** The RFID transmission through space of electromagnetic waves in the approximate frequency range from 10 kilohertz o 300,000 megahertz.

## Radio Basics:

- Waves are measured by frequency of movement
- Radio devices operate in bands or a designated frequency range



## Electromagnetic Spectrum:



## Regulation of RFID:

Radio Frequency (RF) is a scarce and shared resource. Each country governs the use of radio spectrum. In the U.S. the F.C.C. allocates spectrum for use and resolves conflict disputes internationally coordinated through the ITU.

## Spectrum Licensing:

- Spectrum can be allocated for specific users

Government

Licensed

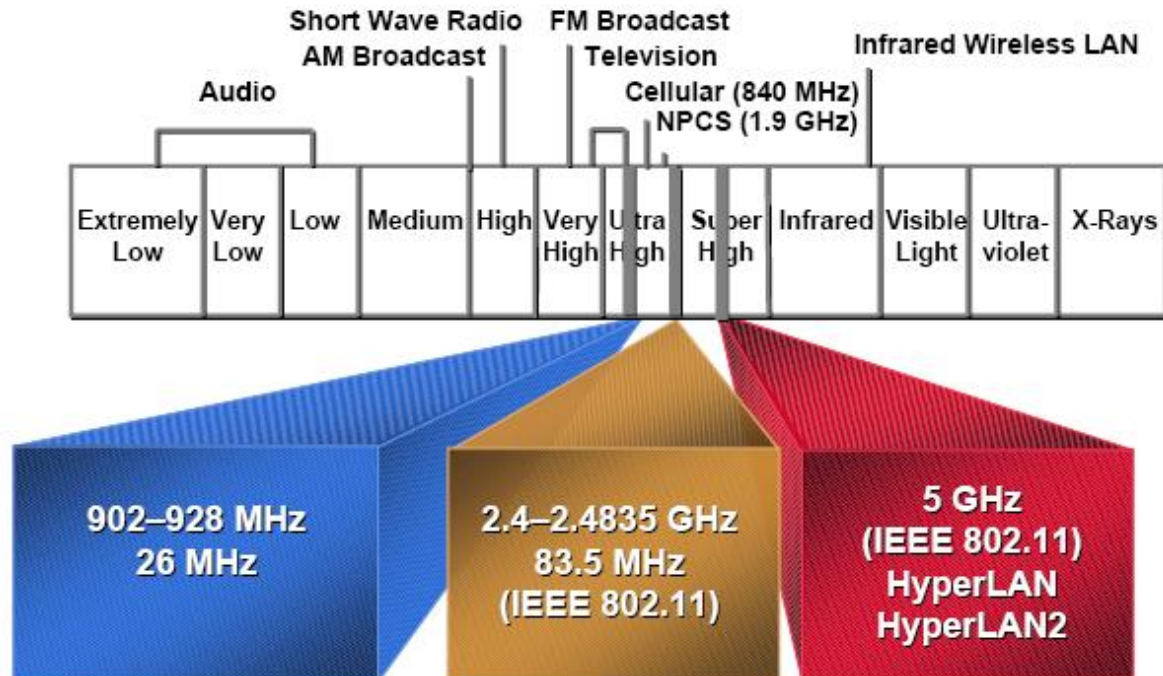
- Unlicensed or Industrial, Scientific and Medical (ISM) bands

902–928 MHz (US only)

2400 MHz

5800 MHz worldwide

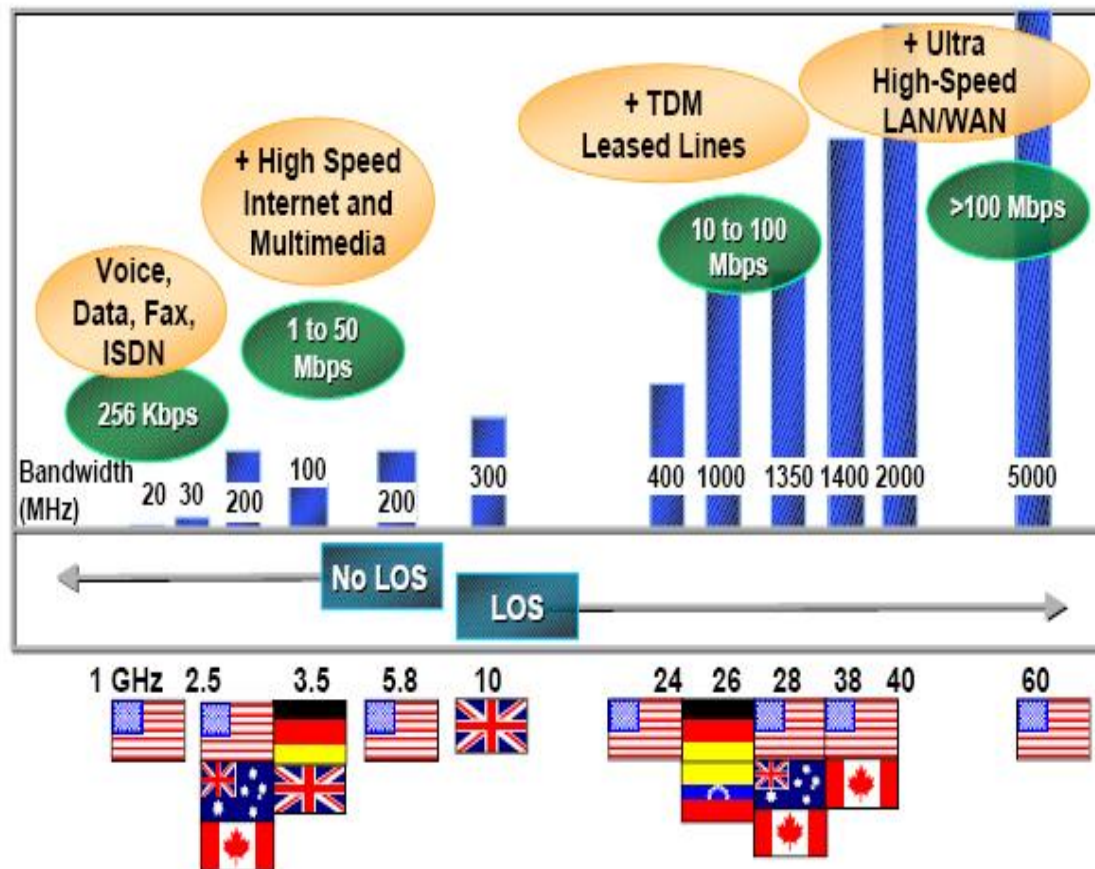
ISM Unlicensed frequency bands:



## What Is Spread Spectrum RF Technology?

- Data sent over the air waves
- Two-way radio communications
- Same radio frequency for sending and receiving
- No licensing required

Access Spectrum Availability and Comparison:



## Spectrum Suitability

- Less than 6 GHz

Long range (up to 45 km), non Line of Sight (LOS), not affected by weather

- Greater 6 GHz

Line of Sight (LOS), short range (1–5 km), affected by weather, more spectrum (1 Ghz)

## RFID Basics:

- Signals
- Modulation
- Access technology
- Antenna theory
- Range
- Interference

## Data Bandwidth Depends On...

- Frequency bandwidth
- Modulation techniques

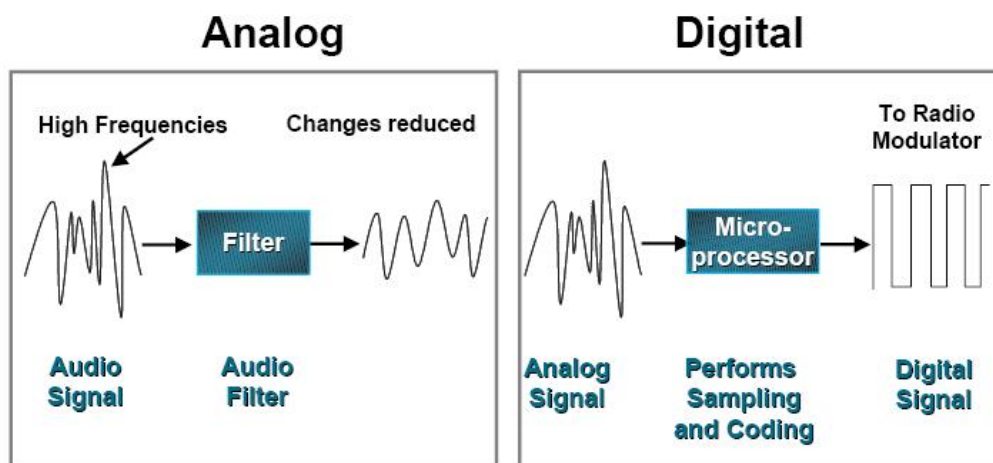
## Transmitting of a Signal:

- The goal of sending data over RF is to get information across with as much data as possible, sending it as far as possible and as fast as possible.
- More data can be placed on a signal in one of two ways:

More frequency used or

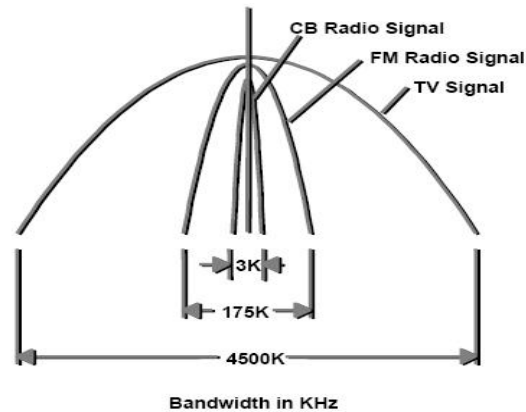
Complex modulation

## Signal Processing:



## Radio Modulation:

- **More information =**
- **More frequency spectrum used**

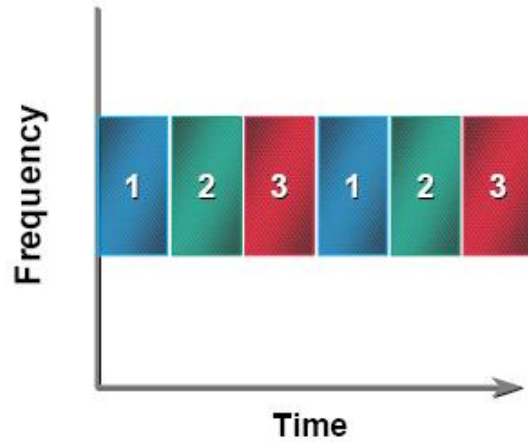


- High speed modem compress the data to use the same line as an old 300 baud modem. This means the same bandwidth is available.
  - 56Kmodems require a better (quieter) phone line to communicate at the higher speed
  - If there is noise on the line, the modem will drop down in speed to connect.
  - Mode noise, less speed
  - Complex modulation requires better signal strength, therefore less coverage is available
- System Access Technology:
- Frequency division multiple access
  - Time division multiple access
  - Code division multiple access
  - Frequency hopping

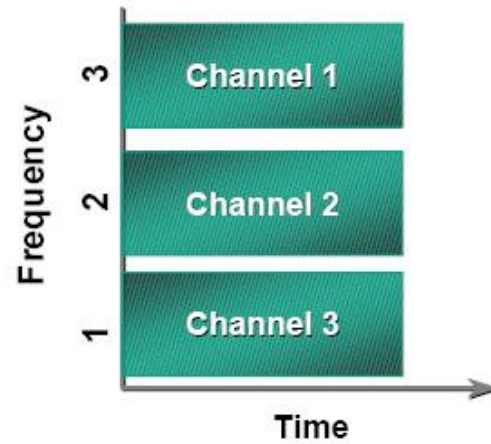
Each technique varies in its efficiency (throughput), interference and range depends on application and environment

## TDMA & FDMA:

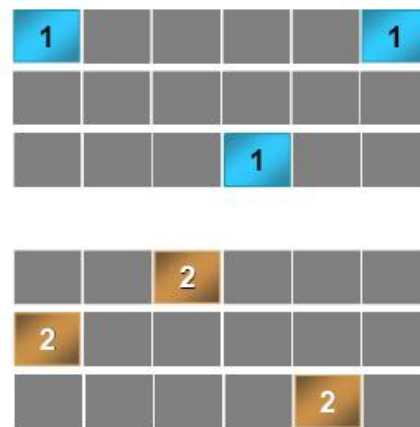
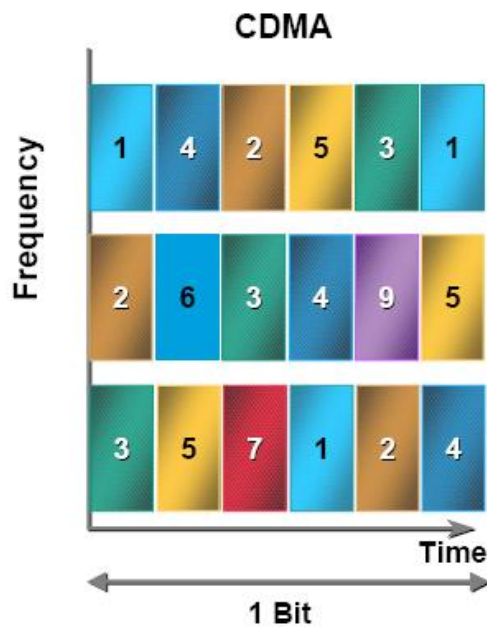
**TDMA**



**FDMA**



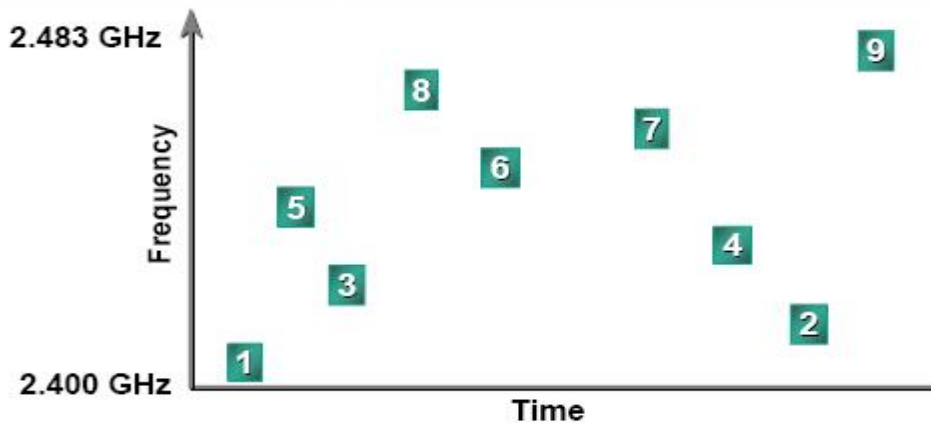
## CDMA:



A long code is used to generate a mask for each radio.

