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DEPARTMENT OF CIVIL ENGINEERING

RE-ENGINEERNIG LOGISTICS CONTROL PROCESS

PROJECT REPORT

Submitted by

Madhan N **USN: 1RV17CV055**

Under the guidance of

Internal Guide	External Guide
Dr. K N Subramanya	Mr. Gurpreet Singh Saini
Principal	Senior Manager II
R.V. College of Engineering	Flipkart Pvt Ltd

In partial fulfilment for the award of degree of
Bachelor of Engineering in
Civil Engineering
2020-2021

RV COLLEGE OF ENGINEERING®, BENGALURU-59

(Autonomous Institution Affiliated to VTU, Belagavi)

DEPARTMENT OF CIVIL ENGINEERING

CERTIFICATE

Certified that the major project work titled ***'Re-engineering Logistics Control Process'*** is carried out by **Madhan N (1RV17CV055)** in partial fulfilment for the award of degree of **Bachelor of Engineering in Civil Engineering** of the Visvesvaraya Technological University, Belagavi during the year 2020-2021. It is certified that all corrections/suggestions indicated for the Internal Assessment have been incorporated in the major project report deposited in the departmental library. The major project report has been approved as it satisfies the academic requirements in respect of major project work prescribed by the institution for the said degree.

Signature of Head of the Department	**Signature of Guide & Principal**
Dr. Radhakrishna	**Dr. K.N. Subramanya**
Prof. & Head Dept. of Civil Engg., R.V. College of Engineering Bangalore-560 059	PRINCIPAL RV COLLEGE OF ENGINEERING BENGALURU - 560 059

External Viva

Name of Examiners	**Signature with Date**
1	
2	

Letter of Engagement

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20-Jan-2021

Madhan N

Dear **Madhan N,**

Congratulations!!

After a rigorous process of selection, we are pleased to offer you the position of an **Intern** with InstaKart Services Private Limited (**"Flipkart"** or the **"Company"**) as per the terms of reference given below at our Bangalore-ETV office.

Your internship period will be from **01-Feb-2021 to 30-Jun-2021.** For this position, you will be paid a Stipend of **INR 50000 (Rupees Fifty Thousand Only) per month** (subject to deduction on leaves) and Meal Allowance of **INR 2,200** per month.

At Flipkart, you will soon discover, is all about people - the best people. This offer comes to you as the culmination of a rigorous selection process and you are sure to find a challenging peer group at Flipkart. We are positive you will find the work environment stimulating and conducive to helping you realize your professional goals.

We trust our relationship will be guided by a quest for excellence in all facets of our interactions as well as based on a foundation of mutual respect and sincerity in all dealings.

Please endorse your acceptance by duly signing the duplicate copy of this letter at the earliest.

Welcome aboard!

For InstaKart Services Private Limited

Sameera Chowdry

Sameera Banu Chowdry
Associate Director - People Operations

ACCEPTANCE

I accept internship with the Company under the terms set forth in this letter:

Name: Madhan N

DocuSigned by:

Signature:

7CC06B8AB2C94BD...

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DECLARATION

I, Madhan N student of eighth semester B.E., Department of Civil Engineering, RV College of Engineering, Bengaluru-59, bearing **USN: 1RV17CV055** hereby declare that the major project titled ***'Re-engineering Logistics Control Process'*** has been carried out by me and submitted in partial fulfilment for the award of degree of **Bachelor of Engineering** in Civil Engineering during the year 2020-21.

Further I declare that the content of the dissertation has not been submitted previously by anybody for the award of any degree or diploma to any other university.

Place: Bengaluru

Date: 02/07/2021

Madhan

Signature

Name

MADHAN N (1RV17CV055)

ACKNOWLEDGEMENT

I am indebted to my guide**, Dr. K N Subramanya, Principal, R V College of Engineering,** for his wholehearted support, suggestions and invaluable advice throughout my project work and also helped in the preparation of this thesis. I would also like to extend my gratitude to **Mr. Gurpreet Singh Saini, Senior Manager II, Flipkart Pvt Ltd** for his guidance in the mechanics of the project.

I also express my gratitude to my panel members **Dr. Radhakrishna**, Professor and Head of Department, **Dr. B C Udaya Shankar,** Professor, **Dr. Somnath M Basutkar,** Assistant Professor and **Mr. M Varuna,** Assistant Professor, Department of Civil Engineering for their valuable comments and suggestions.

My sincere thanks to **Dr. Radhakrishna**, Professor and Head, Department of Civil Engineering, RVCE for his support and encouragement.

I express sincere gratitude to our beloved Principal, **Dr. K.N. Subramanya** for his appreciation towards this project work.

I thank all the **teaching staff and technical staff** of Civil Engineering department, RVCE for their help.

Lastly, I take this opportunity to thank my **family** members and **friends** who provided all the backup support throughout the project work.

ABSTRACT

The project focuses on observing the processes in Cross-Dock and identify the Non-Value-Added activities. The main objective of the project was to increase the productivity of the Cross-Dock by reducing the wastes (Muda). The processes were observed, enlisted, segregated into Value-Added Activities and Non-Value-Added Activities, data collected and analyzed using Time and Motion Study (TMS) and Value Stream Mapping (VSM), action plan prepared using Kaizen tools and implemented, and finally, the results calculated.

After analyzing the processes, it was seen that the non-value-added time in the cross-dock was high, certain processes were repetitive and there wasn't enough transparency in few processes. The time and effort spent in certain processes were more than required. The process of van validation which involves vendor payment, making it sensitive, had lots of manual interference. To overcome these problems, the improvement plan consisted of a major process change and Kaizens that mainly focused on improving the processes so that they become more transparent and on reducing the process time the productivity in the cross-dock is increased, thus improving its efficiency.

While closely observing the processes in the Cross-Dock, it was seen that the existing process of Van (Vehicle) Validation was manual. The chances of manual errors were very high. The Vans utilized in the Grocery Last Mile are provided by the Third-Party Vendors. The payment to the vendors is done monthly based on the distance traveled by the vans. Hence, lots of manual interference in the process gives rise to ethical and compliance issues. Also, the errors will lead to cash leakages. In order to bring in an error-proof and transparent method of validating the vans, automation of the process was done. The other processes in the cross-dock were observed and changes were brought in through Kaizens. These Kaizens, helped in faster processes, contributing to improving the overall productivity in the Cross-Dock. The unnecessary movement of men and material in the cross-dock was also reduced to a great extent. By implementing the PDCA cycle, the Kaizens helped in increasing the percentage of Value-Added time from 13.56% to 14.43%. This also resulted in an increase in the productivity of the cross-dock by 1.46 units. The increase in productivity promises more time for delivery and hence making it possible for delivering more orders.

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1. **ABP-** Automated Beat Planning
2. **BP-** Business Partner
3. **BPU-** Boxes Per Unit
4. **C/T-** Cycle Time
5. **CBA-** Cost Benefit Analysis
6. **CMT-** City Maintenance Team
7. **CPS-** Cost Per Saving
8. **DB-** Delivery Bags
9. **DRS-** Daily Run Sheet
10. **ENVA-** Essential Non Value Added Activities
11. **PDCA-** Plan, Do, Check and Act
12. **FC-** Fulfilment Centre
13. **OPD-** Orders Per Day
14. **VA-** Value Added activities
15. **NVA-** Non Value-Added activities
16. **CT-** Cycle Time
17. **TT-** Takt Time
18. **Muda-** Waste
19. **VSM-** Value Stream Mapping
20. **TMS-** Time and Motion Study
21. **VOD-** Vehicle On Dock
22. **TD-** Truck Dock

CHAPTER-1
INTRODUCTION

CHAPTER 1
INTRODUCTIO
N

This project titled "**RE-ENGINEERING LOGISTICS CONTROL PROCESS**" is carried out at Flipkart Grocery, Flipkart Pvt Ltd, Bengaluru.

The approach adopted towards this project is to first observe the existing processes in the Grocery Cross Dock. The grocery cross dock is operational in all the days of a week. The delivery of the grocery orders to customers takes place in 2 shifts a day i.e., Morning (1H) shift and Evening (2H) shift. As shown in the Figure 1.1 below, the canters from the Fulfilment Centre arrive twice in a day to the cross-dock. In the cross-dock, the orders are unloaded from the canter and loaded into delivery vans depending on the beat planning.

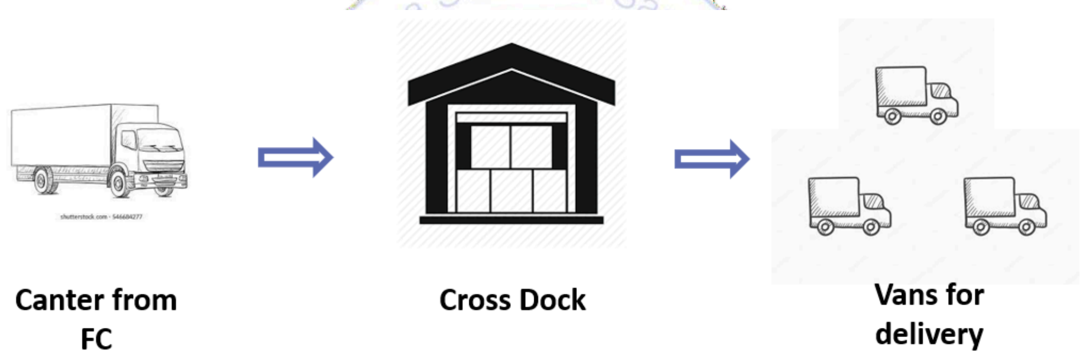

Figure 1.1: Flow of Orders

Logistics planning ensures that orders promptly arrive at the cross docks, gets loaded into the respective vans and leave for delivery within the stipulated time. Cross docking eliminates the put-away process and directs the product to shipping. Decreasing order fulfillment time is essential when orders like groceries have to be delivered soon. Cross dock minimizes handling time and storage time. It is the fastest way to get a product in the warehouse and out the door to the customer.

This project mainly focuses on improving overall productivity in the cross-dock by reducing the non-value-added activities and cycle time by automating certain processes and implementing Kaizens.

1.1.Organizational Profile: Flipkart Pvt Ltd

Flipkart is an Indian e-commerce company, headquartered in Bengaluru, Karnataka and incorporated in Singapore as a Private Ltd. The corporate initially focused on online book sales before expanding into other product categories like consumer electronics, fashion, home essentials, groceries, and lifestyle products. As of March 2017, Flipkart held a 39.5% market share of India's e-commerce industry. Flipkart encompasses a dominant position within the apparel segment, bolstered by its acquisition of Myntra. Flipkart also owns PhonePe, a mobile payments service based on the Unified Payments Interface (UPI). In August 2018, U.S retail giant Walmart acquired a 77% controlling stake in Flipkart**.**

1.1.1 The Business Units of Flipkart

- Flipkart Large
- Flipkart Non-Large
- Flipkart Grocery
- Flipkart Hyperlocal

1.1.2 Subsidiaries of Flipkart

- Ekart Logictics
- Myntra
- Jabong
- PhonePe
- Mallers, Inc
- Ugenie, Inc
- Scapic Innovations Pvt Ltd

The logo of Flipkart is is given below in Figure 1.2.

Figure 1.2: Flipkart Logo

1.1.3 Location

The company is headquartered in Bengaluru, Karnataka.

1.2. Literature Review

According to **S Santosh Kumar and M Pradeep Kumar[1]** Trying to improve the productivity and customer response is very important. Cycle time can act as an important aspect while trying to do so. Tools such as lean manufacturing and line balancing is required to reduce cycle time. This will help in reducing NVA works in the assembly line. Line balancing will make sure there is no delay and unnecessary value-added work to be present in the work stations.

According to **Rahul Pulkurte, Ravindran Masilamani, Sarvesh Sonpatki, Rajesh Dhake[2]** Line balancing is used to make sure that all processes run smoothly without any delays and to make sure there isn't any bottlenecks. By line balancing we can achieve equal cycle time for all the stations such that it can easily supply to customers on time. In this paper they focus on productivity improvement in the assembly line which has various stations. To do this the paper has looked at eliminating unwanted mudas, changing layout to be more ergonomic, changing the standard work procedures of work stations, Clubbing and eliminating of operations to reduce workers and REBA analysis.

According to **Dinesh Sethy and Vaibhav Gupta[3],** value stream-mapping is a mapping in which all the components and sub-assemblies are mapped, which pictures material and information flow of all the components. This visually depicts the flow of all the components and where all the wastes are eliminated. In this paper a technique of value stream mapping helps in improvement in productivity at all the phases that a material undergoes in the industry. This is supported by calculation of takt time and areas at gap. Inventory and finished goods also affect productivity and per person, gain in production affects the production improvement. Present and future condition of supplies at shop floor are identified and analyzed using value stream mapping.

According to **Azharul Karim and Kazi Arif-Uz-Zaman[4],** the methodology of lean evaluation matrices proposed lean tools and techniques helps to achieve most significant lean culture and continuous improvement. In terms of effectiveness and efficiency it is one of the measurement matrices is continuous improvement. Various lean philosophy's is based on principles of lean. Those philosophies are value identification, Muda elimination and smooth flow of generation. This philosophy was based on lean principles. The three core principles are identified as:

(1) Identification of waste;

(2) Elimination of waste; and

(3) The generation of smooth flow (Womack et al., 1990).

According to **Vipulkumar V. Mori, Yuvrajsinh B. Kanchava, Pravin A. Karetha, Manish B. Charola[5],** in order to have minimum cost and good quality product and minimum delivery time we need to also have customer satisfaction. How to achieve all this is by improving production at assembly line and making simple changes at workstation at assembly line. In order to improve the speed of production and to have best quality products we need to identify all the hidden Kaizens and improve those hidden opportunities at workstation. The output will increase drastically when cost and benefits are calculated and time taken is reduced at the production. By analyzing the present condition and completely eliminating all the non-value-added activities procedure for standard operating and cycle time is reduced. Various problems at the assembly lines to be resolved and unique Kaizens are implemented to reduce the muda and improve the production at the assembly line. The rate of quality, production are to be minimized with rate of rejection.