Typically a code is transmitted on a separate channel

## Frequency Hopping:



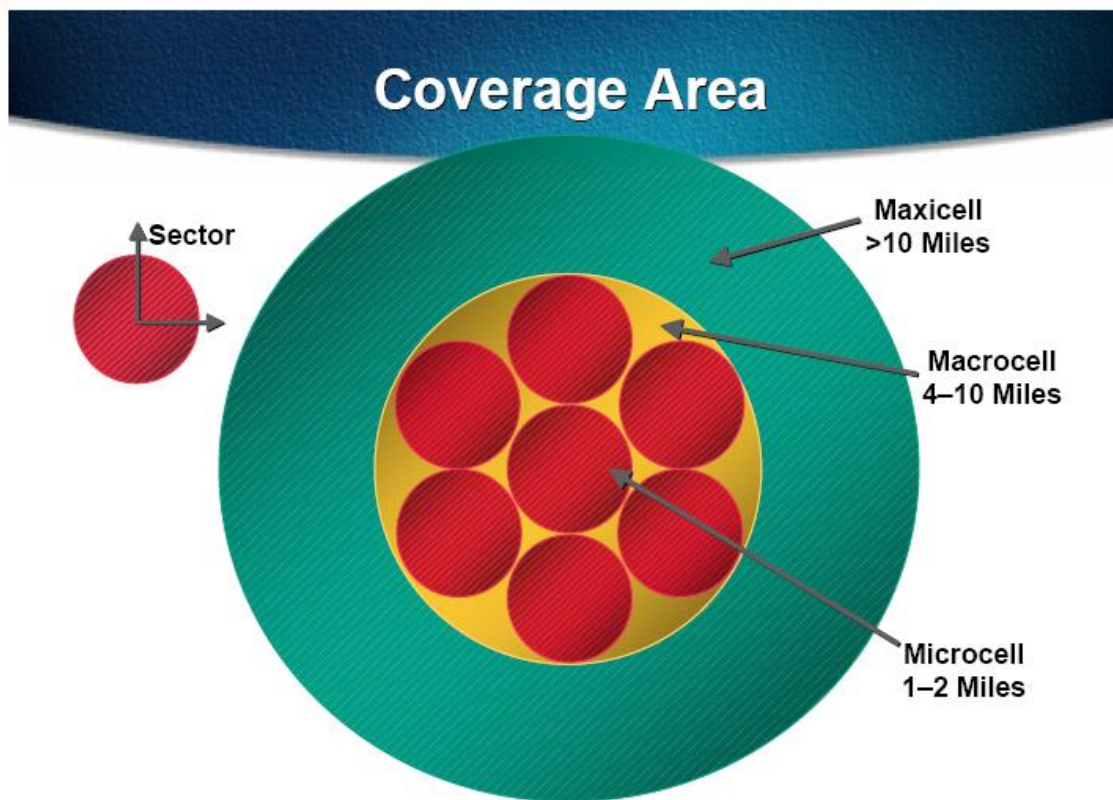
- 79 channels, 1 MHz each
- Changes frequency (hops) at least every 0.4 seconds
- Synchronized hopping required

| Pattern Number | Channel Numbers |   |   |   |   |   |   |   |   |   |
|----------------|-----------------|---|---|---|---|---|---|---|---|---|
| 1              | 1               | 8 | 4 | 9 | 2 | 6 | 5 | 3 | 7 | 0 |
| 2              | 4               | 6 | 8 | 3 | 2 | 7 | 1 | 0 | 9 |   |
| 5              | 9               | 7 | 2 | 1 | 3 | 8 | 4 | 6 | 0 |   |
| 5              | 9               | 3 | 6 | 8 | 4 | 1 | 5 | 0 | 2 |   |

Time →

- Each radio transmits on a channel briefly and then changes to another channel
- Channel numbers in *N* print are actually interfering with other channels at the point in time
- In any multichannel scheme, there is the possibility of interference

## Antenna Concepts:



- Directionality:

Omni (360 degree coverage) directional

Directional (limited range of coverage)

- Gain Measured in dBi and dBd. ( $0 \text{ dBd} = 2.14 \text{ dBi}$ )

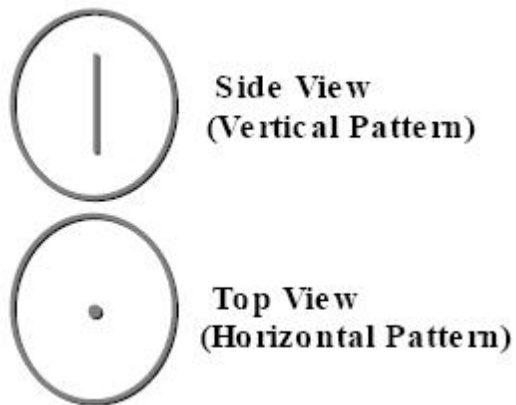
More gain means more coverage—in certain directions!

- Polarization:

Antennas are used in the vertical polarization

- In life you never get 'something for nothing', the same is true in antenna gain
- If the gain of an antenna goes up, the coverage area or angle goes down
- Coverage areas or radiation patterns are measured in degrees
- These angles are referred to as beam width, and have a horizontal and vertical measurement

## Antenna Theory:



- A theoretical antenna (Isotropic) has a perfect 360 degree vertical and horizontal beam width
- This is a reference for all antennas

### Dipole:

- To obtain Omni directional gain from an isotropic antenna, the energy lobes are ‘pushed in’ from the top and bottom, and forced out in a doughnut type pattern.
- The higher the gain smaller the vertical beam width, and the more horizontal lobe area
- This is the typical dipole pattern. Gain of a dipole is 2.14dBi (0dBd)

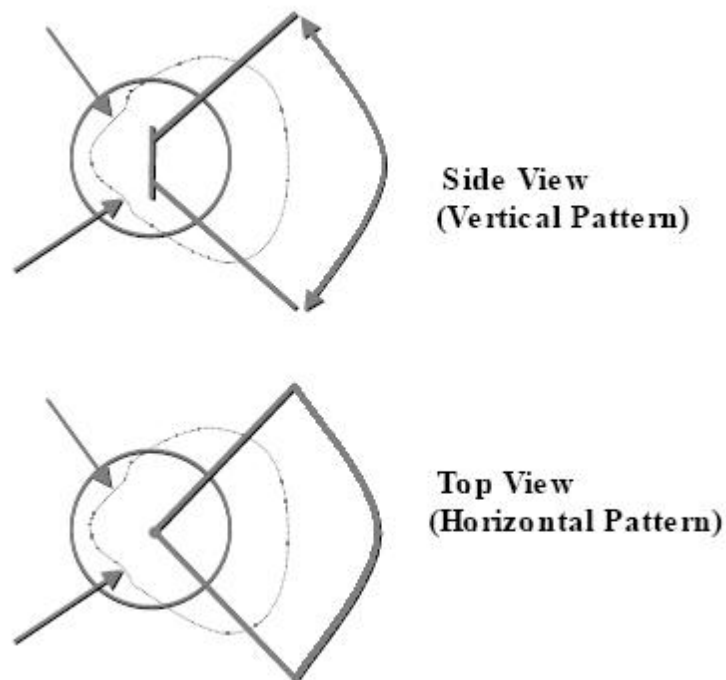
### High Gain Omni directional's:



- High gain Omni-directional antennas will create more coverage area in far distances, but the energy level directly below the antenna will become lower, and coverage here may be poor

### **Directional antennas:**

- For directional antennas the lobes are pushed in a certain direction, causing the energy to move be condensed in a particular area
- Very little energy is in the back side of a directional antenna

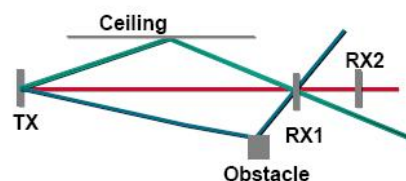


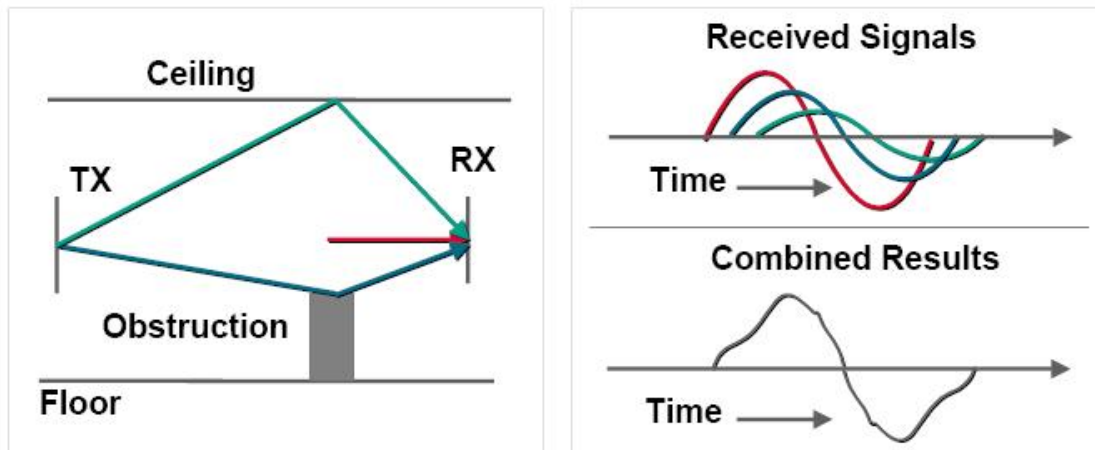
### **Diversity & Multipath:**

- In a multipath environment, the signal can be reflected off surfaces, creating multiple paths to the receiver. This can cause interference and signal degradation.
- Moving the antenna slightly will allow you to move out of a null point and receive the signal correctly

### **Multipath:**

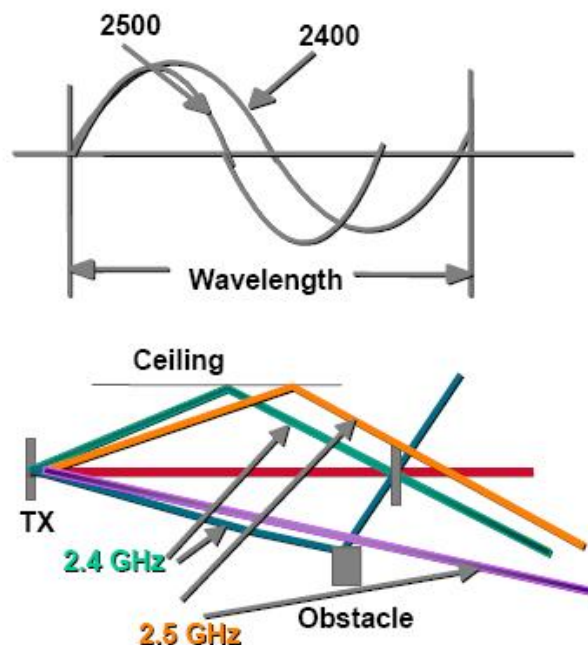
Dual antennas typically mean if one antenna is in a null, the other one will not be, therefore providing better performance in multipath environments.





- The distance an RF wave travels, how it bounces and where the multipath nulls occur are based on the wavelength of the frequency
- As Frequency changes, so does the wavelength
- Therefore as frequency changes, so will the location of the multipath null
- Multipath signals can cause high RF signal strength, but poor signal quality levels
- Bottom line-Low RF signal strength does not mean poor communications

Low Signal Quality DOES mean poor communications



### **The LOS Problem:**

Line-of-sight propagation refers to electro-magnetic radiation traveling in a straight line. The rays or waves are deviated or reflected by obstructions and cannot travel over the horizon or behind obstacles. Beyond that, material disperses the rays respectively the energy of the waves.

Radio signals, like all electromagnetic radiation, travel in straight lines. At low frequencies (below approximately 2 MHz or so) ground effect transmission causes significant diffraction, allowing photons to partially follow the Earth's curvature along multiply deflected straight lines, thus enabling AM radio signals in low-noise environments to be received well after the transmitting antenna has dropped below the horizon. Additionally, frequencies between approximately 1 and 30 MHz, can be reflected by the F1/F2 Layer, thus giving radio transmissions in this range a potentially global reach (see shortwave radio), again along multiply deflected straight lines. However, electro-magnetic radiation never propagates other but along straight lines. Just the effects of multiple diffraction or deflection serve for macroscopically "quasi-curved paths".

However, at higher frequencies and in lower levels of the atmosphere, neither of these effects apply. Thus any obstruction between the transmitting antenna and the receiving antenna will block the signal, just like the light that the eye senses. Therefore, as the ability to visually sight a transmitting antenna (with regards to the limitations of the eye's resolution) roughly corresponds with the ability to receive a signal from it, the propagation characteristic of high-frequency radio is called "line-of-sight" as per radio wave propagation is called as "radio horizon".

In practice, the propagation characteristics of these radio waves vary substantially depending on the exact frequency and the strength of the transmitted signal (a

function of both the transmitter and the antenna characteristics). Broadcast FM radio, at comparatively low frequencies of around 100 MHz using immensely-powerful transmitters, easily propagates through buildings and forests.