According to **Milan Radosevic, Milan Pasula, Nemenja Berber, Neskovic Nebojsa, Branislav Nerandzic[6],** reengineering processes is a complex process consisting of many elements that the companies have to focus on. First and foremost it is necessary to analyze the processes instead of focusing on company's functions and activities. Am appropriate methodology has to be figured out to implement the changes. The changes should also be analyzed after implementation. During reengineering, usage of modern technologies have to be adopted for better results. The approach of implementation should be in a phased manner. Top down approach is more acceptable.

According to **Anchal Gupta, Rajesh K. Singh, Pradeep K. Suri[7],** the Indian logistics service providers face a lot crucial challenges. The system in which they operate have to undergo automation and optimization in order to work with the improved and technologically modernized market. They lack efficient technical system. There is always a need for availability of technical systems and updated technology.

According to **Saurabh Sharma[8],** India's e-commerce industries are readily growing. When the encounter problems and challenges, the solutions drive technology adoption. Companies can combine payment and last mile logistics to address the risks of returns and cash on delivery. To reduce the high rate of returns, the delivery accuracy and quality is to be improved. The logistics providers in tier II and tier III cities can capture the growth pockets easily with their ideation and innovations in the process.

According to **Allen, Piecyk, Piotrowska, McLeod, Cherrett, Nguyen, Bektas, Bates, Friday, Wise and Austwick[9],** the pressure on the last mile logistics mainly include the peakness of seasonal demand patterns, the reduced lead-times between customers placing orders and deliveries being made. They have to manage high levels of product return. Most of them lack affordable logistics depots and fulfilment centres. Most of them invest very little on the maintenance of the vehicles.

According to **Mohd Ghazali, Maarof and Fatimah Mahmud [10],** one method to improve business competitiveness is by applying the concept of continuous improvement also known as Kaizen. The factors such as good communication between the top management and their employees, clear corporate strategy, the presence of a Kaizen champion personnel in the organization, good knowledge management and employees empowerment were found to contribute to the successful implementation of Kaizen. The review also found that resistance to change, failure to motivate employees, lack of understanding on companies' strategic path and difficulties in managing continuous improvement itself formed some of the challenges in implementing Kaizen. It appears some similarities exist between small and medium enterprises, and large companiesinterm of the contributing factors in implementing Kaizen. Thus, this paper can provides some insights into the factors contributing to successful implementation of Kaizen and its challenges. Hopefully, this paper can be beneficial to the Small and Medium Enterprises as well as other industry players in formulating their continuous improvement or Kaizen strategies.

According to **Raquel Acero, Marta Torralba, Roberto Perez-Moya, Jose Antonio Pozo[11],** value stream analysis is necessary to apply lean methodology in military logistics process. The critical activities of the processes have to be identified first. The value-added activities in the affected areas were assessed. The critical activities were eliminated, improved or redefined. The value-added activities increased and hence the overall efficiency too.

According to **Lang Jung CHENG [12],** Before the implementing Kaizen events, an organization needs consultant to survey the current status and to determine which Kaizen activities can be improved. The consultant should communicate with top management to understand the expectations of the organizational improvements. A macro view 3 steps framework for implementing kaizen events

1. **Open meetings**: In an interactive meeting a kaizen sensei teaches skills improvement courses.

the skills needed in implementing the improvement activities and then the SITs implement the improvement events.

2. **Close meeting**: The improvement plans are presented by the SITs in a kaizen seminar where the top management and kaizen sensei confirm and comment on these plans.

According to **Farris, J.A, Van Aken, E.M, Doolen, T.L. and Worley, J [13],** An input-outcome model can be used to understand the team effectiveness in implementing kaizens as given by J.A.Farris (2009) [16] with five basic factor groups. These groups are kaizen event design antecedents, Organizational and work area antecedents, Kaizen event process factors, Social system outcomes and Technical system outcomes.

According to **Yiyo Kuo[14],** truck and van sequencing and the dock assignment influence the efficiency of a cross docking operation. He also proposed a make-span calculation model to optimize sequencing and dock assignment. He explains how to improve the efficiency of the optimum usage of the cross docks.

According to **Ammar Mohamed Aamer[15],** several areas of wastes were found in the cross docking operations. The wastes contributed to the long lead time. He explains the process of understanding the cross docking workflow and lead-time issues. Using Value stream mapping, he says how to identify the waste and maximise the order throughput.

The above papers explain different ways to identify the Value added and Non-value added activities in the cross dock. The usage of tools like VSM and TMS is also explained. The cross-docking operation optimization is also understood. The usage of Kaizens to optimize the processes and to eliminate the mudas is also learnt. The overall productivity of the cross dock can be improved with necessary process changes and usage of technologies.

1.3.Motivation for research

The motivation for this project was to create a new and innovative solution to existing difficulties and problems in the Grocery cross-dock. The unnecessary time and effort in various processes can be potentially reduced. As a result, the percentage share of Value-Added-Activities in the grocery cross dock increases thus improving its productivity. Few manual processes had to be converted to automated processes to speed up as well as to maintain transparency in the process. The incidental work and Muda in the assembly were high and there was high scope for improvement. This motivated to apply theoretical knowledge in practice.

1.4.Problem Statement

1. Van (Vehicle) Validation - Current process of van validation is not transparent. There are high chances of ethical and compliance issues due to manual intervention. The chances of manual errors are also high which can lead to cash leakages.
2. Day Start Process - Current through put time for Day start process is 62 mins. The reason for this:
    - Non-value-added time is very high.
    - Movement of men and material is high.
3. Carbon Emission Analysis – The Grocery last mile contributes substantial amount of Carbon Dioxide in the atmosphere. The carbon emitted has adverse effects which has to be controlled.

1.4.1 Industrial Reasons

There is lot of scope for improvement at the FC and vendors to meet daily target requirement. Cross Docks face various problems such as,

1. Canter and Van Delay
2. Poor Cross Dock design.
3. Late arrival of Wishmasters.
4. Mixed up pallets due to errors in ASRS in FC
5. Technical errors in beat planning
6. FIFO not followed properly due to errors in Automatic tote staging in FC.

1.4.2 Delivery (customer) related Reasons

Extra Processes take place in Cross Dock due to certain customer related reasons. The challenges faced might be:

1. Delivery during time other than the chosen timeslot.
2. Partial mismatch of orders
3. Complete order mismatch
4. Order refusal/exchange by customers

5. Damages in the products

6. Expired products

1.5.The objective of the project:

a) Van (Vehicle) Validation – To improve the transparency of the process by automating it.
b) Day Start Process- To improve actual productivity of the cross-dock by at least 1 unit.

1.6.Organization of the Report

The report is bifurcated into different chapters that starts with introduction and then moves on the different concepts.

Chapter 1 deals with the introduction to project with an overview of what is the final motive of conducting this project. Then about Flipkart Pvt Ltd, Bangalore, overview of an appropriate literature survey, motivation for this study, problem genesis, objective and the methodology followed for execution of the report.

Chapter 2 provides the information about the tools and techniques used to study and solve the problem. Collection of data of all processes in the Cross-Dock and their time study. Identifying the critical steps in the processes and taking those critical processes under consideration for the improvement. Using various tools such as 5S, Kaizens, TMS, VSM and PDCA cycle for implementation.

Chapter 3 deals with the methodology of data collection for TMS. Preparing the current state VSM of the processes using the TMS. Understanding the root cause and reducing and eliminating the NVA Activities in the Cross Dock.

Chapter 4 dwells on with the implementation of the methodology to improve the productivity in the Cross Dock. Representation of improvement that is made by showing before conditions and after conditions. Further, this chapter explains each module elaborately with all the data collected and conclusion from the analyzed data.

Chapter 5 is on the aspects leading to conclusions and percentage of improvement in Value-Added time. Conclusions will be supported by the results from chapter 4.

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CHAPTER-2 OVERVIEW OF TOOLS AND TECHNIQUES USED FOR PROBLEM

CHAPTER 2
OVERVIEW OF TOOLS AND TECHNIQUES USED FOR PROBLEM

There were various tools and techniques used in the project to obtain the expected results. The different tools and techniques and methodologies used are explained in this section of the report.

2.1 Various Tools and Techniques

Various Tools and techniques were used to observe, analyze and optimize the processes in the cross dock. Kaizen tools, Time & Motion Studies and PDCA cycle for implementation were used. For Van Validation, an application, named 'Scan It to Office' was used for the process automation.

2.1.1 Kaizen tools and techn

1. **Value Stream M** nap is a flowchart depicting all the activities requir ial to delivery to the customer. Its main agenda is n the process.
2. **Takt time:** Tal ng order from customer to handing over the produc ize through reduction of waste and other unwanted ac
3. **Standard Operating I** on standardize all the operating procedures for comparing and creating scope for further improvements.
4. **Kaizen Blitz/Kaizen Event:** Kaizen blitz or kaizen event involves cross functional teams for small incremental improvements projects.
5. **7 wastes:** The 7 wastes include transportation, waiting, overproduction, defective parts, inventory, movements and excessive processing.

2.1.2 Time and Motion Studies

It is the systematic observation, analysis, and measurement of the separate steps in the performance of a specific job for the purpose of establishing a standard time for each performance, improving procedures, and increasing productivity.

This aims at examining the way an activity is being carried out, simplifying or modifying the method of operation to reduce unnecessary or excess work, or the wasteful use of resources, and setting up a time standard for performing that activity.

Time study is a direct and continuous observation of a task, using a timekeeping device to record the time taken to accomplish a task and it is often used when:

- there are repetitive work cycles of short to long duration
- wide variety of dissimilar work is performed
- process control elements constitute a part of the cycle

2.1.3 PDCA Model

PDCA (Plan-Do-Check-Act) is an iterative, four-stage approach for continually improving processes, products and for resolving problems. It involves systematically testing possible solutions, assessing the results, and implementing the ones that have shown to work. It is a problem-solving technique that is being used during the project. Figure 2.1 shows the PDCA cycle.

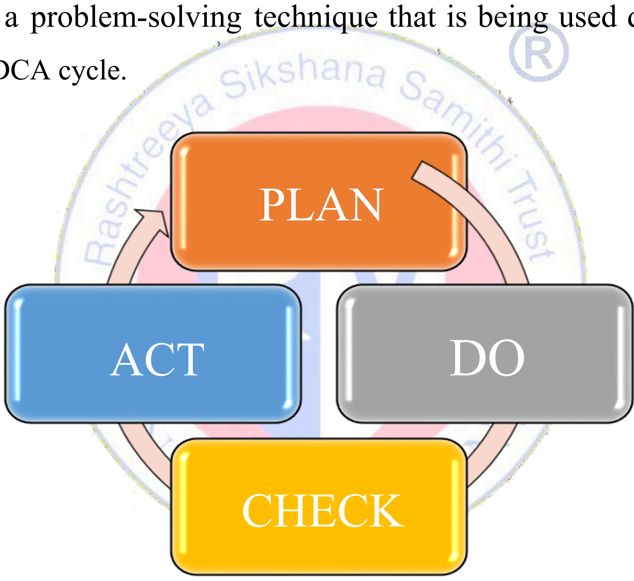


Figure 2.1 PDCA Cycle

1. **Plan** – Identify the problem, collect relevant data, and understand the problem's root cause, develop solution about what the issues may be, and decide which one to test.
2. **Do** – Develop and implement a solution, decide upon a measurement to gauge its effectiveness, test the potential solution, and measure the results.
3. **Check** – Confirm the results by comparing the data collected before and after the process changes. Study the result, measure effectiveness, and decide whether the hypothesis is supported or not.
4. **Act** – Document the results, inform others about process changes, and make

recommendations for the future PDCA cycles. If the solution was successful, implement it. If not, tackle the next problem and repeat the PDCA cycle again.

2.1.4 Scan-It-to Office Application

Remote Data Collection and Barcode Scanning: Scan-IT to Office is the complete solution for mobile data collection and barcode scanning. The mobile app captures barcodes, images, user input, GPS locations, etc. Cloud services immediately transfer the data into arbitrary desktop applications, Excel spreadsheets, documents, databases and much more.

The Scan-IT to Office App captures data and barcodes anywhere. Smart cloud services transfer the remotely collected data to arbitrary target systems, documents or databases. This works in real-time regardless of the devices' locations, even across different offices, facilities or countries.

Field Types: The form editor currently provides the following field types:

- Barcode scan
- Text
- Number
- List box
- Date
- Time
- Checkbox
- Image
- Location data
- Date & time
- Static text
- Stopwatch

Figure 2.2: Scan-IT to Office Logo

Figure 2.2 shows the logo of the Scan-IT to Office application.

Multiple Users and Multiple Targets: Multiple mobile devices can be used to scan data into one single target document (Microsoft Word / Excel, Google Sheets or Google Chrome) simultaneously. To do this, pair each Scan-IT to Office App with a single Scan-IT to Office Add-In/Tool. A single mobile device may send the scanned data to multiple target documents at the same time. To do this, pair the Scan-IT to Office App with multiple Add-Ins or Tools.

Working of the App: The Scan-IT to Office solution uses Microsoft Azure cloud services, as shown in Figure 2.3. The servers are hosted in Texas/USA. The communication is secured using Transport Layer Security (TLS). By default, mobile collected data is transmitted using end-to-end encryption. The servers do not store data permanently. Data collected with the App is discarded immediately after processing it. Configuration data is stored exclusively in the App (on the mobile device) or in the private storage of the Scan-it to Office Add-In/Tool (on your desktop computer). For pairing purposes, an anonymized mobile device ID is exchanged with the Scan-IT to Office Add-In/Tool. No user or account data is used. To identify connected Add-Ins/Tools in the App, a randomly generated Add-In/Tool ID and the Add-In/Tool name are exchanged with the Scan-IT to Office App. No user or account data is used.

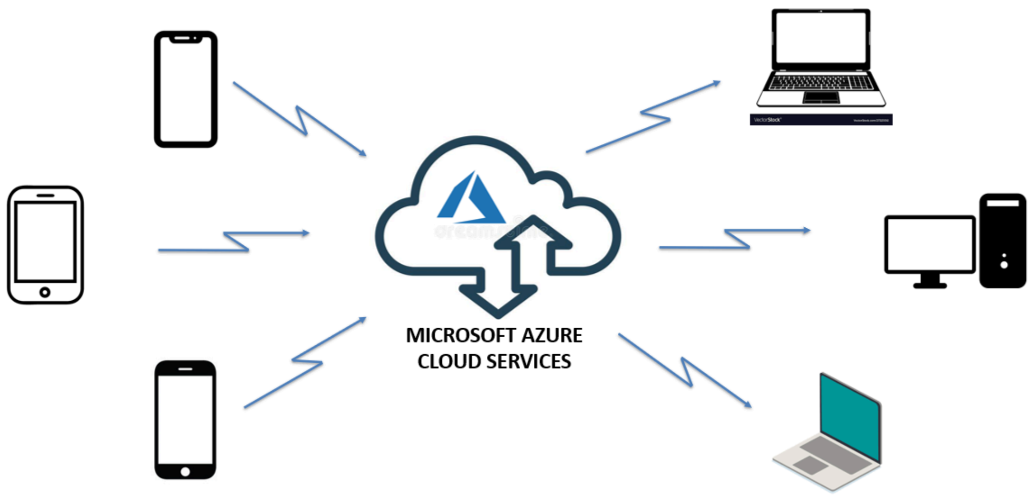


Figure 2.3: Working of the App

Via an Internet service connection, cloud storage works by enabling users access and to download data on any chosen device, such as a laptop, tablet or smartphone. Cloud storage users can also edit documents simultaneously with other users as well, making it easier to work away from the office. Depending on specific needs, prices vary for cloud storage. As an individual user, you can usually get initial amounts of cloud storage for free – such as 5GB with Apple iCloud, which previously dealt with some highly publicized cloud security issues. Common price models include monthly or yearly rates, depending on the services used by the user.

Few International Customers:

- Continental Airlines - Houston, TX
- Harvard University (NOvA Experiment at Fermilab) - Cambridge, MA
- Lucent Technologies
- Military Traffic Management Command (Army) - Alexandria, VA
- Pfizer, Inc.
- State of Florida (Highway Dept.) - Tallahassee, FL
- US Bank
- IBM Deutschland GmbH
- BMW Österreich Holding
- Baleno - Hong Kong
- General Motors - Columbia
- Samsung Electro-Mechanics Co. Ltd. – Korea
- Siemens AG Karlsruhe

2.2 Data collections

Before starting the project, data had to be collected for different processes and steps.

Van Validation and Day Start Process

The detailed process list was obtained from the design team and the learning team. The processes in the cross-dock can be broadly classified into the Day Start, Delivery and the Day End Processes as shown in the Figure 2.4.

From the list collected, the initial observations were carried out in the cross-dock. Each day a set of processes were observed and the observations were noted. Few activities, were chosen to work on based on the initial observations.

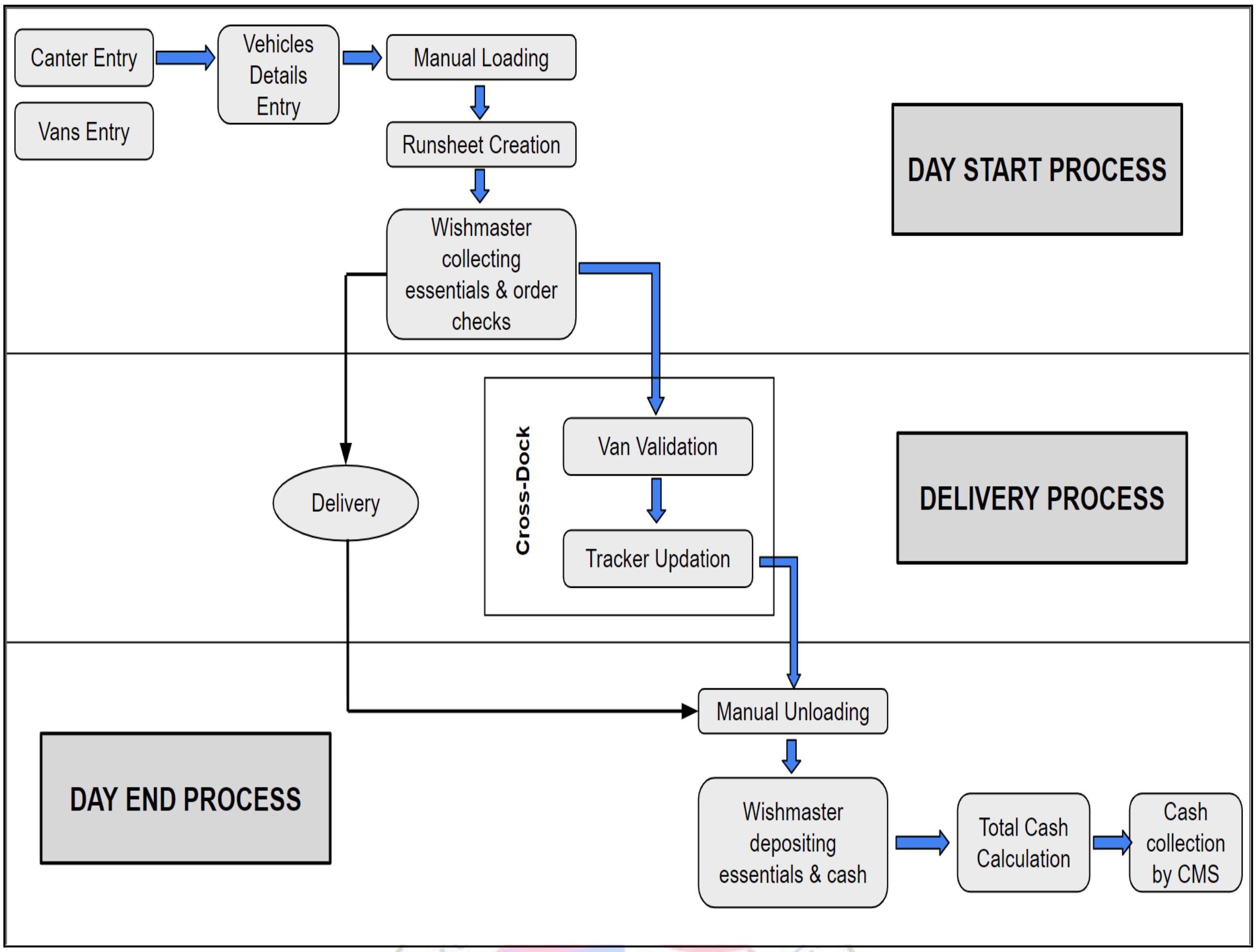


Figure 2.4: Processes in Cross-Dock

Carbon Emission Analysis

The data required for analyzing the Carbon Emitted in Grocery Last Mile was collected from the central team. The data was based on the year 2020. The total orders catered and the total distance travelled by all the Last Mile vehicles were obtained and analyzed.

CHAPTER-3

METHODOLOGY

CHAPTER 3

METHODOLOGY

From the understanding of the literature review from the previous chapter, this chapter provides the basic theory and fundamentals associated with problem statement and the Methodology followed and derived for the study and it only speaks about the steps followed throughout the study and how the results were obtained. Although the approach for all the 3 problem statements was same, the methodologies followed to arrive at detailed results were different.

Initially all the processes in the cross-dock were closely observed. The processes were broken down into smaller steps to reduce or eliminate the steps which doesn't add any value to the goods. The non-value-added steps in the process had to be segregated into 8 sources of wastes as shown in Figure 3.1.

Figure 3.1: The 8 Sources of Waste (MUDA)

3.1 Segregation of Processes

Over a month was spent observing and collecting data from the cross-docking operations. After initial observation of all the processes in cross-dock, the processes were segregated into Value-added (VA) activities and Non-value-added (NVA) activities. Non-value-added activities are steps and activities that do not add value to the end product. In simple terms, non-value-added activities are those that are performed but for which a customer is not willing to pay. In cross-docks, products wait in the canter/cross dock before delivery, but the waiting, or temporary storage of a product in a cross-dock, is not of value to the end-user.

The value to the customer lies in the ability of operations to process the part. Only run/process time is considered a value-added activity. All other categories are considered non-value-added activities. The lower the lead-time, the more flexible the system is in responding to demands. After in-depth analysis of the processes in the cross-dock the processes were segregated into VAs and NVAs as depicted in the Figure 3.2 below, which explains the overall operations in the Cross-Dock its relationship to value-added and non-value-added activities. The colour code is shown in Figure 3.3.