## The LOS Solution

- VOFDM (Vector Orthogonal Frequency Division Multiplexing) technology employs both frequency and spatial diversity to create a robust processing technique for multipath fading and narrow band interference

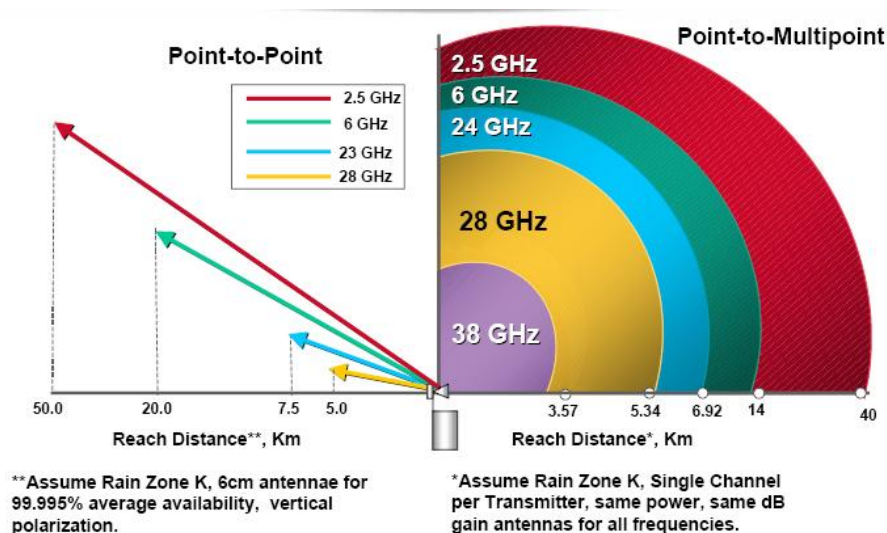
- VOFDM enables greater coverage and substantially reduces

## LOS limitations

### Range Depends On...

- Frequency
- Transmit power
- Radio sensitivity
- Processing gain from access technique and redundancy
- Interference effects (-)

### Range distance from hub:



### **Interference Is Caused By...**

- Obstacles like buildings, trees, walls that absorb or refract signals
- Atmospherics like rain, fog, solar spots
- Other electromagnetic devices Interference can appear as noise or can cause loss of signal strength

## CHAPTER 3

### RESEARCH METHODOLOGY

In order to accomplish the objectives of the study, it is essential to articulate the manner in which it is to be conducted, i.e., the research process is to be carried-out in a certain framework. The Research Methodology, which follows, is the backbone of the study. An Exploratory Research with the secondary data study was conducted. Primary data was collected with the help of a questionnaire. A conclusive research was also conducted, which involved Causal research in the field.

Research Methodology is a way to systematically solve the research problem. The Research Methodology includes the various methods and techniques for conducting a Research.

#### **Research design**

**Descriptive research** tries to explain analytically a situation, crisis, incident, service or programme, or provides information about, say, living condition of a community, or describes attitudes towards an issue.

**Sampling Plan** – Sampling can be defined as the section of some part of an aggregate or totality on the basis of which judgment or an inference about aggregate or totality is made.

**Sample size:**

A total of 125 employees were selected with an attempt to cover a wide cross section of the Mahindra Logistics Pvt Ltd.

**Sampling Technique**

Simple random sampling method is used in this study for data collection.

**Primary data:**

Primary data was collected with the help of a Questionnaire. A detailed questionnaire was prepared for which data is collected from 125 employees of Mahindra Logistics Pvt Ltd in Chennai

**Secondary data:**

Secondary data was collected by external sources like books, newspapers and journals; new age sources like the internet. Some White papers and articles were also referred to get an insight on the working of wireless Technology. Access to different articles with respect to wireless technology on the internet enabled to gather some useful information and facts about the same.

**Mode of data collection:**

The questionnaire consisted of questions on the existing method of inventory management, use of supply chain management software and other aspects of supply chain management. The questionnaire also designed to gather information on the need, perception and barriers towards wireless and readiness of these firms to embrace wireless technology in the near future.

### **Tools data Analysis**

Under probability clustered sampling, the statistical tools applied are,

1. Percentage method
2. Chi-square method
3. Karl Pearson's Correlation co-efficient

### **LIMITATIONS OF THE STUDY**

1. The study is restricted to few of the companies in Mahindra Logistics Pvt Ltd in Chennai
2. Due to time constraint the whole population could not be considered.
3. The study considered only 125 samples.
4. The employees could not contribute more time. Not all the employees answer the questionnaire

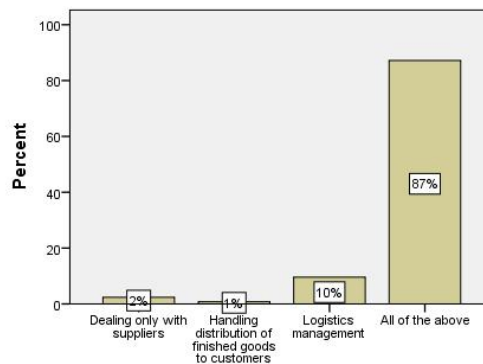
## CHAPTER 4

### DATA ANALYSIS & INTERPRETATION

**TABLE 1**  
**IN-HOUSE SCM**

|              |                          | <b>Frequen<br/>cy</b> | <b>Percent</b> | <b>Valid<br/>Percent</b> | <b>Cumulative<br/>Percent</b> |
|--------------|--------------------------|-----------------------|----------------|--------------------------|-------------------------------|
| <b>Valid</b> | Dealing Suppliers        | 3                     | 2.4            | 2.4                      | 2.4                           |
|              | Handling<br>distribution | 1                     | .8             | .8                       | 3.2                           |
|              | Logistics<br>Management  | 12                    | 9.6            | 9.6                      | 12.8                          |
|              | All the above            | 109                   | 87.2           | 87.2                     | 100.0                         |
|              | <b>Total</b>             | <b>125</b>            | <b>100.0</b>   | <b>100.0</b>             |                               |

**CHART 1**  
**IN-HOUSE SCM**



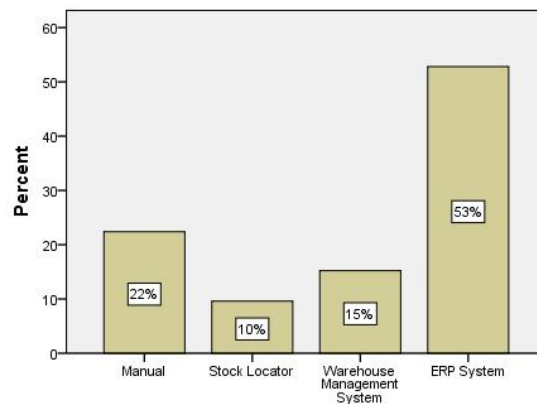
#### **Interpretation:**

2% said they are dealing only with suppliers, 1% said they are handling distribution of finished goods to customers, 10% said they are involved in logistics management, and 87% said all the above functions are dealt by in-house SCM.

**TABLE 2**  
**INVENTORY MANAGEMENT SYSTEM**

|              |                             | <b>Frequen<br/>cy</b> | <b>Percent</b> | <b>Valid<br/>Percent</b> | <b>Cumulativ<br/>e Percent</b> |
|--------------|-----------------------------|-----------------------|----------------|--------------------------|--------------------------------|
| <b>Valid</b> | Manual                      | 28                    | 22.4           | 22.4                     | 22.4                           |
|              | Stock Locator               | 12                    | 9.6            | 9.6                      | 32.0                           |
|              | Warehouse Management System | 19                    | 15.2           | 15.2                     | 47.2                           |
|              | ERP System                  | 66                    | 52.8           | 52.8                     | 100.0                          |
|              | <b>Total</b>                | <b>125</b>            | <b>100.0</b>   | <b>100.0</b>             |                                |

**CHART 2**  
**INVENTORY MANAGEMENT SYSTEM**



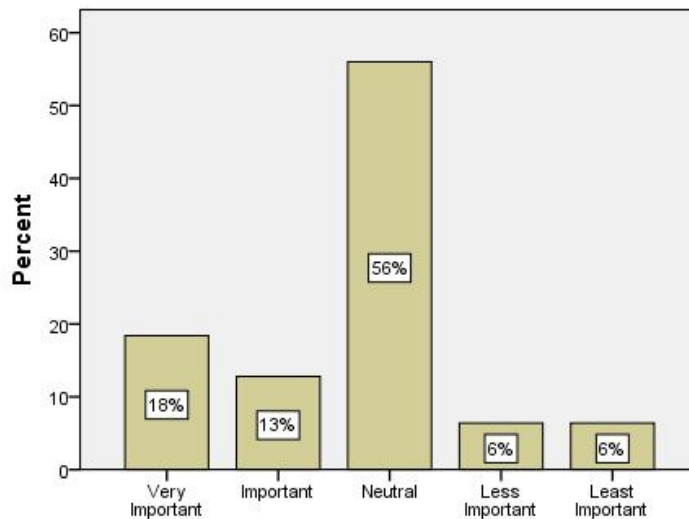
**Interpretation:**

22% said the company's inventory management system is manual, 10% said they are adopting warehouse management system, 15% of them said they are using ERP systems and the rest 53% said they are using stock locator.

**TABLE 3**  
**WIRELESS TECHNOLOGIES TO LOWER INVENTORY**

|              |                 | <b>Frequen<br/>cy</b> | <b>Percent</b> | <b>Valid<br/>Percent</b> | <b>Cumulative<br/>Percent</b> |
|--------------|-----------------|-----------------------|----------------|--------------------------|-------------------------------|
| <b>Valid</b> | Very Important  | 23                    | 18.4           | 18.4                     | 18.4                          |
|              | Important       | 16                    | 12.8           | 12.8                     | 31.2                          |
|              | Neutral         | 70                    | 56.0           | 56.0                     | 87.2                          |
|              | Less Important  | 8                     | 6.4            | 6.4                      | 93.6                          |
|              | Least Important | 8                     | 6.4            | 6.4                      | 100.0                         |
|              | <b>Total</b>    | <b>125</b>            | <b>100.0</b>   | <b>100.0</b>             |                               |

**CHART 3**  
**WIRELESS TECHNOLOGIES TO LOWER INVENTORY**

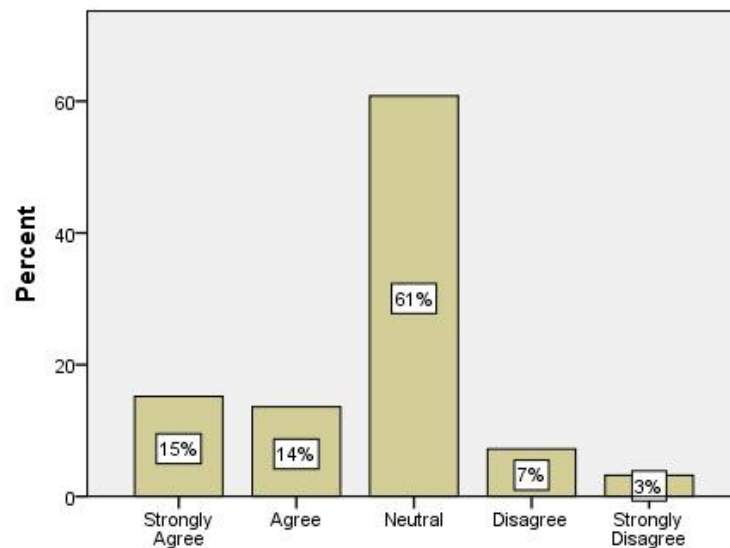


**Interpretation:** 18% respondents said wireless technology is very important to lower inventory, 13% said it is important, 56% of the respondents are neutral towards the wireless Technologies to lower inventory, 6% of them said it is less important, 6% said it is least important.

**TABLE 4**  
**WIRELESS TECHNOLOGIES FOR COMPETITIVE ADVANTAGE**

|              |                      | <b>Frequen<br/>cy</b> | <b>Percent</b> | <b>Valid<br/>Percent</b> | <b>Cumulative<br/>Percent</b> |
|--------------|----------------------|-----------------------|----------------|--------------------------|-------------------------------|
| <b>Valid</b> | Strongly Agree       | 19                    | 15.2           | 15.2                     | 15.2                          |
|              | Agree                | 17                    | 13.6           | 13.6                     | 28.8                          |
|              | Neutral              | 76                    | 60.8           | 60.8                     | 89.6                          |
|              | Disagree             | 9                     | 7.2            | 7.2                      | 96.8                          |
|              | Strongly<br>Disagree | 4                     | 3.2            | 3.2                      | 100.0                         |
|              | <b>Total</b>         | <b>125</b>            | <b>100.0</b>   | <b>100.0</b>             |                               |

**CHART 4**  
**WIRELESS TECHNOLOGIES FOR COMPETITIVE ADVANTAGE**

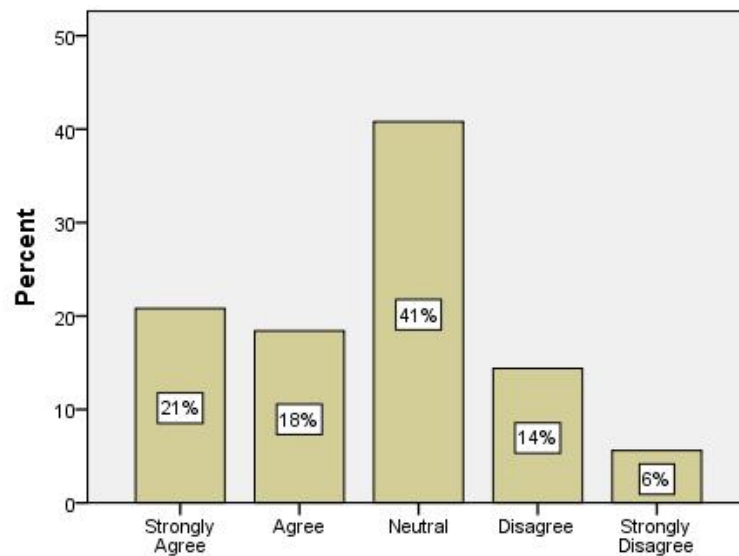


**Interpretation:** 15% strongly agree that wireless Technology is needed to gain competitive advantage, 14% of them agree this, 61% of the respondents are neutral towards the wireless technologies for competitive advantage, 7% disagree, and 3% strongly disagree this.