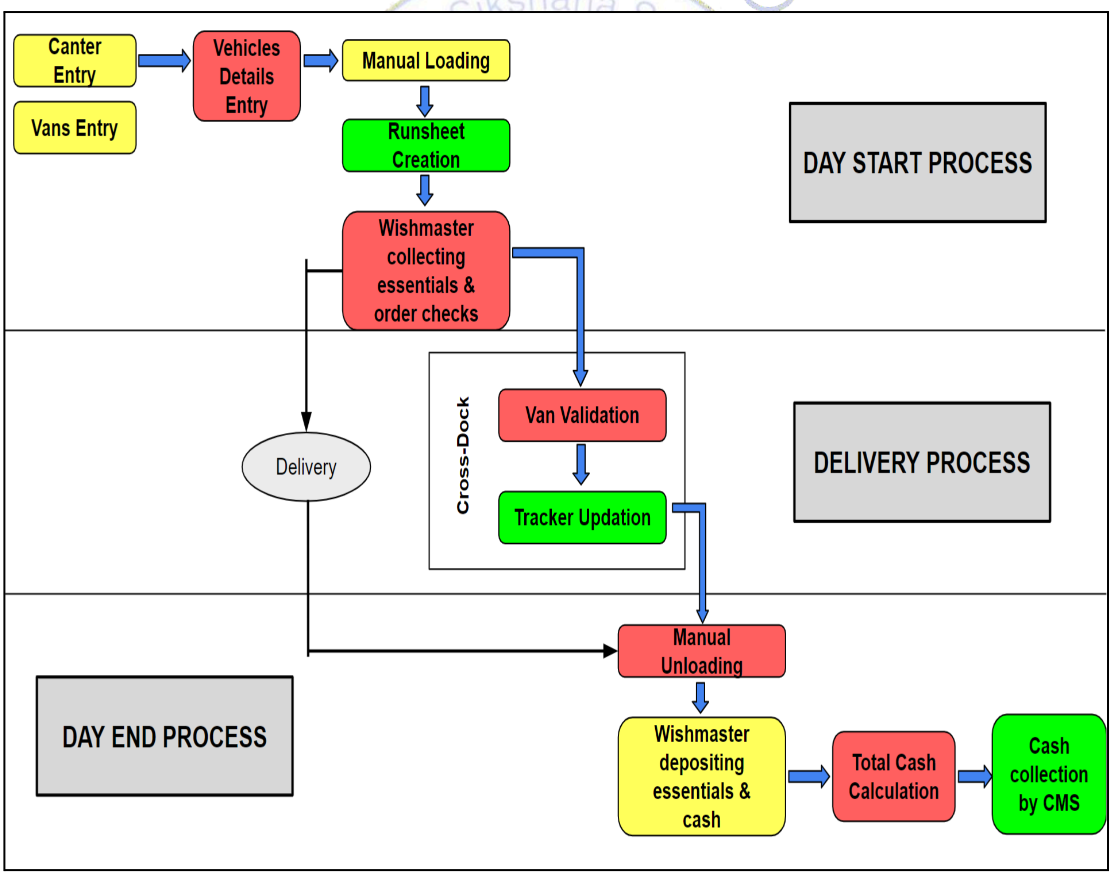


Figure 3.2: VA & NVA Activities Identification

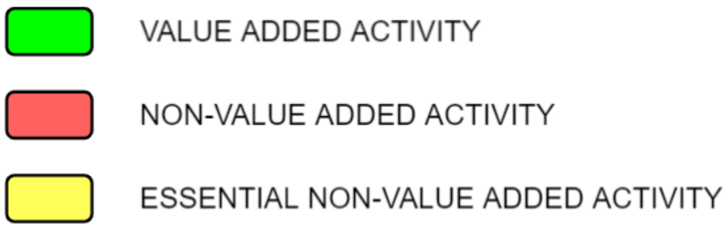


Figure 3.3: Colour Code for Activities

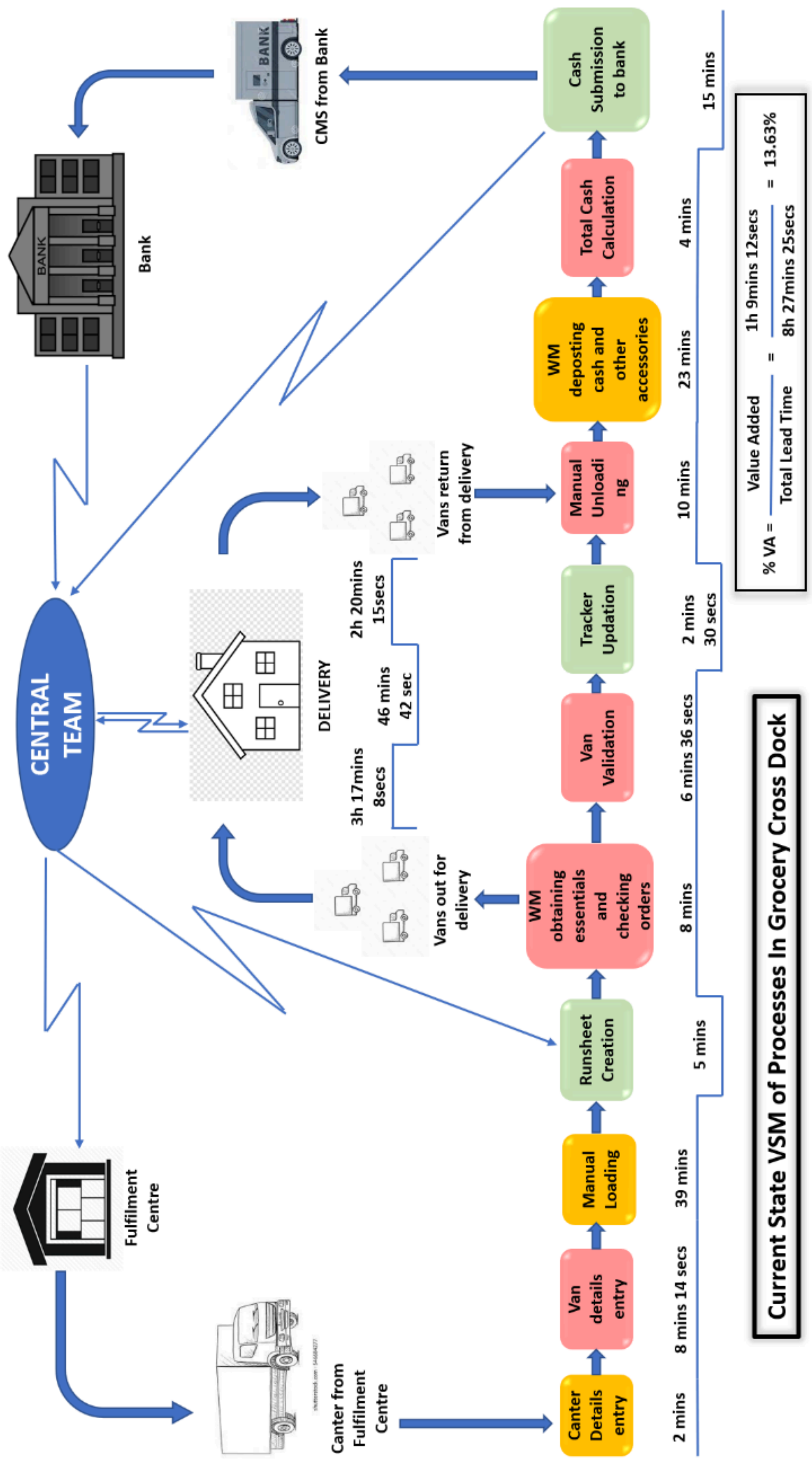
3.2 Time Study of the Processes

- For a period of 20 days the processes were closely followed.
- The time taken for the processes were noted down.
- The average time taken for the completion of the process was taken into consideration for the project.

The time study is shown in Table 3.1 below.

Table 3.1: Time Study of Processes

SL NO	ACTIVITY	TIME TAKEN
1	Canter & Vans Entry	2 mins
2	Vehicles Details Entry	8 mins 14 secs
3	Manual Loading	39 mins
4	Runsheet Creation	5 mins
5	WM collecting essentials & order checks	8 mins
6	Van Validation	6 mins 36 secs
7	Tracker Updation	2 mins 30 secs
8	Travel time	5 h 37 mins 23 secs
9	Doorstep Delivery	46 mins 42 secs
11	Manual Unloading	10 mins
12	WM depositing cash & essentials	23 mins
13	Total Cash Calculation	4 mins
14	Cash Collection by CMS	15 mins



Current State VSM

To examine the cross-docking operations flow, a value stream map was created to identify direct and indirect activities related to operational performance as shown in the Figure 3.4. This was done by identifying lead-time components. To calculate lead time, few totes were tracked throughout the value stream from canter, all the way to delivery and back to canter.

Each step of the flow of the totes involved direct and indirect activities which affected the cross-docking operational performance. Product flow encompassed material, personnel, and information flow as illustrated in Figure 9. Figure 9 depicts the Cross-Dock value stream map. A value stream map is a visual tool that illustrates, and thus helps in the understanding of, the flow of material and information as a product makes its way through the value stream.

After Value Stream Mapping all the processes in the Cross Dock, few activities, which seem to be critical and had the potential to be improved were chosen to work on. The activities were:

1. Van Validation
2. Wishmaster collecting essentials
3. Checking of the number of totes and orders
4. Van Sequencing
5. Pallet ID – Van Matching

As mentioned earlier the existing manual process of Van Validation had to be automated and Kaizens were worked out for the other four processes.

3.3 Van Validation

The process of van validation consists of the following steps:

Entry of van details which takes place at the entrance. Tracking the reporting status of the vans based on their reporting time. Calculation of distance travelled by each van in that particular shift. Summing up the total distance travelled by all the vans of each vendor in each shift. Calculation of the total monthly payment to the vendors. Deduction of penalties based on the reporting status of the vans of the specific vendor. The process of van validation is shown in the Figure 3.5. The security stationed at the gate of the cross dock enters the details (reporting time and Odometer readings) manually. The distance travelled is calculated manually and entered into the system.

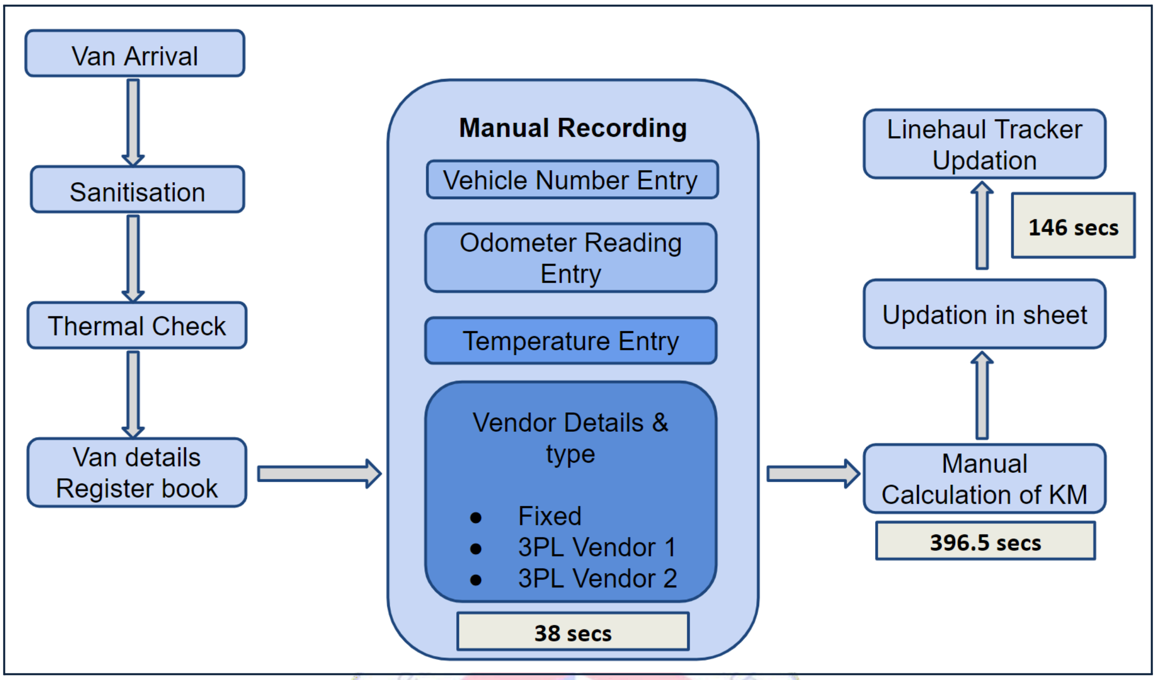


Figure 3.5: Existing Process of Van Validation

As soon as the vans arrive at the gate, the security enters the van details which include the following:

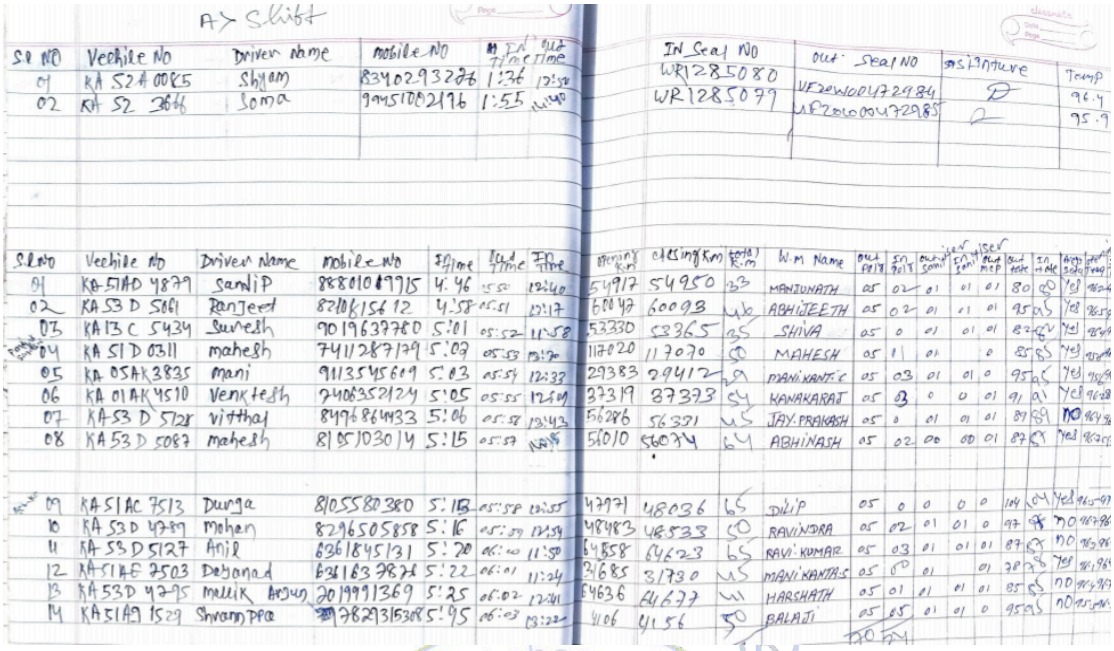
- Vehicle number
- Driver Name
- Odometer Reading
- Vendor Name
- Driver Temperature

These details are recorded manually into a van details register. It takes around 38 secs for entering the details of each van. After the entry of the details, the Closing and the opening odometer readings of each van are subtracted to obtain the total distance travelled by each van in that particular shift. This step takes around 396.5 secs since it is completely manual.

The total distance travelled by all the vans of each vendor is also calculated for aligning the payment process too. The vans are penalized for late reporting. The vans which have reported late are noted and based on the delay, the penalty is fixed.

All the details are copied into the system from the manual register. From the system the central (linehaul) tracker is updated on an everyday basis and monthly basis. This step takes around 146 secs.

The entry in the van details register is shown in Figure 3.6 below.



A> Shift

Sl NO	Veehile No	Driver name	mobile NO	IN Time	out Time	IN Seal NO	out Seal NO	signature	Temp
01	KA 52 A 0085	Shyam	8340293226	1:36	12:50	WR1285080	VF20W0047 2984		96.4
02	KA 52 3666	Soma	9945100 2196	1:55	12:40	WR1285079	VF2010004729 85		95.9

Sl No	Veehile No	Driver Name	mobile No	In Time	Out Time	In Time	opening K.m	closing K.m	total K.m	W.M Name	out Polly	In Polly	out Sanitiser	In Sanitiser	Out mep	out temp	In temp	Arogya setu	Temp
01	KA 51 AD 4879	sandip	8880108 9915	4:46	05:50	12:40	54917	54950	33	MANJUNATH	05	02	01	01	01	80	80	Yes	96.2
02	KA 53 D 5061	Ranjeet	8210815612	4:58	05:51	12:17	60047	60093	46	ABHIJEETH	05	02	01	01	01	95	95	Yes	96.5
03	KA 13 C 5434	Suresh	9019637780	5:01	05:52	11:58	53330	53365	35	SHIVA	05	0	01	01	01	82	82	Yes	95.4
04	KA 51 D 0311	mahesh	7411287179	5:02	05:53	13:30	117020	117070	50	MAHESH	05	11	01		0	85	85	Yes	95.8
05	KA 05 AK 3835	mani	9113545609	5:03	05:54	12:33	29383	29412	29	MANI KANT C	05	03	01	01	0	95	95	Yes	95.9
06	KA 01 AK 4510	Venktesh	7406352124	5:05	05:55	12:09	37319	37373	54	KANAKARAJ	05	03	0	0	01	91	91	Yes	96.28
07	KA 53 D 5728	vitthal	8496864433	5:06	05:58	13:43	56286	56331	45	JAY PRAKASH	05	0	01	01	01	89	89	NO	96.4
08	KA 53 D 5087	mahesh	8105103014	5:15	05:57	[illegible]	56010	56074	64	ABHINASH	05	02	00	00	01	87	87	Yes	96.7
09	KA 51 AC 7513	Durga	8105580380	5:13	05:58	12:55	47971	48036	65	DILIP	05	0	0	0	0	104	104	Yes	96.5
10	KA 53 D 4789	mohan	8296505858	5:16	05:59	12:54	48483	48533	50	RAVINDRA	05	02	01	01	0	97	98	NO	96.7
11	KA 53 D 5127	Anil	6361845131	5:20	06:00	11:50	64858	64623	65	RAVI KUMAR	05	03	01	01	01	87	87	NO	96.5
12	KA 51 AE 7503	Dayanand	6361637876	5:22	06:01	11:24	31685	31730	45	MANI KANTA S	05	50	01		01	78	78	Yes	96.1
13	KA 53 D 4795	mallik Arjun	7019991369	5:25	06:02	12:41	64636	64677	41	HARSHATH	05	01	01	01	01	85	85	NO	96.4
14	KA 51 A9 1529	Shivanappa	7829315308	5:45	06:03	13:22	4106	4156	50	BALAJI	05	05	01	01	0	95	95	NO	95.5

Figure 3.6: Van details entry in register

3.3.1 Methodology for Van Validation

The Plan-Do-Check-Act Methodology followed is shown in the Figure 3.7 below:

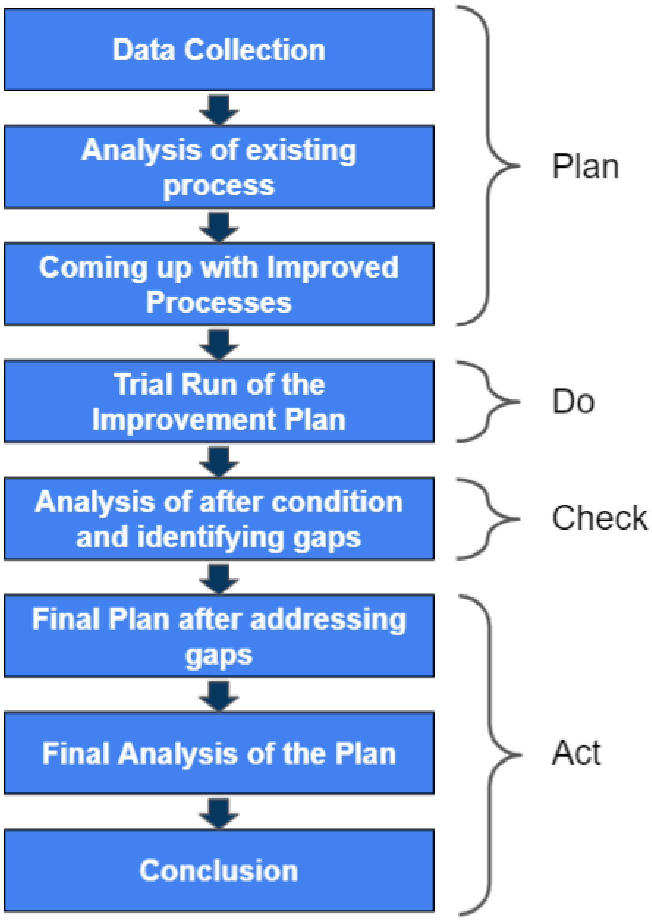


Figure 3.7: Methodology for Van Validation

The implementation of Automated Van Validation Process was carried out by a four step PDCA cycle.

A] Plan: The first step in working on automated van validation was to develop a strategic plan in order to understand the problem and set the goals. First how the van validation was carried out was understood. This helped in making the necessary changes in the processes to automate it. The wastes (MUDA) in the existing process were identified for potential improvement which is listed in Table 3.2.

Table 3.2: MUDA in Van Validation

MUDA	TYPE OF MUDA	QUANTIFIABLE
Security going to get the Register of a particular Vendor	Motion	10 secs per van
Vans waiting behind one another for details entry	Waiting	38 secs per van
Manual entry of details in the register	Extra-Processing	28 secs per van
Carrying the register to the system cabin	Motion	30 secs
Copying of data into the system	Extra-Processing	100 secs

In order to convert the manual data entry process into automated one, Scan-It to Office Application was adopted. The app was customized to take the following responses:

1. Date
2. Van Number
3. Time
4. Odometer Reading
5. Driver Temperature

When the app is linked to the google spreadsheet, the data gets transferred directly to the system. Shift 1 and Shift 2 had two different sheets and for every day start and day end process of the corresponding shifts, the first non-empty cell of the respective sheets had to be chosen.

B] Do: The customized app was now used for trial run. The data entry process was done both by manual register and using the app too.

For initial 15 days only the data entry process was done using the app. The data entered in the device was obtained in the google sheet shift wise.

C] Check: After the initial trial run for 15 days, the modified process was analyzed and feedbacks taken from the ground team. Few challenges and gaps were identified. These gaps and challenges could be addressed by necessary modifications to make the process simpler.

D] Act: The gaps and challenges identified during the trial run in the previous phase, were addressed with necessary process modifications and app customization.

Now the processes were analyzed after modification. A presentation giving instructions on the usage of the app for data entry process in van validation was prepared and shared with the ground team for their reference. The process was then implemented in a full-fledged manner in the cross-dock.

3.9 Collection of Delivery Essentials by the Wishmaster

The wishmasters carry few essentials before leaving for delivery. The list of those essentials is:

1. **Mswipe**: Mswipe is the device used for card payment on delivery orders. Every wishmasters mobile device is mapped to a particular Mswipe given in Figure3.8.

Figure 3.8: Mswipe

2. **Delivery Bags:** The delivery bags shown in Figure 3.9 are carried by the

wishmasters to:

- Deliver the orders with the neighbors on customer's request in case customers are not available
- Leave the orders with the apartment security on customer's request

Figure 3.9: Delivery Bag

3. **Cutter:** The totes (baskets) are sealed when they arrive from the Fulfilment Centre. These tags are to be removed by the Wish master in front of the customer. For this purpose, he has to always carry a cutter shown in Figure 3.10.

Figure 3.10: Cutter

3.9.1 Existing Process

Each wishmaster is assigned a Mswipe, 5 delivery bags and a cutter. The position of these items is in different places.

- The Runsheet is created by the Shift In-charge
- The Mswipe is collected from the Team Leader
- The delivery bags and cutter are obtained from the Security

The wishmaster moves from one place to another in order to collect these essentials.

After collection of these essentials he moves towards the van assigned to him for tote check and order check. The process is shown in Figure 3.11.

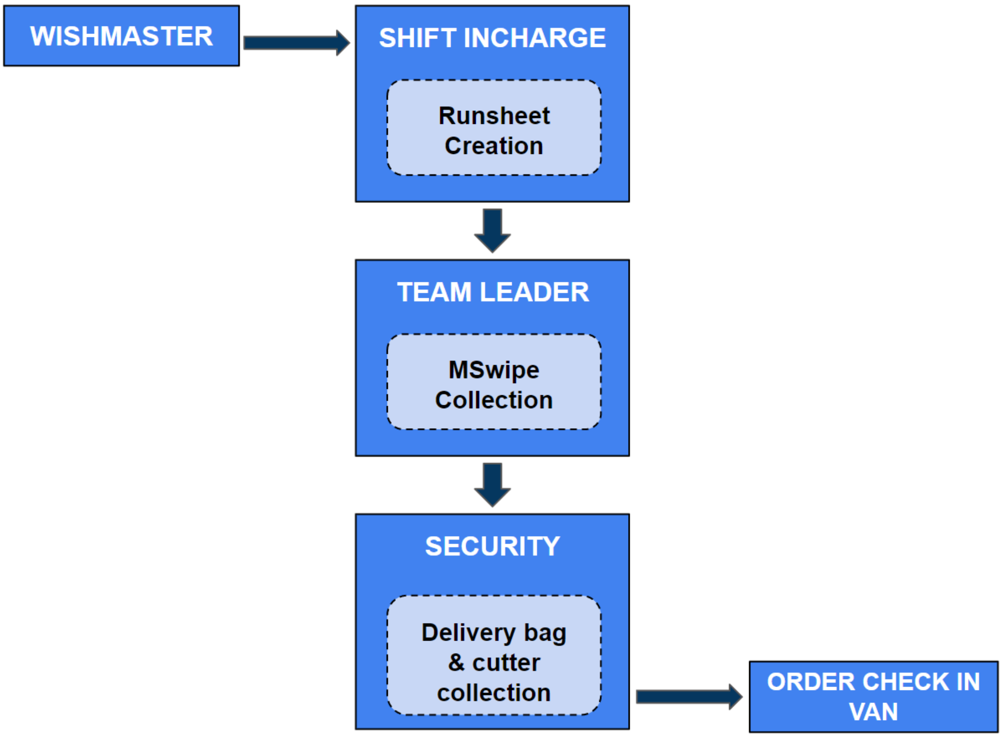


Figure 3.11: Existing Process of Collection of essentials

3.9.2 Methodology for Collection of Delivery Essentials

The implementation of this process was carried out by a 4 step PDCA cycle as shown in Figure 3.12.

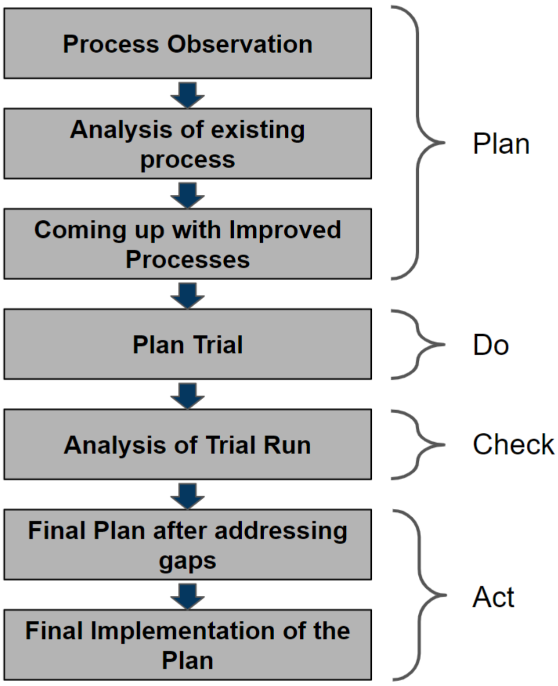


Figure 3.12: Methodology for Collection of Delivery Essentials

A] Plan: The first step in working on collection of delivery essentials, was to develop a strategic plan in order to understand the problem and set the goals. Initially the existing process was closely observed and the wastes were noted down as shown in Table 3.3.

Table 3.3: MUDA in Collection of Delivery Essentials

MUDA	TYPE OF MUDA	QUANTIFIABLE
Wishmaster going from Shift In-Charge to Team Leader	Motion	15 secs
Wishmasters waiting for their turn	Waiting	3 mins 30 secs
Wishmaster going from Team Leader to Security	Motion	30 secs
Wishmaster waiting for his turn	Waiting	4 mins
Wishmaster moving towards van	Motion	15 secs

B] Do: The improved (modified) process was carried on for one wishmaster. This was done for 1 week to check the feasibility of the process.

C] Check: After the initial trial run for 1 week, the modified process was analyzed and feedbacks taken from the ground team.

D] Act: The gaps and challenges identified during the trial run in the previous phase, were addressed with necessary process modifications.

Now the processes were analyzed after modification. The modified process was then implemented in a full-fledged manner in the cross-dock. The implemented process was then explained to the members of other cross docks too. Doubts from their end were clarified and explained.

3.5 Tote count and order check

The totes are loaded into the vans according to the Pallet ID. After Runsheet creation the wishmasters collect their delivery essentials and move towards the van to check the orders and the tote counts. The process is shown in detail in Figure 3.13.

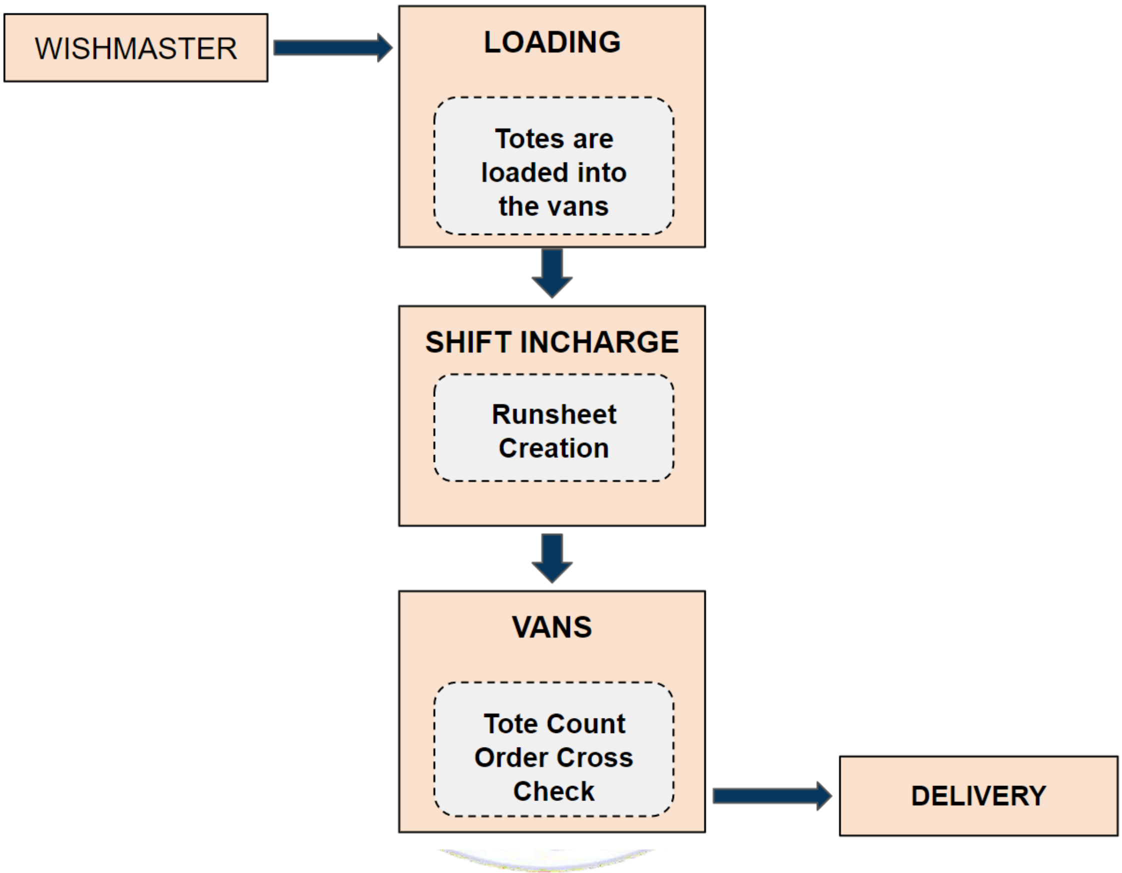


Figure 3.13: Existing Process of Tote Count and Order Check

3.5.1 Methodology for Tote Count and Order Check

The implementation was carried out by 4 step PDCA cycle as shown in the Figure 3.14:

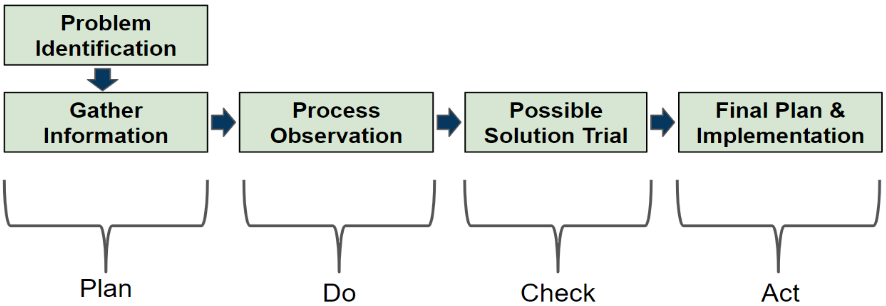


Figure 3.14: Methodology for Tote Count and Order Check

A] Plan: The present sequence of processes was identified and observed closely for the first few days. Necessary information was gathered from the ground team. The wastes in the existing process were identified and listed in Table 3.4.