**TABLE 5**  
**WIRELESS TECHNOLOGY TO INCREASE VISIBILITY**

|              |                      | <b>Frequen<br/>cy</b> | <b>Percent</b> | <b>Valid Percent</b> | <b>Cumulative<br/>Percent</b> |
|--------------|----------------------|-----------------------|----------------|----------------------|-------------------------------|
| <b>Valid</b> | Strongly Agree       | 26                    | 20.8           | 20.8                 | 20.8                          |
|              | Agree                | 23                    | 18.4           | 18.4                 | 39.2                          |
|              | Neutral              | 51                    | 40.8           | 40.8                 | 80.0                          |
|              | Disagree             | 18                    | 14.4           | 14.4                 | 94.4                          |
|              | Strongly<br>Disagree | 7                     | 5.6            | 5.6                  | 100.0                         |
|              | <b>Total</b>         | <b>125</b>            | <b>100.0</b>   | <b>100.0</b>         |                               |

**CHART 5**  
**WIRELESS TECHNOLOGY TO INCREASE VISIBILITY**

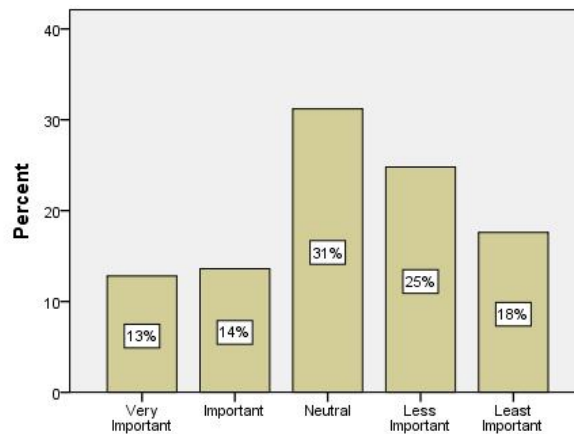


**Interpretation:** 21% strongly agree that wireless Technology increases visibility, 18% of them agree this, and 41% of the respondents are neutral towards the wireless technology to Increase visibility, 14% disagree, and 6% strongly disagree this.

**TABLE 6**  
**WIRELESS TECHNOLOGY REDUCE OPERATION COST**

|              |                 | <b>Frequen<br/>cy</b> | <b>Percent</b> | <b>Valid<br/>Percent</b> | <b>Cumulative<br/>Percent</b> |
|--------------|-----------------|-----------------------|----------------|--------------------------|-------------------------------|
| <b>Valid</b> | Very Important  | 16                    | 12.8           | 12.8                     | 12.8                          |
|              | Important       | 17                    | 13.6           | 13.6                     | 26.4                          |
|              | Neutral         | 39                    | 31.2           | 31.2                     | 57.6                          |
|              | Less Important  | 31                    | 24.8           | 24.8                     | 82.4                          |
|              | Least Important | 22                    | 17.6           | 17.6                     | 100.0                         |
|              | <b>Total</b>    | <b>125</b>            | <b>100.0</b>   | <b>100.0</b>             |                               |

**CHART 6**  
**WIRELESS TECHNOLOGY REDUCE OPERATION COST**

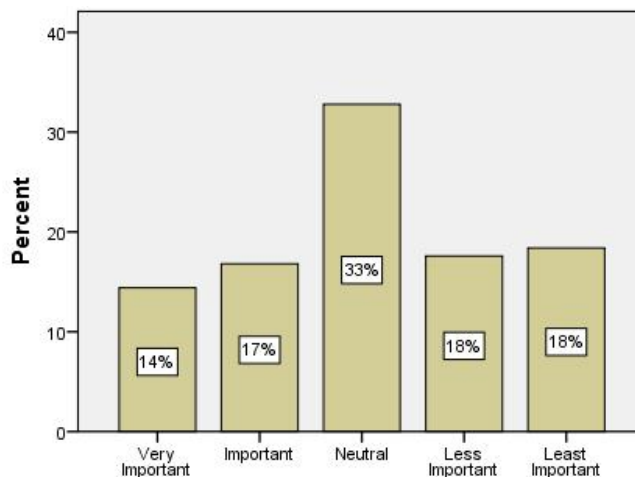


**Interpretation:** 13% said wireless Technologies is needed to increase visibility in supply chain by tracking goods in supply chain, 14% of them said it is important, 31% of the respondents are neutral towards this, 25% said it is less important that wireless technology reduce operating cost, 18% said it is least important.

**TABLE 7**  
**WIRELESS TECHNOLOGY REDUCE ORDER CYCLE**

| <b>Wireless Technology to reduce order cycle</b> |                 |                       |                |                          |                                |
|--------------------------------------------------|-----------------|-----------------------|----------------|--------------------------|--------------------------------|
|                                                  |                 | <b>Frequen<br/>cy</b> | <b>Percent</b> | <b>Valid<br/>Percent</b> | <b>Cumulativ<br/>e Percent</b> |
| <b>Valid</b>                                     | Very Important  | 18                    | 14.4           | 14.4                     | 14.4                           |
|                                                  | Important       | 21                    | 16.8           | 16.8                     | 31.2                           |
|                                                  | Neutral         | 41                    | 32.8           | 32.8                     | 64.0                           |
|                                                  | Less Important  | 22                    | 17.6           | 17.6                     | 81.6                           |
|                                                  | Least Important | 23                    | 18.4           | 18.4                     | 100.0                          |
|                                                  | <b>Total</b>    | <b>125</b>            | <b>100.0</b>   | <b>100.0</b>             |                                |

**CHART 7**  
**WIRELESS TECHNOLOGY REDUCE ORDER CYCLE**



**Interpretation:** 14% said wireless Technologies is needed to reduce order cycle, 17% of them said it is important, 33% of the respondents are neutral towards the statement that wireless technology reduce order cycle, 18% said it is less important, 18% said it is least important.

**TABLE 8: PREREQUISITE FOR SCM INITIATIVE**

| <b>Description</b>        | <b>No of respondents</b> |          |          |           |            | <b>Total</b> |
|---------------------------|--------------------------|----------|----------|-----------|------------|--------------|
|                           | <b>SA</b>                | <b>A</b> | <b>N</b> | <b>DA</b> | <b>SDA</b> |              |
| Company outlook           | 24                       | 48       | 14       | 12        | 27         | <b>125</b>   |
| Involvement of management | 20                       | 56       | 21       | 15        | 13         | <b>125</b>   |
| Budget allocations        | 25                       | 60       | 15       | 10        | 15         | <b>125</b>   |
| Existence of ERP software | 15                       | 27       | 48       | 19        | 16         | <b>125</b>   |
| Trained manpower          | 18                       | 11       | 43       | 38        | 15         | <b>125</b>   |
| Suppliers involvement     | 34                       | 48       | 04       | 12        | 27         | <b>125</b>   |

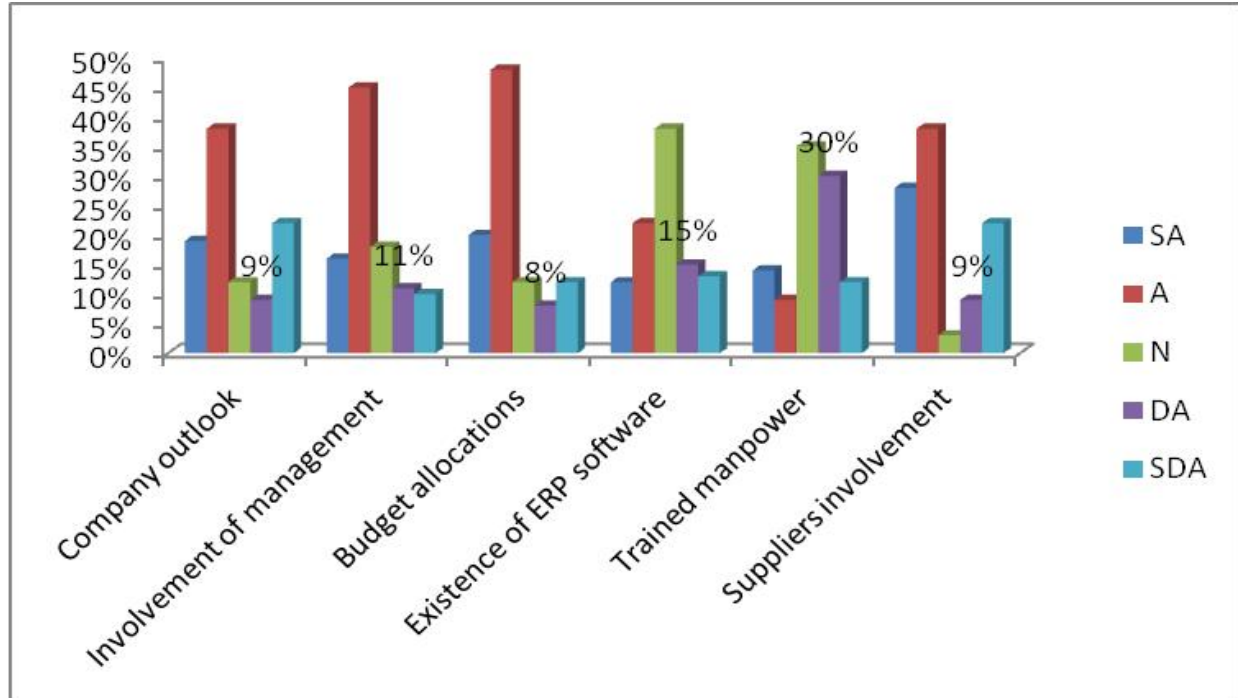
**PERCENTAGE OF PREREQUISITE FOR SCM INITIATIVE**

| <b>Description</b>        | <b>No of respondents</b> |          |          |           |            | <b>Total</b> |
|---------------------------|--------------------------|----------|----------|-----------|------------|--------------|
|                           | <b>SA</b>                | <b>A</b> | <b>N</b> | <b>DA</b> | <b>SDA</b> |              |
| Company outlook           | 19%                      | 38%      | 12%      | 9%        | 22%        | <b>100 %</b> |
| Involvement of management | 16%                      | 45%      | 18%      | 11%       | 10%        | <b>100 %</b> |
| Budget allocations        | 20%                      | 48%      | 12%      | 8%        | 12%        | <b>100 %</b> |
| Existence of ERP software | 12%                      | 22%      | 38%      | 15%       | 13%        | <b>100 %</b> |
| Trained manpower          | 14%                      | 9%       | 35%      | 30%       | 12%        | <b>100 %</b> |
| Suppliers involvement     | 28%                      | 38%      | 3%       | 9%        | 22%        | <b>100 %</b> |

**Inference:**

- ✓ 19% of the respondents strongly agree that Company outlook is the pre requisite for wireless Technologies initiative, 38% agree this statement, 12% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.
- ✓ 16% of the respondents strongly agree that involvement of management is the pre requisite for wireless Technologies initiative, 45% agree this statement, 18% of them are neutral towards this, 11% of them disagree this, and 10% of them strongly disagree this opinion.
- ✓ 20% of the respondents strongly agree that Budget allocations is the pre requisite for wireless Technologies initiative, 48% agree this statement, 12% of them are neutral towards this, 8% of them disagree this, and 12% of them strongly disagree this opinion.
- ✓ 12% of the respondents strongly agree that existence of ERP software is the pre requisite for wireless Technologies initiative, 22% agree this statement, 38% of them are neutral towards this, 15% of them disagree this, and 13% of them strongly disagree this opinion.
- ✓ 14% of the respondents strongly agree that trained manpower is the pre requisite for wireless Technologies initiative, 9% agree this statement, 35% of them are neutral towards this, 30% of them disagree this, and 12% of them strongly disagree this opinion.
- ✓ 28% of the respondents strongly agree that suppliers involvement is the pre requisite for wireless Technologies initiative, 38% agree this statement, 3% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.

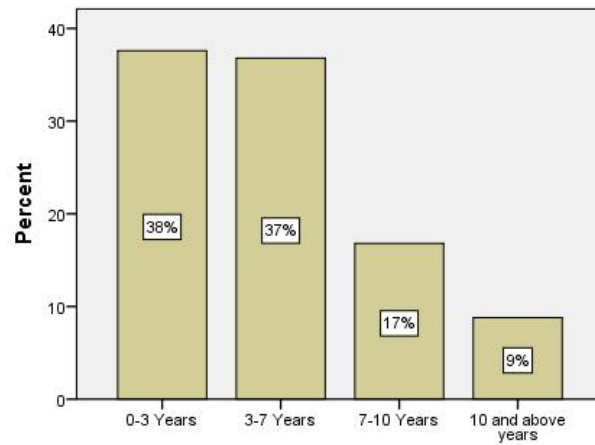
**CHART 8**  
**PERCENTAGE OF PREREQUISITE FOR SUPPLY CHAIN**  
**MANAGEMENT INITIATIVE**



**TABLE 9**  
**EXPERIENCE IN SUPPLY CHAIN MANAGEMENT**

| Experience in SCM |              |            |              |               |                    |
|-------------------|--------------|------------|--------------|---------------|--------------------|
|                   |              | Frequency  | Percent      | Valid Percent | Cumulative Percent |
| Valid             | 0-3 Years    | 47         | 37.6         | 37.6          | 37.6               |
|                   | 3-7 Years    | 46         | 36.8         | 36.8          | 74.4               |
|                   | 7-10 Years   | 21         | 16.8         | 16.8          | 91.2               |
|                   | More than 10 | 11         | 8.8          | 8.8           | 100.0              |
|                   | <b>Total</b> | <b>125</b> | <b>100.0</b> | <b>100.0</b>  |                    |

**CHART 9**  
**EXPERIENCE IN SUPPLY CHAIN MANAGEMENT**



**Interpretation:** 38% of them are having 0-3 years of experience in supply chain management, 37% of them are having 3-7 years experience, 17% of them are having 7-10 years of experience and the rest 9% of them are having more than 10 years of experience.