Table 3.4: MUDA in Tote Count & Order Check

MUDA	TYPE OF MUDA	QUANTIFIABLE
Totes in the vans till the counting and checking is done	Inventory	15 mins
Wishmasters moving to the van to check and count	Motion	30 secs
Wishmaster Counting the Totes and checking the orders	Extra Processing	2 mins 30 secs
Vans waiting to leave for delivery	Waiting	15 mins

B] Do: The improved (modified) process was carried on for one wishmaster. This was done for 1 week to check the feasibility of the process.

C] Check: After the initial trial run for 1 week, the modified process was analyzed and feedbacks taken from the ground team.

D] Act: The gaps and challenges identified during the trial run in the previous phase, were addressed with necessary process modifications.

Now the processes were analyzed after modification. The modified process was then implemented in a full-fledged manner in the cross-dock.

3.6 Van Sequencing

The totes on each pallet are loaded into the vans from the canter. The vans are stationed behind the canter for unloading from the canter and loading into the vans. This is the main purpose of the cross dock. This process is called Cross-Docking. In this process of cross-docking 2 vans are stationed behind each canter at one point of time as shown in Figure 3.15.

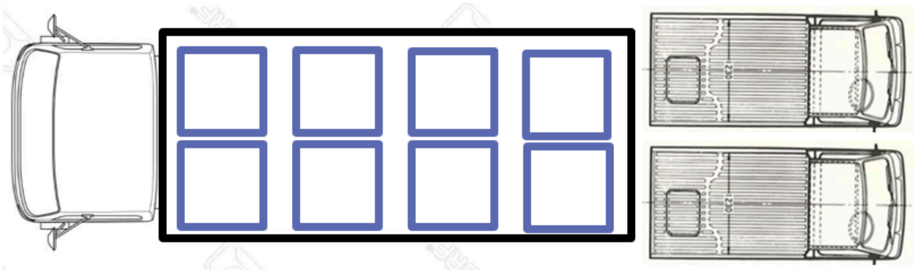


Figure 3.15: Existing Van Sequencing

3.6.1 Methodology for Van Sequencing

The implementation was carried out by 4 step PDCA cycle as shown in Figure 3.16.

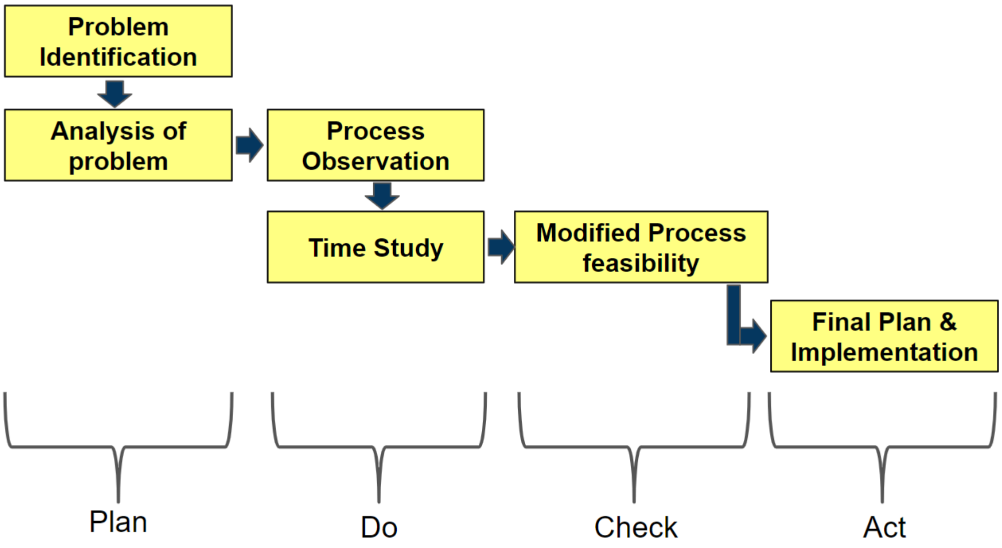


Figure 3.16: Methodology for Van Sequencing

A] Plan: The present sequencing of vans was observed closely for the first few days. The problem with respect to van sequencing during loading was analysed with the help of the ground team. Necessary information was gathered from the ground team. In the existing process the vans to canter ratio during loading into vans was 2:1.

The wastes in the existing process were identified and listed in Table 3.5.

Table 3.5: MUDA in Van Sequencing

MUDA	TYPE OF MUDA	QUANTIFIABLE
Totes in the canter till the loading of all the vans take place	Inventory	35 mins
Vans moving in and out of the docking area	Motion	2 mins
Vans waiting to get loaded	Waiting	8 mins (when 1 van is getting loaded)
Movement of totes from inside end of canter to the edge	Extra-Processing	3 mins (extra compared to normal pallets)

B] Do: The time taken to load 1 pair of vans were noted. The average time taken was worked upon. The improved (modified) process was discussed with the hub in-charge and the vendors.

C] Check: The feasibility of getting a better and improved van sequencing was analyzed based on the availability and readiness of the vendors.

D] Act: The final proposal for the new van sequencing during loading was put forward. The goodness of the modifies process was explained and its role in reducing the time if cross docking was explained.

3.7 Pallet ID & Van Number Pairing

Each pallet inside the canter is to be loaded into 1 van. It forms a beat. The pallet loaded into the van must be noted down to pair the Pallet ID and the Van Number for runsheet creation. In the existing process:

The Pallet ID and the vehicle number is noted down in a piece of paper by the security as shown in Figure 3.17. After all the vans are loaded, the noted down data is transferred to system for runsheet creation.

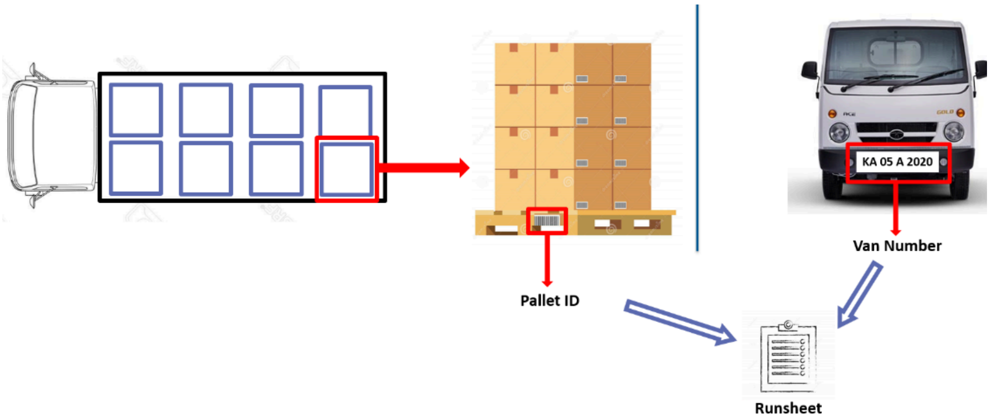


Figure 3.17: Pallet ID & Van Number Pairing

3.7.1 Methodology for Pairing Pallet ID & Van Number

The implementation was carried out by 4 step PDCA cycle as shown in Figure 3.18.

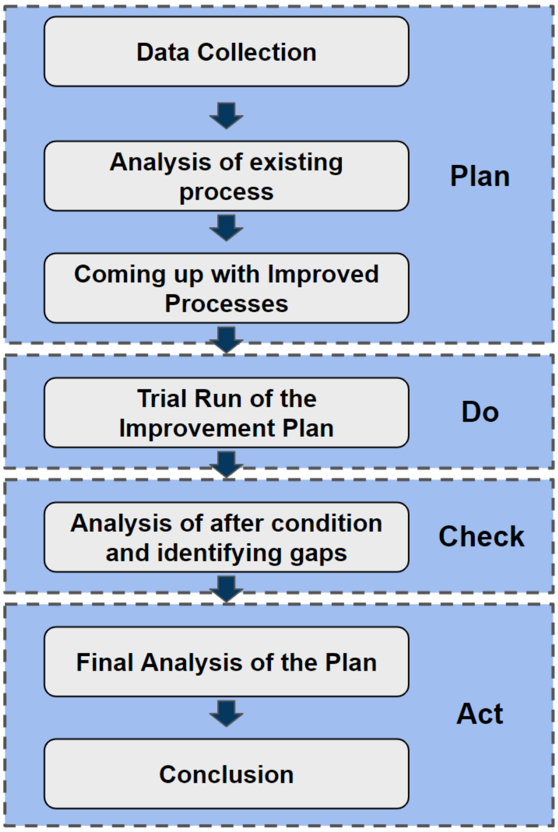


Figure 3.18: Methodology for Pairing Pallet ID & Van Number

A] Plan: The first step is developing a strategic plan in order to understand the problem and set the goals. First the present process was observed and understood. This helped in making the necessary changes in the processes to improve it. The wastes (MUDA) in the existing process were identified for potential improvement as in Table 3.6.

Table 3.6: MUDA in Pairing Pallet ID & Van Number

MUDA	TYPE OF MUDA	QUANTIFIABLE
Shift In-Charge waiting for Runsheet creation till all the vans are loaded	Waiting	40 mins
Other vans with orders waiting for runsheet creation	Inventory	34 mins
Carrying the register to the system cabin	Motion	30 secs
Copying of data into the system	Extra-Processing	4 mins

In order to improve the manual data entry process, Scan-It to Office Application was adopted. The app was customized to take the following responses:

1. Van Number
2. Pallet ID

When the app is linked to the google spreadsheet, the data gets transferred directly to the system.

B] Do: The customized app was now used for trial run. The data entry process was done using the app.

For initial 15 days the data entry process was done using the app. The data entered in the device was obtained in the google sheet shift wise.

C] Check: After the initial trial run for 15 days, the modified process was analyzed and feedbacks taken from the ground team. Few challenges and gaps were identified. These gaps and challenges could be addressed by necessary modifications to make the process simpler.

D] Act: The gaps and challenges identified during the trial run in the previous phase, were addressed with necessary process modifications and app customization.

Now the processes were analyzed after modification. The process was then implemented in a full-fledged manner in the cross-dock

3.8 Carbon Emission Analysis

Various e-grocery home delivery service models may have a strong impact on the development of the traffic environment in population centers and thus on Green House Gas emissions. Home delivery operations are developing rapidly at present, and current knowledge of last-mile operations is imperfect as compared with the other elements of supply-chain operations.

With the increasing grocery orders, the carbon emitted due to the last mile has increased substantially. The main objective of this project is to track the total carbon emitted by grocery last mile in the year 2020.

3.8.1 Data Collection

The central team and the operations team were consulted and all the data required for the analysis of the carbon emitted by Grocery last mile were collected. The required data were:

1. The list of all the grocery cross docks and FCs across India
2. Total Monthly orders in different cities
3. Total Number of vans utilized in the grocery last mile
4. Total distance travelled by the vans and canters
5. Mileage of vans and canters

3.8.2 Carbon Emission Calculation

From the collected data, the following were found out:

- Total fuel consumed by all vans and canters in Grocery Last Mile across India
- The formula for carbon emitted in Kilograms due to the fuel consumed is as follows:
    - 1 L Diesel – 2.64 kg of Carbon Dioxide
- The total carbon emitted by different cities in each month of 2020 was calculated and plotted.

3.8.3 Observations

Monthly Orders vs Carbon Emitted: To find a relationship between the monthly orders and the Carbon emitted by the last mile, various cross docks in main cities were chosen. The total order scale and their last mile carbon emissions were plotted in a graph as shown in Figure 3.19.

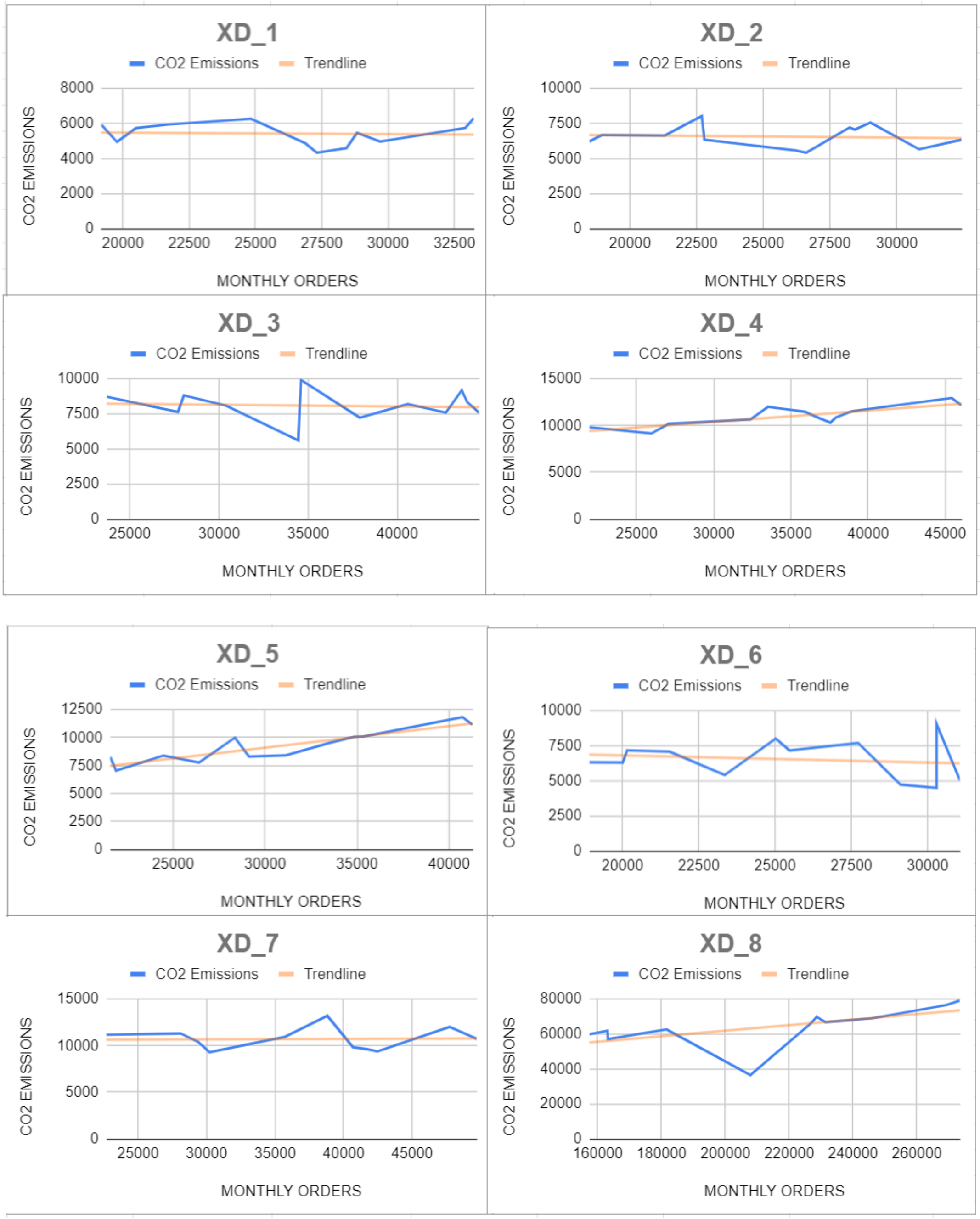


Figure 3.19: Monthly Orders vs Carbon Emitted

After analyzing the graphs, it was observed that in spite of the increase in the number of orders, the carbon emitted is fairly constant.