**TABLE 10**  
**WIRELESS TECHNOLOGY IMPLEMENTATION IN MAHINDRA**  
**LOGISTICS PVT LTD**

| Description                 | No of respondents |       |         |          |                   | Total |
|-----------------------------|-------------------|-------|---------|----------|-------------------|-------|
|                             | Strongly Agree    | Agree | Neutral | Disagree | Strongly Disagree |       |
| Pressure from major players | 25                | 60    | 15      | 10       | 15                | 125   |
| Compliance to standards     | 24                | 48    | 14      | 12       | 27                | 125   |
| Select process              | 18                | 11    | 43      | 38       | 15                | 125   |
| Competitive advantage       | 34                | 48    | 04      | 12       | 27                | 125   |

## PERCENTAGE OF WIRELESS TECHNOLOGY IMPLEMENTATION IN MAHINDRA LOGISTICS PVT LTD

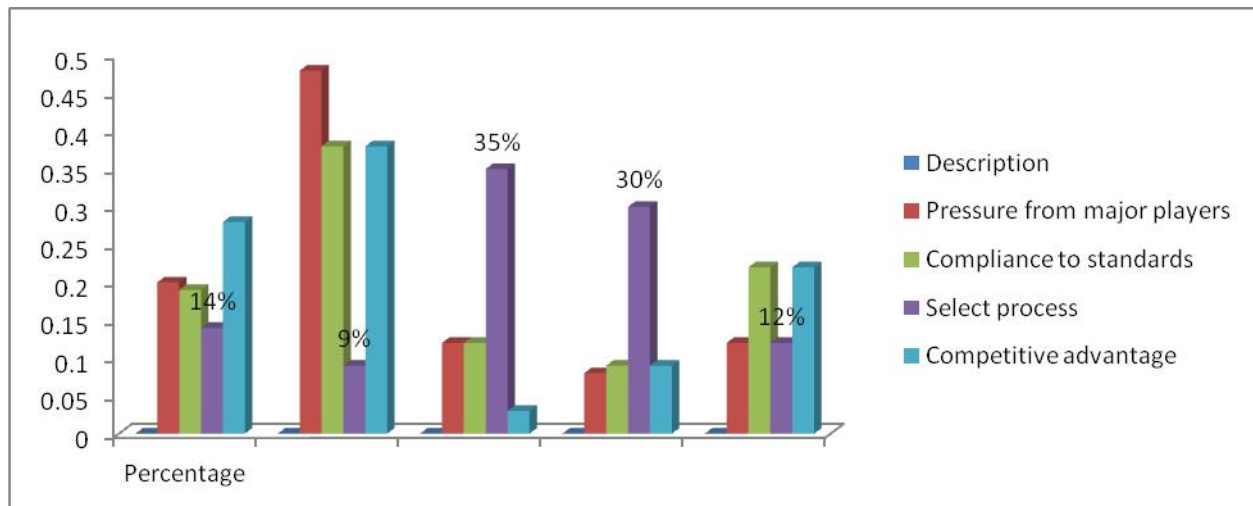
| Description                 | Percentage     |       |         |          |                   | Total |
|-----------------------------|----------------|-------|---------|----------|-------------------|-------|
|                             | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |       |
| Pressure from major players | 20%            | 48%   | 12%     | 8%       | 12%               | 100%  |
| Compliance to standards     | 19%            | 38%   | 12%     | 9%       | 22%               | 100%  |
| Select process              | 14%            | 9%    | 35%     | 30%      | 12%               | 100%  |
| Competitive advantage       | 28%            | 38%   | 3%      | 9%       | 22%               | 100%  |

### **Inference:**

- ✓ 20% of the respondents strongly agree that implementation of technology in the company creates pressure from major players, 48% agree this statement, 12% of them are neutral towards this, 8% of them disagree this, and 12% of them strongly disagree this opinion.
- ✓ 19% of the respondents strongly agree that implementation of technology in the company creates compliance to standards, 38% agree this statement, 12% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.
- ✓ 14% of the respondents strongly agree that implementation of technology in the company creates pressure from major select process, 9% agree this statement, 35% of them are neutral towards this, 30% of them disagree this, and 12% of them strongly disagree this opinion.
- ✓ 28% of the respondents strongly agree that implementation of technology in the company creates competitive advantage, 38% agree this statement, 3% of them

are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this.

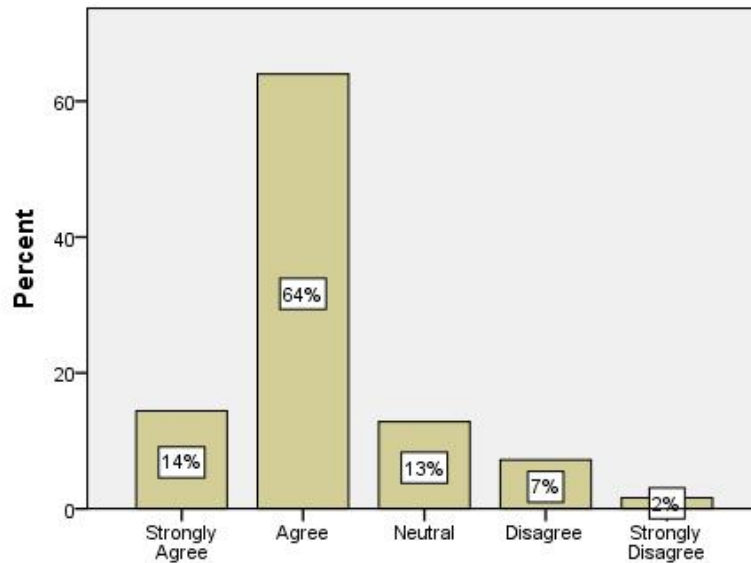
**CHART 10: WIRELESS TECHNOLOGY IMPLEMENTATION IN  
MAHINDRA LOGISTICS PVT LTD**



**TABLE 11  
PREVENTION OF PILFERAGE AND COUNTERFEITING STOCK**

| WIRELESS prevent pilferage and counterfeiting stock |                   |            |              |               |                    |
|-----------------------------------------------------|-------------------|------------|--------------|---------------|--------------------|
|                                                     |                   | Frequency  | Percent      | Valid Percent | Cumulative Percent |
| Valid                                               | Strongly Agree    | 18         | 14.4         | 14.4          | 14.4               |
|                                                     | Agree             | 80         | 64.0         | 64.0          | 78.4               |
|                                                     | Neutral           | 16         | 12.8         | 12.8          | 91.2               |
|                                                     | Disagree          | 9          | 7.2          | 7.2           | 98.4               |
|                                                     | Strongly Disagree | 2          | 1.6          | 1.6           | 100.0              |
|                                                     | <b>Total</b>      | <b>125</b> | <b>100.0</b> | <b>100.0</b>  |                    |

**CHART 11**  
**PREVENTION OF PILFERAGE AND COUNTERFEITING STOCK**

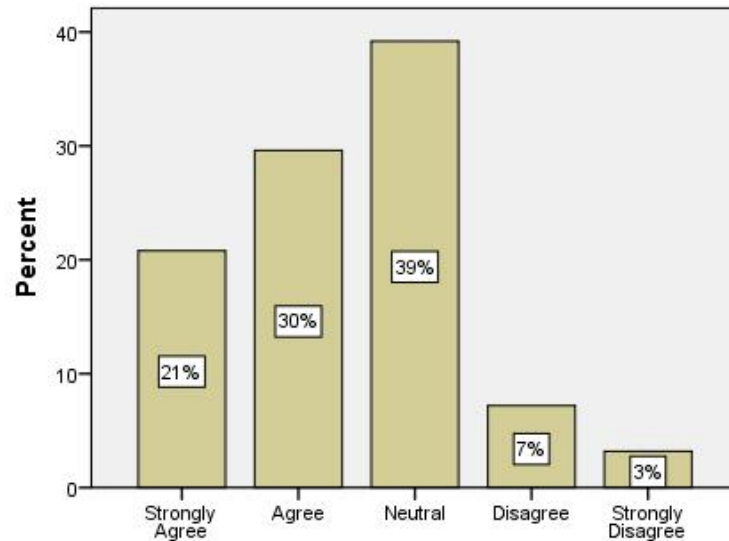


**Interpretation:** 14% of the respondents strongly agree that adoption of new technology is needed to prevent pilferage and counterfeiting, 64% agree this statement, 13% of them are neutral towards this, 7% of them disagree this, and 2% of them strongly disagree this opinion

**TABLE 12**  
**WIRELESS ENHANCE CUSTOMER EXPERIENCE**

| Wireless Technology helps to enhance customer experience |                   |            |              |               |                    |
|----------------------------------------------------------|-------------------|------------|--------------|---------------|--------------------|
|                                                          |                   | Frequency  | Percent      | Valid Percent | Cumulative Percent |
| Valid                                                    | Strongly Agree    | 26         | 20.8         | 20.8          | 20.8               |
|                                                          | Agree             | 37         | 29.6         | 29.6          | 50.4               |
|                                                          | Neutral           | 49         | 39.2         | 39.2          | 89.6               |
|                                                          | Disagree          | 9          | 7.2          | 7.2           | 96.8               |
|                                                          | Strongly Disagree | 4          | 3.2          | 3.2           | 100.0              |
|                                                          | <b>Total</b>      | <b>125</b> | <b>100.0</b> | <b>100.0</b>  |                    |

**CHART 12**  
**WIRELESS ENHANCE CUSTOMER EXPERIENCE**

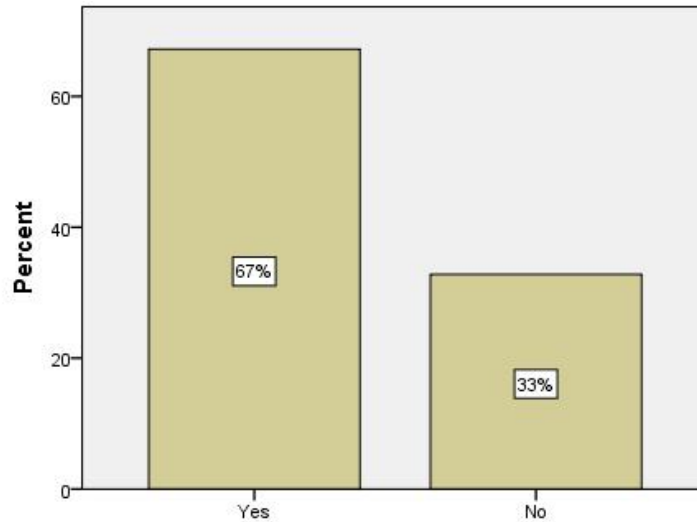


**Interpretation:** 21% of the respondents strongly agree adoption of new technology is needed to enhance customer experience, 30% agree this statement, 39% of them are neutral towards this, 7% of them disagree this, and 3% of them strongly disagree this opinion.

**TABLE 13**  
**WIRELESS TECHNOLOGY IS A TREND SETTER IN SCM**

| Wireless technologies is a trend setter in SCM |              |            |              |               |                    |
|------------------------------------------------|--------------|------------|--------------|---------------|--------------------|
|                                                |              | Frequency  | Percent      | Valid Percent | Cumulative Percent |
| Valid                                          | Yes          | 84         | 67.2         | 67.2          | 67.2               |
|                                                | No           | 41         | 32.8         | 32.8          | 100.0              |
|                                                | <b>Total</b> | <b>125</b> | <b>100.0</b> | <b>100.0</b>  |                    |

**CHART 13**  
**WIRELESS TECHNOLOGY IS A TREND SETTER IN SCM**

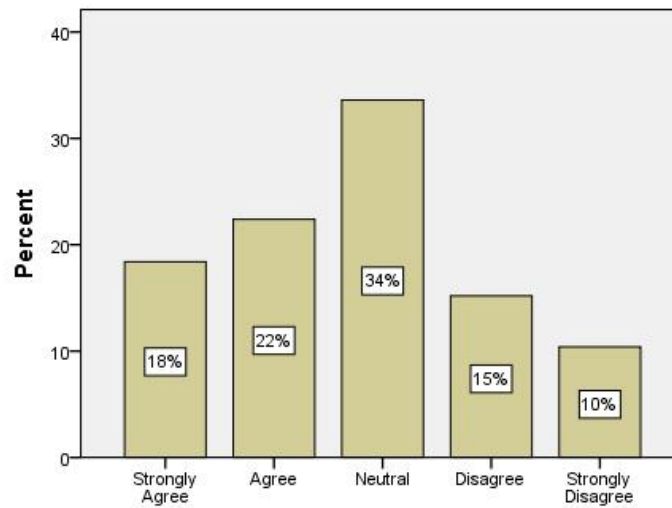


**Interpretation:** 67% of them said wireless technology is a trend setter in supply chain management and the rest 33% of them disagree this.

**TABLE 14**  
**WIRELESS HELPFUL IN INCREASING ASSET EFFICIENCY**

|       |                   | <b>Frequen<br/>cy</b> | <b>Percent</b> | <b>Valid<br/>Percent</b> | <b>Cumulativ<br/>e Percent</b> |
|-------|-------------------|-----------------------|----------------|--------------------------|--------------------------------|
| Valid | Strongly Agree    | 23                    | 18.4           | 18.4                     | 18.4                           |
|       | Agree             | 28                    | 22.4           | 22.4                     | 40.8                           |
|       | Neutral           | 42                    | 33.6           | 33.6                     | 74.4                           |
|       | Disagree          | 19                    | 15.2           | 15.2                     | 89.6                           |
|       | Strongly Disagree | 13                    | 10.4           | 10.4                     | 100.0                          |
|       | <b>Total</b>      | <b>125</b>            | <b>100.0</b>   | <b>100.0</b>             |                                |

**CHART 14**  
**WIRELESS HELPFUL IN INCREASING ASSET EFFICIENCY**



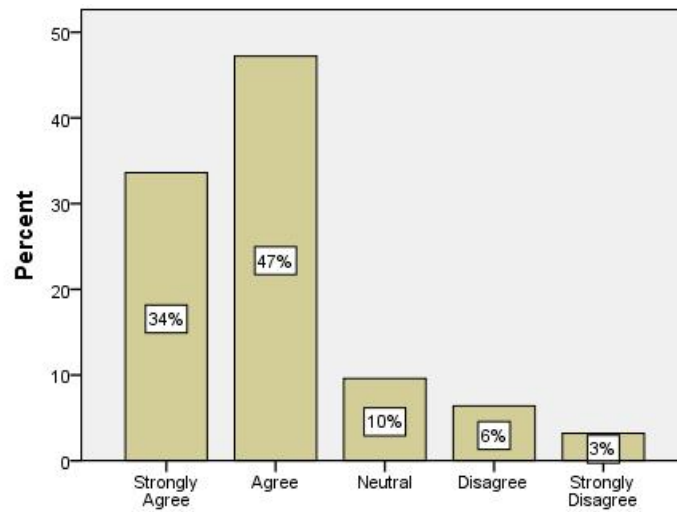
**Interpretation:** 18% of the respondents strongly agree that adoption of new technology is needed to increase asset efficiency, 22% agree this statement, 34% of them are neutral towards this and 15% of them disagree this and the rest 10% of them strongly disagree this.

**TABLE 15**  
**WIRELESS INCREASE CORPORATE CONTROL OVER MECHANISMS**

|       |                   | <b>Frequen<br/>cy</b> | <b>Percent</b> | <b>Valid<br/>Percent</b> | <b>Cumulativ<br/>e Percent</b> |
|-------|-------------------|-----------------------|----------------|--------------------------|--------------------------------|
| Valid | Strongly Agree    | 42                    | 33.6           | 33.6                     | 33.6                           |
|       | Agree             | 59                    | 47.2           | 47.2                     | 80.8                           |
|       | Neutral           | 12                    | 9.6            | 9.6                      | 90.4                           |
|       | Disagree          | 8                     | 6.4            | 6.4                      | 96.8                           |
|       | Strongly Disagree | 4                     | 3.2            | 3.2                      | 100.0                          |
|       | <b>Total</b>      | <b>125</b>            | <b>100.0</b>   | <b>100.0</b>             |                                |

**CHART 15**

**WIRELESS INCREASE CORPORATE CONTROL OVER MECHANISMS**



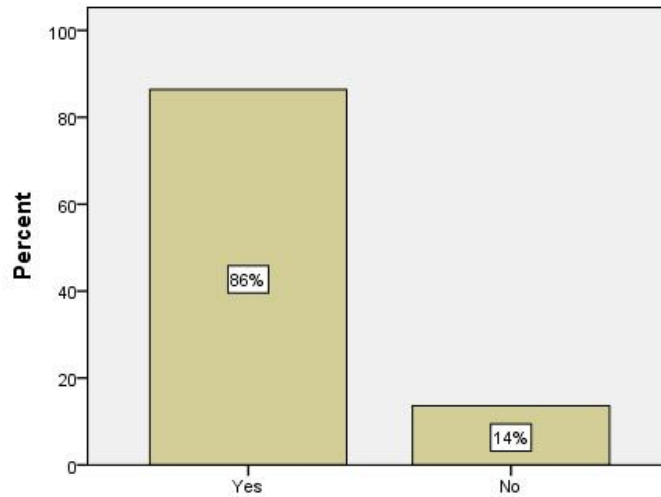
**Interpretation:** 34% of the respondents strongly agree that adoption of new technology is needed to increase corporate control over mechanisms, 47% agree this statement, 10% of them are neutral towards this and 6% of them disagree this and the rest 3% of them strongly disagree this

**TABLE 16**

**INCREASE IN ORGANIZATION REVENUE AFTER IMPLEMENTATION  
OF WIRELESS**

|       |              | Frequen<br>cy | Percent      | Valid<br>Percent | Cumulative<br>Percent |
|-------|--------------|---------------|--------------|------------------|-----------------------|
| Valid | Yes          | 108           | 86.4         | 86.4             | 86.4                  |
|       | No           | 17            | 13.6         | 13.6             | 100.0                 |
|       | <b>Total</b> | <b>125</b>    | <b>100.0</b> | <b>100.0</b>     |                       |

**CHART 16**  
**INCREASE IN ORGANIZATION REVENUE AFTER IMPLEMENTATION**  
**OF WIRELESS**



**Interpretation:** 86% respondents strongly agree that after implementation of wireless there is increase revenue of the organization, 14% of them disagree this opinion.

**TABLE 17 BARRIERS TO IMPLEMENT WIRELESS TECHNOLOGIES**

| Description                        | No of respondents |    |    |    |     | Total      |
|------------------------------------|-------------------|----|----|----|-----|------------|
|                                    | SA                | A  | N  | DA | SDA |            |
| Insufficient knowledge             | 24                | 48 | 14 | 12 | 27  | <b>125</b> |
| Lack of vendor participation       | 18                | 11 | 43 | 38 | 15  | <b>125</b> |
| Organizational readiness to accept | 34                | 48 | 04 | 12 | 27  | <b>125</b> |
| Cost of implementation             | 25                | 60 | 15 | 10 | 15  | <b>125</b> |
| Lack of sufficient business value  | 24                | 48 | 14 | 12 | 27  | <b>125</b> |
| Technology maturity                | 34                | 48 | 04 | 12 | 27  | <b>125</b> |

## PERCENTAGE OF BARRIERS TO IMPLEMENT WIRELESS

| Description                        | No of respondents |     |     |     |     | Total       |
|------------------------------------|-------------------|-----|-----|-----|-----|-------------|
|                                    | SA                | A   | N   | DA  | SDA |             |
| Insufficient knowledge             | 19%               | 38% | 12% | 9%  | 22% | <b>100%</b> |
| Lack of vendor participation       | 14%               | 9%  | 35% | 30% | 12% | <b>100%</b> |
| Organizational readiness to accept | 28%               | 38% | 3%  | 9%  | 22% | <b>100%</b> |
| Cost of implementation             | 20%               | 48% | 12% | 8%  | 12% | <b>100%</b> |
| Lack of sufficient business value  | 19%               | 38% | 12% | 9%  | 22% | <b>100%</b> |
| Technology maturity                | 28%               | 38% | 3%  | 9%  | 22% | <b>100%</b> |

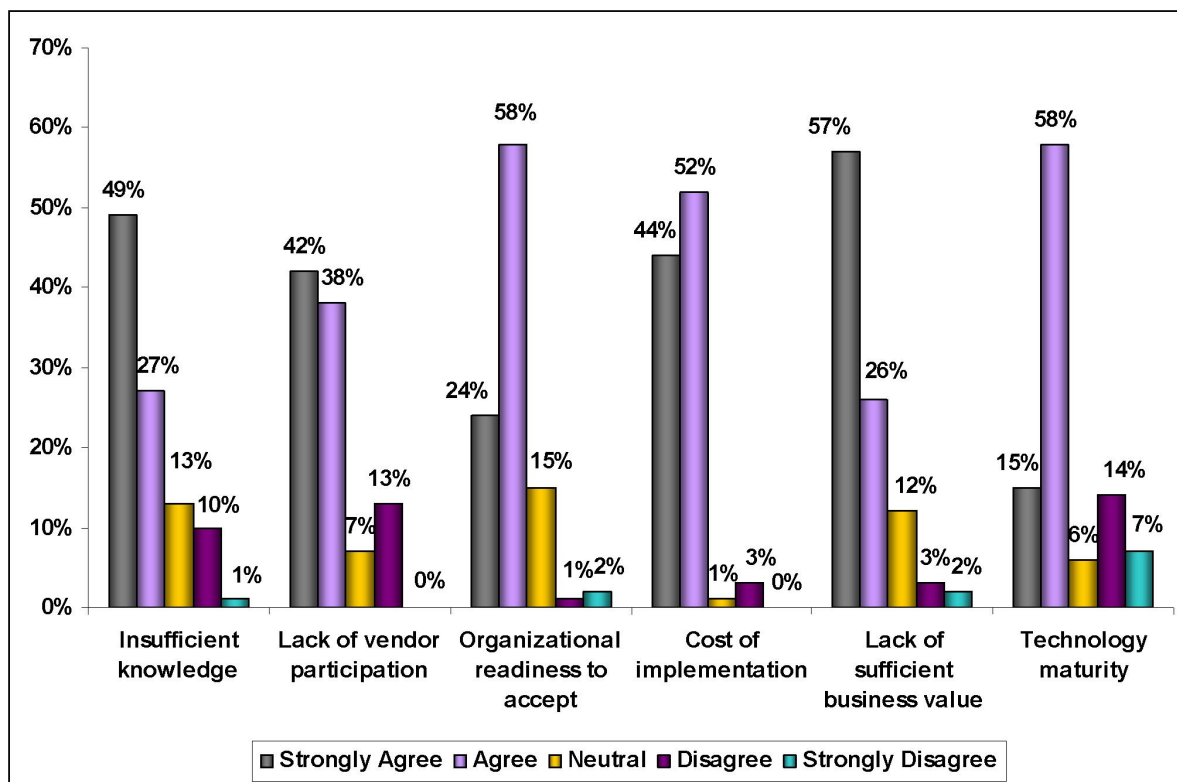
### Inference:

- ✓ 19% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is insufficient knowledge, 38% agree this statement, 12% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.
- ✓ 14% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is lack of vendor participation, 9% agree this statement, 35% of them are neutral towards this 30% of them disagree this and 12% of them strongly disagree this.
- ✓ 28% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is organizational readiness to accept, 38% agree this statement, 3% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.
- ✓ 20% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is cost of implementation, 48% agree this

statement, 12% of them are neutral towards this, 8% of them disagree this and 12% of them strongly disagree this opinion.

- ✓ 19% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is lack of sufficient business value, 38% agree this statement, 12% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.
- ✓ 28% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is technology maturity, 38% agree this statement, 3% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.

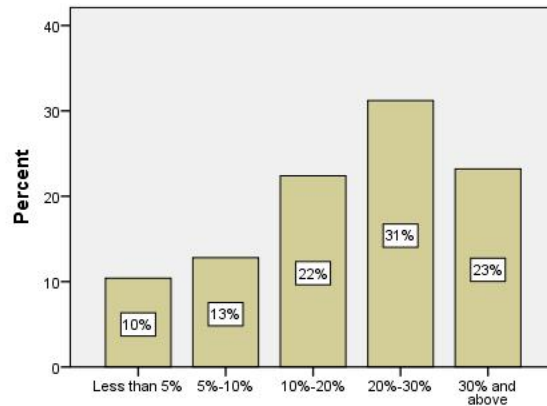
**CHART 17: PERCENTAGE OF BARRIERS TO IMPLEMENT WIRELESS TECHNOLOGIES**



**TABLE 18: EXPECTED GROWTH OF WIRELESS TECHNOLOGIES IN  
NEXT 5 YEARS**

| <b>Expected growth of Wireless technologies in next 5 years</b> |              |                       |                |                          |                                |
|-----------------------------------------------------------------|--------------|-----------------------|----------------|--------------------------|--------------------------------|
|                                                                 |              | <b>Frequen<br/>cy</b> | <b>Percent</b> | <b>Valid<br/>Percent</b> | <b>Cumulativ<br/>e Percent</b> |
| Valid                                                           | Less than 5% | 13                    | 10.4           | 10.4                     | 10.4                           |
|                                                                 | 5-10%        | 16                    | 12.8           | 12.8                     | 23.2                           |
|                                                                 | 10-20%       | 28                    | 22.4           | 22.4                     | 45.6                           |
|                                                                 | 20-30%       | 39                    | 31.2           | 31.2                     | 76.8                           |
|                                                                 | Above 30%    | 29                    | 23.2           | 23.2                     | 100.0                          |
|                                                                 | <b>Total</b> | <b>125</b>            | <b>100.0</b>   | <b>100.0</b>             |                                |

**CHART 18: EXPECTED GROWTH OF WIRELESS TECHNOLOGIES IN  
NEXT 5 YEARS**

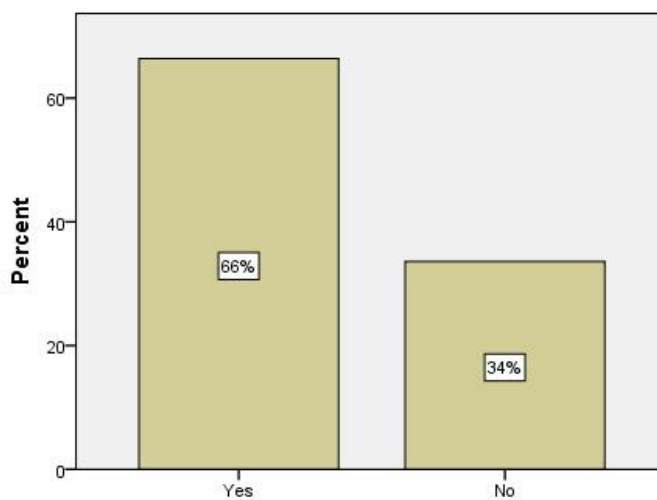


**Interpretation:** 10% of the respondents said less than 5% of expected growth of wireless technologies will be seen in the next 5 years, 13% said the growth rate would be around 5% - 10%, 22% said it is between 10-20%, 31% said it is between 20-30% and the rest 23% said the growth rate would be above 30%.

**TABLE 19: ADOPTION OF WIRELESS TECHNOLOGY REDUCES COST**

| Adoption of wireless technology reduces cost |       |           |         |               |                    |
|----------------------------------------------|-------|-----------|---------|---------------|--------------------|
|                                              |       | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid                                        | Yes   | 83        | 66.4    | 66.4          | 66.4               |
|                                              | No    | 42        | 33.6    | 33.6          | 100.0              |
|                                              | Total | 125       | 100.0   | 100.0         |                    |

**CHART 19: ADOPTION OF WIRELESS TECHNOLOGY REDUCES COST**



**Interpretation:** 66% of the respondents wireless is considerably reducing the cost and 34% of them said it is not cost effective

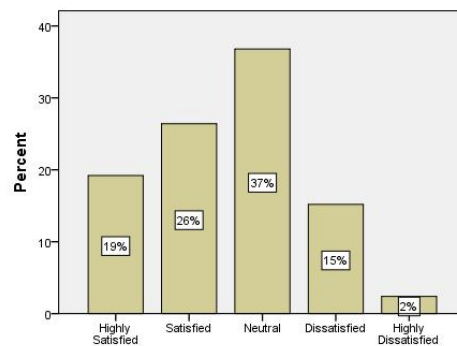
**TABLE 20**

**LEVEL OF SATISFACTION WITH THE IMPACT OF WIRELESS TECHNOLOGY ON WAREHOUSE MANAGEMENT OF MAHINDRA LOGISTICS PVT LTD**

|       |                        | <b>Frequen<br/>cy</b> | <b>Percent</b> | <b>Valid<br/>Percent</b> | <b>Cumulativ<br/>e Percent</b> |
|-------|------------------------|-----------------------|----------------|--------------------------|--------------------------------|
| Valid | Highly Satisfied       | 24                    | 19.2           | 19.2                     | 19.2                           |
|       | Satisfied              | 33                    | 26.4           | 26.4                     | 45.6                           |
|       | Neutral                | 46                    | 36.8           | 36.8                     | 82.4                           |
|       | Dissatisfied           | 19                    | 15.2           | 15.2                     | 97.6                           |
|       | Highly<br>Dissatisfied | 3                     | 2.4            | 2.4                      | 100.0                          |
|       | <b>Total</b>           | <b>125</b>            | <b>100.0</b>   | <b>100.0</b>             |                                |

**CHART 20**

**LEVEL OF SATISFACTION WITH THE IMPACT OF WIRELESS TECHNOLOGY ON WAREHOUSE MANAGEMENT OF MAHINDRA LOGISTICS PVT LTD**



**Interpretation:** 19% of them are highly satisfied with the impact of wireless technology on warehouse management of Mahindra Logistics Pvt Ltd, 26% of them are satisfied, 37% of them said they are neither satisfied nor dissatisfied, 15% of them are found to be dissatisfied and the rest 2% of them said they are highly dissatisfied

## STATISTICAL TOOLS AND ANALYSIS

### **CHI- SQUARE TEST I – ( $\psi^2$ )**

Chi-square is the sum of the squared difference observed (o) and the expected (e) data (or the deviation, d), divided by the expected data in all possible categories.