Hence monthly orders are not a major contributing factor for the carbon emitted in the last mile.

Carbon Emitted vs Number of vans utilized: After analyzing the graph of monthly orders vs carbon emitted, it was observed that the carbon emitted was constant. Hence in order to find the factor responsible for the increasing carbon emissions, the number of vans was plotted against the carbon emitted in the 10 Cross-Docks as shown in Figure 3.20.

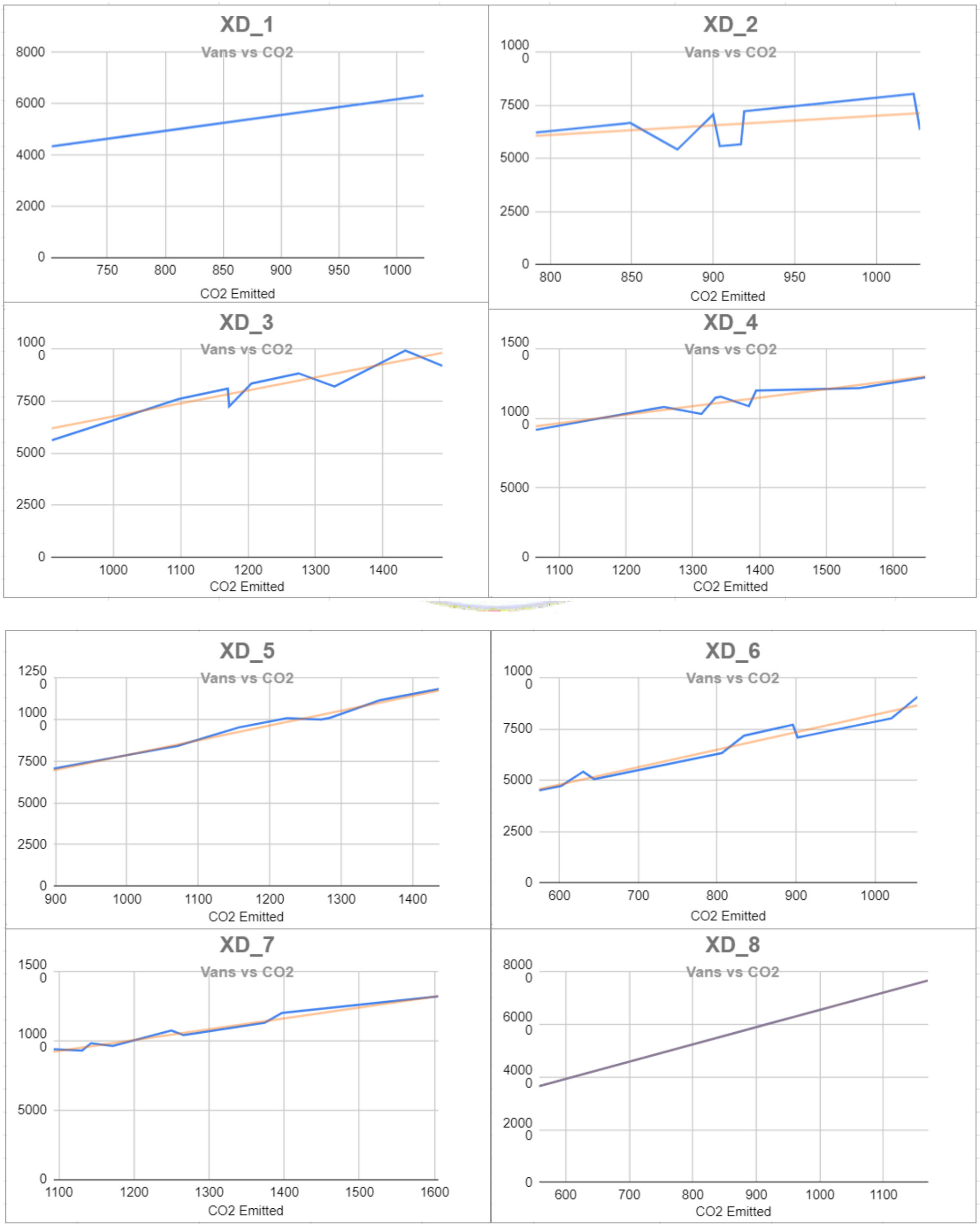


Figure 3.20: Carbon Emitted vs Number of vans

As the number of vans increased, the carbon emitted also increased. An increasing trend was observed in the graph of carbon emitted vs number of vans. This shows that as vans increase, the fuel consumed increases with the increasing distance travelled and hence the carbon emitted also increases.

3.8.4 Analysis

From both the graphs above it was observed that, there is no increase in the carbon emitted with the increasing orders. The major reasons for this being:

- Area under Cross Dock remains constant.
- The increase in the orders only mean increase in the order density since the area covered under each cross dock is constant.
- The distance covered by each vans remains fairly constant.

The main reason for this observation is, as the orders keep increasing, the space utilization in the van keeps getting optimized. There's no increase in the number of vans utilised.

The increasing order scale doesn't affect the Carbon emission, only up to an extent where all the existing vans are utilized up to 100%. Further increase in order will lead to increased number of vans and hence the Carbon emitted also increases.

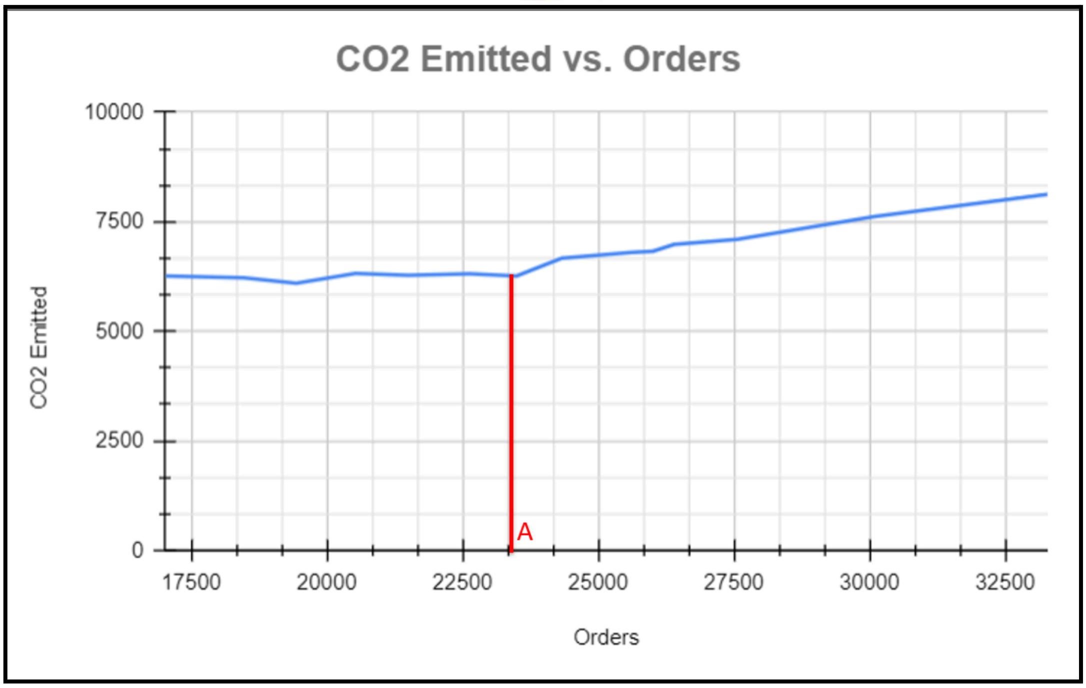


Figure 3.21: Orders vs Carbon Emitted

In Figure 3.21, up to Point A, the carbon emitted remains constant irrespective of the increase in order scale, due to fixed number of vans operating. Beyond Point A, the carbon emitted increases with the increase in the Order scale due to increased number of vans utilised. As the orders keep increasing beyond the optimum capacity of the vans, the number of vans utilized also increases. This leads to the increased trend observed in the graph when the number of vans utilized increases.

Classification of cities: The cities where grocery is operational had to be classifies to suggest a solution for the increasing carbon emissions.

The 2 major factors on which the cities could be classified were:

1. Orders per Day (OPD)
2. Beat Distance

Orders Per Day (OPD) - The average number of orders delivered per day in each cross dock is called the OPD.

Beat Distance- The distance travelled by each delivery van for delivering one set of orders is called the Beat Distance.

Each city had its own OPD and Beat Distance values. The data was collected from the design team and graph plotted as shown in Figure 3.22 to find where there is lesser optimization of vans.

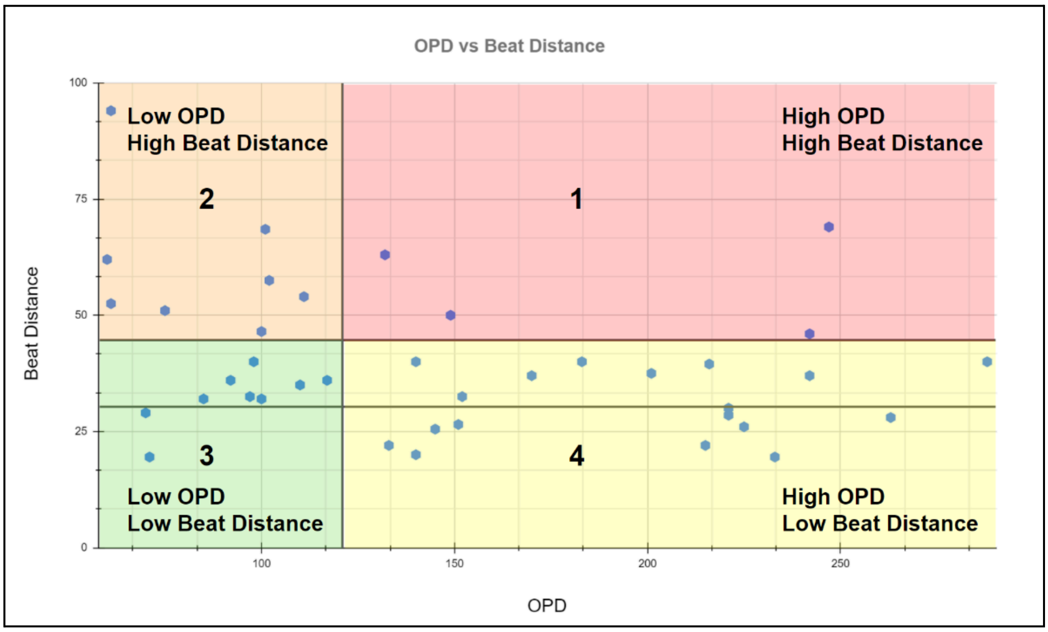


Figure 3.22: OPD vs Beat Distance of cities

From the graph plotted, the cities were classified in to 4 quadrants according to their Orders Per Day (OPD) and the Beat Distance.

Quadrant 1 - High OPD & High Beat Distance

Quadrant 2 - Low OPD & High Beat Distance

Quadrant 3 - Low OPD & Low Beat Distance

Quadrant 4 - High OPD & Low Beat Distance

From this classification biker model of delivery was worked up on wherever feasible and wherever the vans aren't utilised to their maximum capacity. The cost and environmental benefit of switching to bikes were worked upon.

CHAPTER-4 IMPLEMENTATION

CHAPTER 4

IMPLEMENTATION

After initial phase analysis of the existing process and coming up an idea for the new modified and efficient process, the implementation of the ideas was done. The observations were taken into consideration.

4.1 Van Validation

After analyzing the existing process closely, the Scan IT-to office app was customized according to the requirement. The data to be entered were similar to the manual process but, typed in the mobile device. The modified process was implemented in one of the cross-docks in Bangalore.

4.1.1 Data Entry

The customized app's screen is as shown in Figure 4.1.