#### **Null hypothesis (Ho):**

There is a relationship between the experience in supply chain management and wireless technology to increase visibility.

#### **Alternate hypothesis (H1):**

There is no relationship between the experience in supply chain management and wireless technology to increase visibility.

### **Case Processing Summary**

|                                                                                    | Cases |         |         |         |       |         |
|------------------------------------------------------------------------------------|-------|---------|---------|---------|-------|---------|
|                                                                                    | Valid |         | Missing |         | Total |         |
|                                                                                    | N     | Percent | N       | Percent | N     | Percent |
| EXPERIENCE IN SUPPLY CHAIN MANAGEMENT * WIRELESS TECHNOLOGY TO INCREASE VISIBILITY | 125   | 100.0 % | 0       | .0%     | 125   | 100.0 % |

| EXPERIENCE IN SUPPLY CHAIN MANAGEMENT * WIRELESS TECHNOLOGY TO INCREASE VISIBILITY Crosstabulation |              |                                                                     |                                            |           |             |              |                           |            |
|----------------------------------------------------------------------------------------------------|--------------|---------------------------------------------------------------------|--------------------------------------------|-----------|-------------|--------------|---------------------------|------------|
|                                                                                                    |              |                                                                     | WIRELESS TECHNOLOGY TO INCREASE VISIBILITY |           |             |              |                           | Total      |
|                                                                                                    |              |                                                                     | Strongl<br>y Agree                         | Agre<br>e | Neut<br>ral | Disa<br>gree | Strongl<br>y Disagre<br>e |            |
| EXPERIENC<br>E IN<br>SUPPLY<br>CHAIN<br>MANAGEME<br>NT                                             | 0-3<br>Years | Count                                                               | 26                                         | 29        | 0           | 0            | 0                         | 55         |
|                                                                                                    |              | % within<br>EXPERIENC<br>E IN<br>SUPPLY<br>CHAIN<br>MANAGEME<br>NT  | 47.3%                                      | 52.7<br>% | .0%         | .0%          | .0%                       | 100.0<br>% |
|                                                                                                    |              | % within<br>WIRELESS<br>TECHNOLO<br>GY TO<br>INCREASE<br>VISIBILITY | 100.0%                                     | 87.9<br>% | .0%         | .0%          | .0%                       | 44.0<br>%  |
|                                                                                                    |              | % of Total                                                          | 20.8%                                      | 23.2<br>% | .0%         | .0%          | .0%                       | 44.0<br>%  |
|                                                                                                    | 3-7<br>Years | Count                                                               | 0                                          | 4         | 40          | 0            | 0                         | 44         |
|                                                                                                    |              | % within<br>EXPERIENC<br>E IN<br>SUPPLY<br>CHAIN<br>MANAGEME<br>NT  | .0%                                        | 9.1<br>%  | 90.9<br>%   | .0%          | .0%                       | 100.0<br>% |
|                                                                                                    |              | % within<br>WIRELESS<br>TECHNOLO<br>GY TO<br>INCREASE<br>VISIBILITY | .0%                                        | 12.1<br>% | 97.6<br>%   | .0%          | .0%                       | 35.2<br>%  |
|                                                                                                    |              |                                                                     |                                            |           |             |              |                           |            |
|                                                                                                    |              |                                                                     |                                            |           |             |              |                           |            |
|                                                                                                    |              |                                                                     |                                            |           |             |              |                           |            |

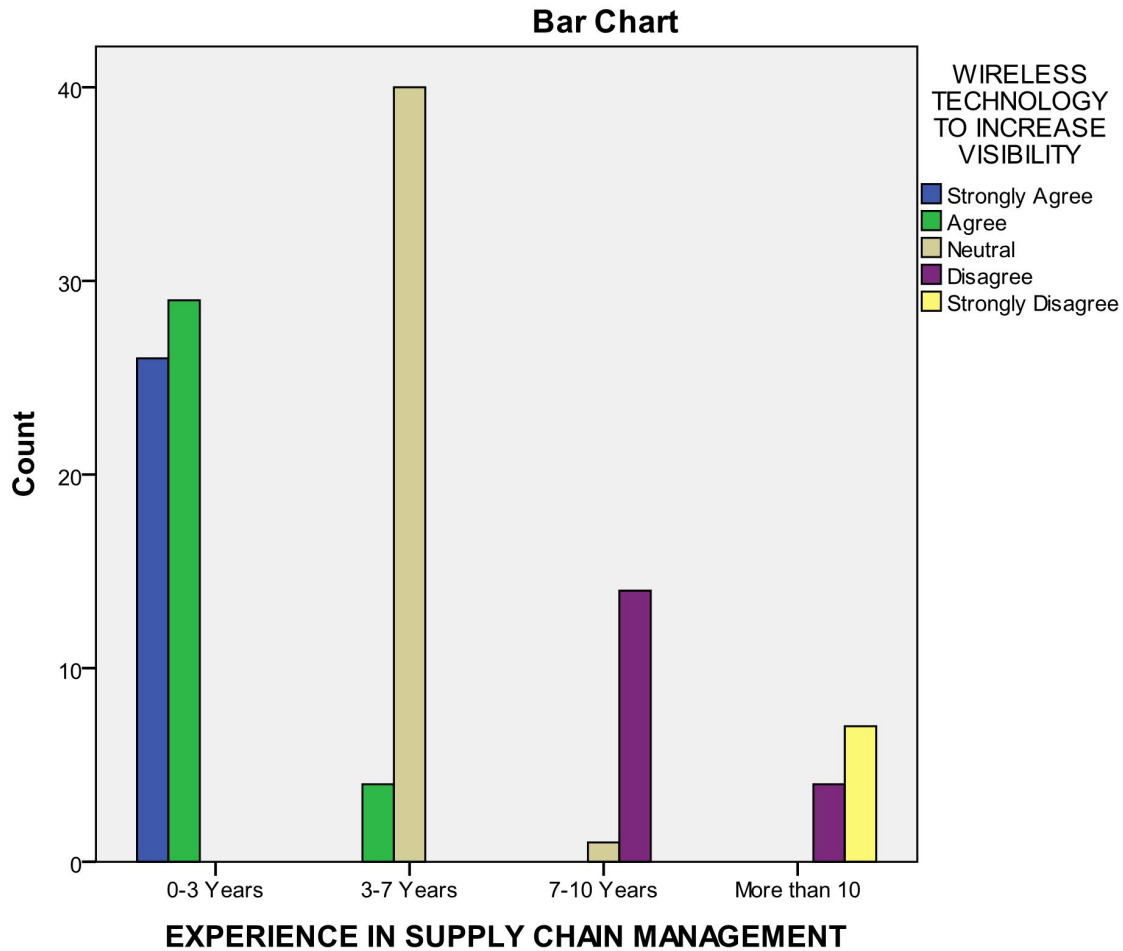
|       |              |                                                      |     |       |        |        |        |         |
|-------|--------------|------------------------------------------------------|-----|-------|--------|--------|--------|---------|
|       |              | % of Total                                           | .0% | 3.2 % | 32.0 % | .0%    | .0%    | 35.2 %  |
|       | 7-10 Years   | Count                                                | 0   | 0     | 1      | 14     | 0      | 15      |
|       |              | % within EXPERIENC E IN SUPPLY CHAIN MANAGEME NT     | .0% | .0%   | 6.7 %  | 93.3 % | .0%    | 100.0 % |
|       |              | % within WIRELESS TECHNOLO GY TO INCREASE VISIBILITY | .0% | .0%   | 2.4 %  | 77.8 % | .0%    | 12.0 %  |
|       |              | % of Total                                           | .0% | .0%   | .8%    | 11.2 % | .0%    | 12.0 %  |
|       | More than 10 | Count                                                | 0   | 0     | 0      | 4      | 7      | 11      |
|       |              | % within EXPERIENC E IN SUPPLY CHAIN MANAGEME NT     | .0% | .0%   | .0%    | 36.4 % | 63.6%  | 100.0 % |
|       |              | % within WIRELESS TECHNOLO GY TO INCREASE VISIBILITY | .0% | .0%   | .0%    | 22.2 % | 100.0% | 8.8%    |
|       |              | % of Total                                           | .0% | .0%   | .0%    | 3.2%   | 5.6%   | 8.8%    |
| Total |              | Count                                                | 26  | 33    | 41     | 18     | 7      | 125     |

|  |                                                     |        |        |        |        |        |        |
|--|-----------------------------------------------------|--------|--------|--------|--------|--------|--------|
|  | % within EXPERIENCE IN SUPPLY CHAIN MANAGEMENT      | 20.8%  | 26.4%  | 32.8%  | 14.4%  | 5.6%   | 100.0% |
|  | % within WIRELESS TECHNOLOGY TO INCREASE VISIBILITY | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
|  | % of Total                                          | 20.8%  | 26.4%  | 32.8%  | 14.4%  | 5.6%   | 100.0% |

### Chi-Square Tests

|                              | Value                | df | Asymp. Sig. (2-sided) |
|------------------------------|----------------------|----|-----------------------|
| Pearson Chi-Square           | 284.844 <sup>a</sup> | 12 | .000                  |
| Likelihood Ratio             | 246.420              | 12 | .000                  |
| Linear-by-Linear Association | 105.526              | 1  | .000                  |
| N of Valid Cases             | 125                  |    |                       |

a. 12 cells (60.0%) have expected count less than 5. The minimum expected count is .62.



Degree of Freedom= (r-1) \*(c-1)

$$= 3*4= 12$$

**Calculated value = 284.844**

**Tabulated value = 21.026**

$Z = Z_{cal} > Z_{tab}$

$$Z = 284.844 > 21.026$$

Hence, the Alternate hypothesis [H1] is accepted

## INFERENCE:

Since the calculated value is greater than the tabulated value, we accept the alternate hypothesis and hence there is a relationship between the experience in supply chain management and wireless technology to increase visibility.

## ONE-WAY ANOVA CLASSIFICATION

### Null hypothesis (Ho):

There is a significance difference between the adoption of wireless technology reduces cost and level of satisfaction with the impact of wireless technology on warehouse management.

### Alternate hypothesis (H1):

There is no significance difference between the adoption of wireless technology reduces cost and level of satisfaction with the impact of wireless technology on warehouse management.

### Descriptives

#### ADOPTION OF WIRELESS TECHNOLOGY REDUCES COST

|                     | N   | Mean | Std.<br>Deviation | Std.<br>Error | 95% Confidence<br>Interval for Mean |                | Minimum | Maximum |
|---------------------|-----|------|-------------------|---------------|-------------------------------------|----------------|---------|---------|
|                     |     |      |                   |               | Lower<br>Bound                      | Upper<br>Bound |         |         |
| Highly Satisfied    | 24  | 1.00 | .000              | .000          | 1.00                                | 1.00           | 1       | 1       |
| Satisfied           | 51  | 1.00 | .000              | .000          | 1.00                                | 1.00           | 1       | 1       |
| Neutral             | 28  | 1.14 | .356              | .067          | 1.00                                | 1.28           | 1       | 2       |
| Dissatisfied        | 19  | 2.00 | .000              | .000          | 2.00                                | 2.00           | 2       | 2       |
| Highly Dissatisfied | 3   | 2.00 | .000              | .000          | 2.00                                | 2.00           | 2       | 2       |
| Total               | 125 | 1.21 | .408              | .036          | 1.14                                | 1.28           | 1       | 2       |

**Test of Homogeneity of  
Variances**

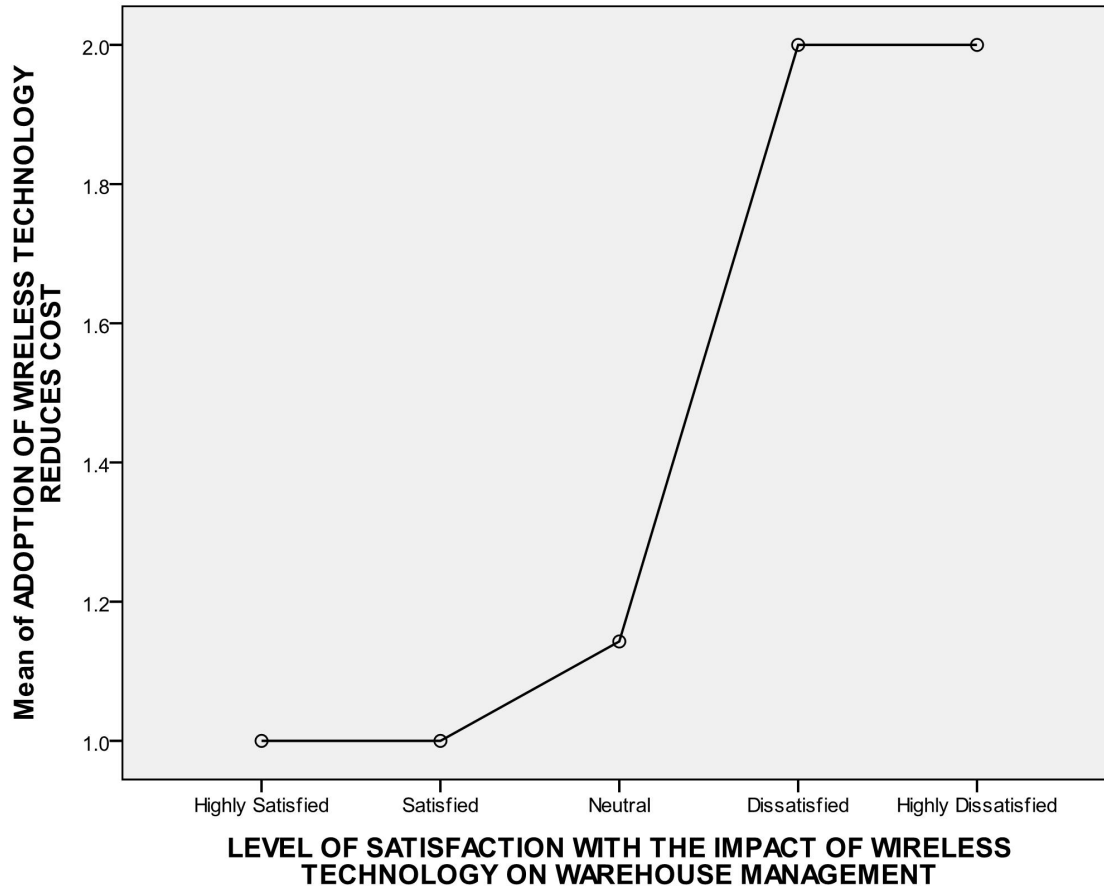
ADOPTION OF WIRELESS  
TECHNOLOGY REDUCES COST

| Levene<br>Statistic | df1 | df2 | Sig. |
|---------------------|-----|-----|------|
| 22.349              | 4   | 120 | .000 |

**ANOVA**

ADOPTION OF WIRELESS TECHNOLOGY REDUCES  
COST

|                   | Sum of<br>Squares | df  | Mean<br>Square | F           | Sig. |
|-------------------|-------------------|-----|----------------|-------------|------|
| Between<br>Groups | 17.163            | 4   | 4.291          | 150.18<br>0 | .000 |
| Within<br>Groups  | 3.429             | 120 | .029           |             |      |
| Total             | 20.592            | 124 |                |             |      |



**Calculated value = 150.180**

**Tabulated value = 2.46**

$F = F_{cal} > F_{tab}$        $F = 150.180 > 2.46$

Hence, the Alternate hypothesis [H1] is accepted.

### **INFERENCE:**

The calculated value of F is greater than the tabulated value. Hence, we reject the null hypothesis and conclude that there is no significance difference between the adoption of wireless technology reduces cost and level of satisfaction with the impact of wireless technology on warehouse management.

## **ANALYSIS USING KARL PEARSON'S CORRELATION**

Correlation analysis is the statistical tool used to measure the degree to which two variables are linearly related to each other. Correlation measures the degree of association between two variables.

### **Null hypothesis (H0):**

There is positive relationship between the wireless technologies to lower inventory and wireless technologies for competitive advantage.

### **Alternate hypothesis (H1):**

There is negative relationship between the wireless technologies to lower inventory and wireless technologies for competitive advantage.

### **Correlations**

|                                                 |                     | WIRELESS TECHNOLOGIES TO LOWER INVENTORY | WIRELESS TECHNOLOGIES FOR COMPETITIVE ADVANTAGE |
|-------------------------------------------------|---------------------|------------------------------------------|-------------------------------------------------|
| WIRELESS TECHNOLOGIES TO LOWER INVENTORY        | Pearson Correlation | 1                                        | .950**                                          |
|                                                 | Sig. (2-tailed)     |                                          | .000                                            |
|                                                 | N                   | 125                                      | 125                                             |
| WIRELESS TECHNOLOGIES FOR COMPETITIVE ADVANTAGE | Pearson Correlation | .950**                                   | 1                                               |
|                                                 | Sig. (2-tailed)     | .000                                     |                                                 |
|                                                 | N                   | 125                                      | 125                                             |

\*\* . Correlation is significant at the 0.01 level (2-tailed).

$$r = \frac{N\sum XY - \sum X \sum Y}{\sqrt{N\sum X^2 - (\sum X)^2} \sqrt{N\sum Y^2 - (\sum Y)^2}}$$

$$r = .950$$

### INFERENCE:

Since r is positive, there is positive relationship between the wireless technologies to lower inventory and wireless technologies for competitive advantage.

## **CHAPTER- V**

### **FINDINGS OF THE STUDY**

1. 87% said that all the functions like Logistics Management, Handling distribution and Dealing Suppliers are dealt by in-house SCM.
2. 53% said they are using stock locator for inventory management
3. Most of the respondents are neutral towards the wireless Technologies to lower inventory
4. 61% of the respondents are neutral towards the wireless technologies for competitive advantage
5. 41% of the respondents are neutral towards the wireless technology to Increase visibility
6. 25% of respondents gave less important that wireless technology reduce operating cost
7. 33% of the respondents are neutral towards the statement that wireless technology reduce order cycle
8. 38% of the respondents agree that Company outlook is the pre requisite for wireless Technologies initiative.
9. 45% of the respondents agree that involvement of management is the pre requisite for wireless Technologies initiative.
10. 48% of the respondents agree that Budget allocations are the pre requisite for wireless Technologies initiative.
11. 38% of the respondents neither agree nor disagree that existence of ERP software is the pre requisite for wireless Technologies initiative.
12. 35% of the respondents neither agree nor disagree that trained manpower is the pre requisite for wireless Technologies initiative.

- 13.38% of the respondents agree that suppliers involvement is the pre requisite for wireless Technologies initiative.
14. 37% of them are having 3-7 years experience,
- 15.48% of the respondents agree that implementation of technology in the company creates pressure from major players.
- 16.19% of the respondents strongly agree that implementation of technology in the company creates compliance to standards, 38% agree this statement, 12% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.
- 17.14% of the respondents strongly agree that implementation of technology in the company creates pressure from major select process,9% agree this statement, 35% of them are neutral towards this, 30% of them disagree this, and 12% of them strongly disagree this opinion.
- 18.28% of the respondents strongly agree that implementation of technology in the company creates competitive advantage, 38% agree this statement, 3% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this.
19. 64% agree this statement that adoption of new technology is needed to prevent pilferage and counterfeiting
20. 39% of them are neutral towards this agree adoption of new technology is needed to enhance customer experience,
21. 67% of them said wireless technology is a trend setter in supply chain management
22. 34% of them are neutral towards agree that adoption of new technology is needed to increase asset efficiency
23. 64% agree this statement, that adoption of new technology is needed to prevent pilferage and counterfeiting

24. 39% of them are neutral towards adoption of new technology is needed to enhance customer experience
25. 67% of them said that wireless technology is a trend setter in supply chain management
26. 34% of them are neutral towards adoption of new technology is needed to increase asset efficiency
27. 47% agree this statement that adoption of new technology is needed to increase corporate control over mechanisms
28. 86% respondents strongly agree that after implementation of wireless there is increase revenue of the organization
29. 19% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is insufficient knowledge, 38% agree this statement, 12% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.
30. 14% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is lack of vendor participation, 9% agree this statement, 35% of them are neutral towards this 30% of them disagree this and 12% of them strongly disagree this.
31. 28% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is organizational readiness to accept, 38% agree this statement, 3% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.
32. 20% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is cost of implementation, 48% agree this statement, 12% of them are neutral towards this, 8% of them disagree this and 12% of them strongly disagree this opinion.

33. 19% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is lack of sufficient business value, 38% agree this statement, 12% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.
34. 28% of the respondents strongly agree that biggest barrier to implement ERP systems for wireless Technologies is technology maturity, 38% agree this statement, 3% of them are neutral towards this, 9% of them disagree this, and 22% of them strongly disagree this opinion.
35. 31% said it is between 20-30% of expected growth of wireless technologies will be seen in the next 5 years
36. 66% of the respondents wireless is considerably reducing the cost
37. 37% of them said they are neither satisfied nor dissatisfied with the impact of wireless technology on warehouse management of Mahindra Logistics Pvt Ltd

## **SUGGESTIONS**

Tracking represents an additional layer of security to ensure goods reach their destination in the same condition as they began their journey, though other layers must be put in place to achieve a more comprehensive level of safety for vehicle and cargo transit. Company is trying to make additional layer of security to ensure whether the products are reached properly.

The main barrier in supply chain vulnerability is often overlooked as the movement of goods from the manufacturer to the port or border crossing, or from the port to the distribution center. Company has to take steps to overcome the problems

Vendor participation in this process is less in the company, so if losses happened it has to be borne by the company alone. The security issue within ERP has been there for a long time, but most of the solutions are based on the assumption that an ERP system is a closed environment. Given current trends, where the ERP is more likely to be an open system, these solutions are insufficient to provide the security. Although there are many researchers working in this area and some solutions are provided to better suite the open environment, yet the security mechanism for ERP system has not yet been brought to the open environment for discussion.

## CONCLUSION

The warehouse often forms the heart of an organization's operations. It's the place through which all materials, products and merchandise flow en route to their final destinations. And among the many industries that rely on warehousing, retailers are leading the growing trend to embrace wireless technologies to transform their warehouse operations and gain ground on the competition. Advances in wireless technology are providing opportunities for companies to think more broadly about how they sell to their customers by extending their sales channels. Mobile technology enables companies to offer customers new methods of access that help streamline processes such as billing, access to product and services information and purchasing.

While Wi-Fi has enabled organizations to significantly increase warehouse efficiencies, it has also made them critically reliant on a technology that can sometimes be complex to troubleshoot. Any interruption in the network that leads to downtime can completely halt operations at the expense of the organization. Recent developments in the realm of international trade have increased the need for heightened security to prevent multi-frontal attacks.

## ANNEXURE

### QUESTIONNAIRE

1. Name : .....
2. Designation : .....
3. Which part of the in-house supply chain management activities do you lay focus on?
  - ☐ Dealing only with suppliers
  - ☐ Handling distribution of finished goods to customers
  - ☐ Logistics management
  - ☐ All of the above
4. What kind of inventory management system does your company have?
  - ☐ Manual
  - ☐ Stock locator
  - ☐ Mahindra Logistics Pvt Ltd Management System
  - ☐ ERP system
5. Is wireless Technologies important to lower excess inventory?
  - ☐ Very Important
  - ☐ Important
  - ☐ Neutral
  - ☐ Less Important
  - ☐ Least Important

6. Do you think wireless Technologies helps to gain competitive advantage?

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

7. Is wireless Technologies needed to increase visibility in supply chain by tracking goods in supply chain?

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

8. Wireless Technologies is essential in reducing in reducing operations cost?

- ☐ Very Important
- ☐ Important
- ☐ Neutral
- ☐ Less Important
- ☐ Least Important

9. “To reduce order cycle wireless Technology is important” - Comment

- ☐ Very Important
- ☐ Important
- ☐ Neutral
- ☐ Less Important
- ☐ Least Important

10. What is the most important prerequisite for supply chain management initiative?

| Description               | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---------------------------|----------------|-------|---------|----------|-------------------|
| Company outlook           |                |       |         |          |                   |
| Involvement of management |                |       |         |          |                   |
| Budget allocations        |                |       |         |          |                   |
| Existence of ERP software |                |       |         |          |                   |
| Trained manpower          |                |       |         |          |                   |
| Suppliers involvement     |                |       |         |          |                   |

11. How many years experience in Supply Chain Management?

- ☐ 0-3 years
- ☐ 3-7 years
- ☐ 7-10 years
- ☐ 10 and above

12. What is your perception towards wireless technology implementation in a company?

| Description                                      | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|--------------------------------------------------|----------------|-------|---------|----------|-------------------|
| Pressure from major players                      |                |       |         |          |                   |
| Compliance to standards                          |                |       |         |          |                   |
| Select process (point solution for specific app) |                |       |         |          |                   |
| Competitive advantage                            |                |       |         |          |                   |

13. Is wireless Technology helps to prevent pilferage and counterfeiting stock?

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

14. Do you agree that wireless Technology helps to enhance customer experience?

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

15. Do you think wireless technologies are a trend setter in Supply Chain Management?

- ☐ Yes
- ☐ No

16. Is wireless Technology helpful in increasing asset efficiency?

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

17. “wireless Technology increase corporate control over mechanisms” –  
Comment

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

18. Do you agree that there is an increase in revenue after implementation of wireless in the organisation?

- ☐ Yes
- ☐ No

19. What do you perceive as the biggest barriers to wireless implementation?

| Description                                 | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---------------------------------------------|----------------|-------|---------|----------|-------------------|
| Insufficient knowledge of wireless          |                |       |         |          |                   |
| Lack of vendor participation                |                |       |         |          |                   |
| Organisational readiness to accept wireless |                |       |         |          |                   |
| Cost of implementation                      |                |       |         |          |                   |
| Lack of sufficient business value           |                |       |         |          |                   |
| Technology maturity                         |                |       |         |          |                   |

20. What is the expected growth of wireless technologies in next 5 years?

- ☐ Less than 5%
- ☐ 5% - 10%
- ☐ 10% - 20%
- ☐ 20% - 30%
- ☐ 30% and above

21. Is adoption of wireless technology reduces cost?

☐ Yes

☐ No

22. Are you satisfied with the impact of wireless Technology on Management of Mahindra Logistics Pvt Ltd?

☐ Highly Satisfied

☐ Satisfied

☐ Neutral

☐ Dissatisfied

☐ Highly Dissatisfied

23. Your overall suggestions towards wireless Technology in Mahindra Logistics Pvt Ltd

.....

## **BIBLIOGRAPHY**

### **WEBSITE REFERENCE:**

<https://mahindralogistics.com>

<https://files.techmahindra.com>

<https://www.logisticsinsider.in>

<https://cio.economictimes.indiatimes.com>