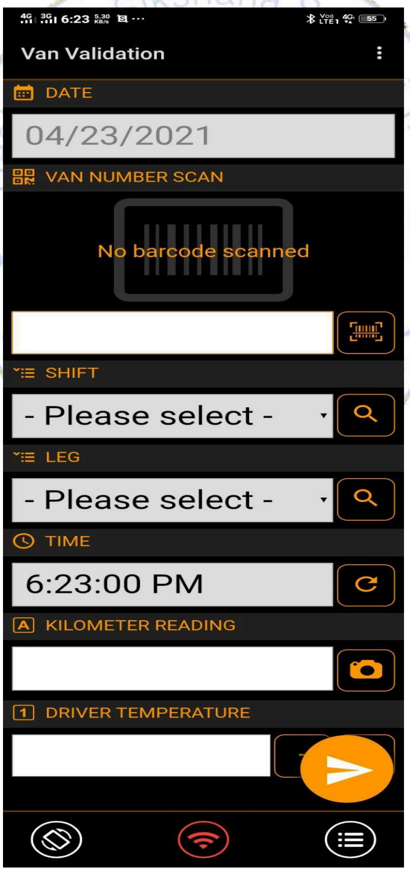


Figure 4.1: App Screen

The details to be entered in the app are as follows:

1. Date (Automatically Captured)
2. Van (Vehicle) Number
3. Shift (1H or 2H)
4. Leg (Day Start or Day End)
5. Time (Automatically Captured)
6. Odometer Reading
7. Driver Temperature

Once the security enters the required details the data gets transmitted to the google sheet linked to the laptop. As and when the vans keep entering, the security keeps entering the data in the app and the data keeps getting reflected on to the laptop.

4.1.2 Transmitted Data

The data is transmitted in the google sheets in the laptop. In the system, the google sheet is formulated to sort input data into Day Start and Day End of both 1H and 2H shifts. The formulations also calculate the distance travelled by each of the vans by subtracting the opening odometer reading from the closing odometer reading as shown in Figure 4.2.

	A	B	C	D	E	F	G	H	I
1	RESPONSES								
2	Date	Vehicle Number	Shift	Leg	Time	KM Reading	Temp	Validation 1	Reporting Statu
132	4/3/2021	KA 05 AK	2	Day Start	1:05:11 PM	28062	97.30	2Day Start	Ontime
133	4/3/2021	KA 13	2	Day Start	1:10:01 PM	52009	97.80	2Day Start	Ontime
134	4/3/2021	KA 53 D	2	Day Start	1:15:12 PM	67922	96.80	2Day Start	Ontime
135	4/3/2021	KA 53 D	2	Day Start	1:26:31 PM	47046	97.10	2Day Start	Ontime
136	4/3/2021	KA 51	2	Day Start	1:43:15 PM	115750	98.10	2Day Start	Ontime
137	4/3/2021	KA 01 A	2	Day Start	1:44:01 PM	35855	96.90	2Day Start	Ontime
138	4/3/2021	KA 51	2	Day Start	2:08:10 PM	18394	97.10	2Day Start	Ontime
139	4/3/2021	KA 51 AF	2	Day Start	2:10:12 PM	19506	97.50	2Day Start	Ontime
140	4/3/2021	KA 53 C	2	Day Start	2:15:14 PM	99536	97.60	2Day Start	Ontime
141	4/3/2021	KA 53 D	2	Day Start	2:45:23 PM	63231	97.30	2Day Start	15Mins
142	4/3/2021	KA 53 D	2	Day Start	3:00:01 PM	54476	97.60	2Day Start	30 Mins

Figure 4.2: Response Sheet

The ground team just had to copy and paste the value of the total distance travelled by all the vans on that particular day.

The real time access of the sheet was given to the following stake holders:

1. The hub teams
2. The central team
3. All the vendors providing vans for that particular cross dock

4.1.3 Data Utilization

The data collected was utilized for the following purposes:

1. Daily Total Distance travelled summary as shown in Figure 4.3.

APRIL - 1H			
SUM of KM travelled	Vendor		
Date	Karvy	Shadowfax	Grand Total
4/1/2021	149	540	689
4/2/2021	157	338	495
4/3/2021	141	598	739
4/4/2021	144	608	752
4/6/2021	164	558	722
4/7/2021	151	600	751
4/8/2021	137	592	729
4/9/2021	128	676	804
4/10/2021	83	656	739
4/12/2021	194	603	797
4/14/2021	172	329	501
4/15/2021	208	501	709
4/16/2021	134	644	778
4/17/2021	164	781	945
4/18/2021	210	586	796
4/19/2021	221	615	836
4/20/2021	207	537	744
4/21/2021	186	1672	1858
4/22/2021	142	599	741
4/23/2021	142	626	768
4/24/2021	164	770	934
4/25/2021	160	703	863
4/26/2021	176	691	867
4/27/2021	261	678	939
4/28/2021	421	724	1145
4/29/2021	182	817	999
4/30/2021	179	882	1061
Grand Total	4777	17924	22701

Figure 4.3: Distance travelled summary

2. Vendor wise reporting status as depicted in Figure 4.4 and 4.5.

April - 1H					
COUNTA of Reporting Status	Reporting Status				
Vendor	15Mins	30 Mins	60Mins	Ontime	Grand Total
Karvy	4	1		71	76
Shadowfax	1	4	2	311	318
Grand Total	**5**	**5**	**2**	**382**	**394**

Figure 4.4: Vendor wise 1H reporting status

April - 2H					
COUNTA of Reporting Status	*Reporting Status*				
Vendor	15Mins	30 Mins	60Mins	Ontime	Grand Total
Karvy	2			54	56
Shadowfax	5	1	1	268	275
Grand Total	**7**	**1**	**1**	**322**	**331**

Figure 4.5: Vendor wise 2H reporting status

3. Daily Reporting Status as shown in Figure 4.6.

April - 1H					
COUNTA of Vehicle Type	*Reporting Status*				
Date	15Mins	30 Mins	60Mins	Ontime	Grand Total
4/1/2021				15	15
4/2/2021				15	15
4/3/2021				15	15
4/4/2021				15	15
4/6/2021				15	15
4/7/2021				14	14
4/8/2021	2	1		12	15
4/9/2021		1		14	15
4/10/2021				15	15
4/12/2021				15	15
4/14/2021				15	15
4/15/2021	1	3	2	9	15
4/16/2021				16	16
4/17/2021				18	18
4/18/2021				16	16
4/19/2021				16	16
4/20/2021				16	16
4/21/2021				17	17
4/22/2021				19	19
4/23/2021				19	19
4/24/2021	1			18	19
4/25/2021				19	19
4/26/2021				20	20
4/27/2021	1			19	20
4/28/2021				20	20
4/29/2021				20	20
4/30/2021			1	19	20
Grand Total	5	5	3	441	454

April - 2H					
COUNTA of Vehicle Type	*Reporting Status*				
Date	15Mins	30 Mins	60Mins	Ontime	Grand Total
4/1/2021	4			7	11
4/2/2021				11	11
4/3/2021	1	1		9	11
4/4/2021				11	11
4/6/2021				11	11
4/7/2021				11	11
4/8/2021				11	11
4/9/2021				11	11
4/10/2021	1			10	11
4/12/2021				11	11
4/14/2021				10	10
4/15/2021				10	10
4/16/2021			1	10	11
4/17/2021				12	12
4/18/2021				12	12
4/19/2021				12	12
4/20/2021				12	12
4/21/2021				12	12
4/22/2021				14	14
4/23/2021				14	14
4/24/2021				14	14
4/25/2021				14	14
4/26/2021				15	15
4/27/2021				15	15
4/28/2021				14	14
4/29/2021				15	15
4/30/2021	1			14	15
Grand Total	7	1	1	322	331

Figure 4.6: Daily Reporting Status

All the stakeholders will have real time access to these. The data extracted can be used for monthly payment of the vendors. For the month of April, the data collected was used for the vendor payment.

4.2 Day Start Process

4.2.1 Implementing the Kaizens

After the management approved the Kaizens, the implementation was started in one of the cross docks. The hub team was informed and explained about the implementation of the Kaizens. The Kaizens were first implemented for a day by me and the ground team was asked to observe. All the questions and doubts were clarified and the process explained clearly. Below we can see all the 5 Kaizens and their benefits in the kaizen representation format.

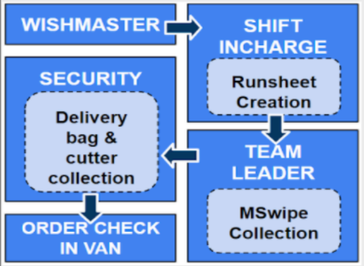
TITLE: Collection of essentials

NAME: Madhan N
DEPT: GROCERY CROSS DOCK

BACKGROUND

Process and lead time allowances from runsheet creation to vans leaving out for delivery is excessive.
Wishmasters have to move round to collect essentials

CURRENT CONDITIONS



The delivery bags, cutter and the Mswipe is at 3 different locations.

After runsheet creation, the wishmaster has to go to 3 different locations to obtain the essentials.
The total time taken is **13 mins**

GOAL

Process and lead time allowances from runsheet creation to vans leaving out for delivery is excessive and has to be reduced.
Cycle time reduction from 13 mins to 5 mins.

ANALYSIS

The 3 different stakeholders are given responsibility of 3 different essentials.
The wishmaster physically moves to each one of them to collect the essentials.

IMPLEMENTATION PLAN

The Mswipe, cutter and the delivery bags is integrated into a single pouch as shown in the figure. The pouchl bears the name of the wishmaster.
The wishmaster collects the pouch after runsheet creation and leaves for order check.

Done by: Team Leader

EFFECT CONFIRMATION

The process and the lead time in collecting essentials after runsheet creation and before vans leaving for delivery, reduced from 13 mins to 5 mins.
The wishmasters movement decreased as he collects the pouch soon after runsheet creation and leaves.

FOLLOW UP

The new process was explained to wishmasters of other cross docks and implemented.
The same process can be integrated in other business units.

KAIZEN 1

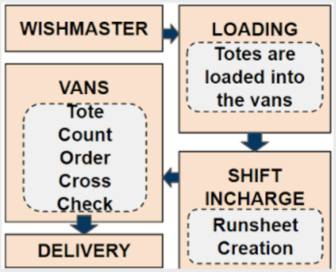
TITLE: Totes & Order Check

NAME: Madhan N
DEPT: GROCERY CROSS DOCK

BACKGROUND

The process and time taken by the wishmasters to check the totes and orders before leaving for delivery is excessive.

CURRENT CONDITIONS



The wishmasters go to the vans assigned to them after runsheet creation and pouch collection.

The wishmasters check the number of totes and cross checks with the number shown in his device. If its matching, he leaves for delivery.

GOAL

The process is extra and time consuming.
The wishmasters should leave for delivery soon after runsheet creation.

ANALYSIS

Missing totes during delivery can create problems to the customers.Hence the wishmasters check it in cross dock before leaving.

IMPLEMENTATION PLAN

While loading the totes into the vans, the number of totes loaded is given in written to the van driver.

After runsheet creation, when the wishmaster goes to his respective van, he just cross verifies it with the driver instead of opening the van and checking it manually.

Done by: Security

EFFECT CONFIRMATION

The wishmaster's manual work of checking the tote and order numbers is eliminated.
The wishmaster directly checks with the driver and leaves for delivery

FOLLOW UP

A more robust method of palletization should take place in FC so that totes aren't missing in the beats.

KAIZEN 2

TITLE: Van Sequencing

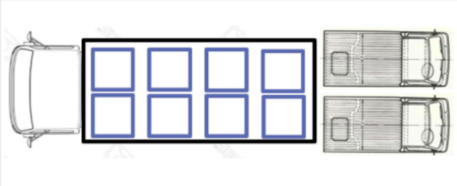
NAME: Madhan N
DEPT: GROCERY CROSS DOCK

BACKGROUND

The sequencing of vans during loading is such that only 2 vans are loaded at a time.

CURRENT CONDITIONS

In the present model, 2 vans are stationed behind each canter and loading into the takes place simultaneously.



All the other vans wait till the 2 vans are loaded.

This takes **42 mins** to load 12 pallets.

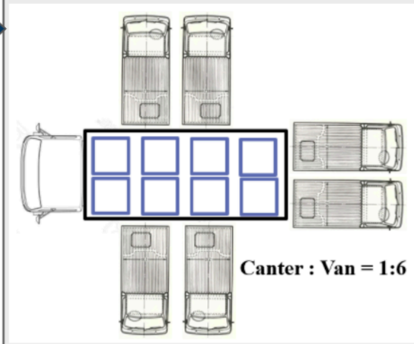
GOAL

To reduce the cycle time for loading the totes into the vans from 42 mins to less than 20 mins.

ANALYSIS

The canters provided by the vendors are the ones with opening only at the back. The innermost pallets have to be either pulled or totes passed manually to load into the vans.

IMPLEMENTATION PLAN



By providing openings on either sides of the container of the canter, 4 more vans can be stationed like at the back.
Here, simultaneously 6 vans can be loaded at once and also all the pallets can be loaded easily.

EFFECT CONFIRMATION

The cycle time for loading reduced from 42 mins to just **14 mins**.
All the pallets were within the reach of the men loading into the respective vans.
There is no need for vans to wait longer.

FOLLOW UP

The dock area (per canter) has to be increased to facilitate the accommodation and movement of vans on either sides of the canter

KAIZEN 3

TITLE: Pallet ID - Van number Pairing

NAME: Madhan N
DEPT: GROCERY CROSS DOCK

BACKGROUND

The details of the pallets which are loaded into particular vans are necessary for runsheet creation.

CURRENT CONDITIONS

All the totes on a pallet are assigned for one beat. All these totes are to be loaded into one particular van.
Before loading starts, the pallet ID and the van number are noted down in a piece of paper.
After all vans are loaded, the details are copied to laptop manually and runsheet is created.

GOAL

To automate the process of pairing the pallet ID with the van number in order to make the process faster.

ANALYSIS

The manual process of writing down the numbers in a sheet of paper and then handing it over for runsheet creation can give rise to errors as well as confusions.The process is not real time and hence till all vans are loaded, runsheet can't be created.

IMPLEMENTATION PLAN

App used: Scan IT to Office
Done by: Security

The Pallet ID is scanned by the app and the van number entered and send button pressed. The details gets reflected in the system.

On a real time basis, data keeps getting transferred and runsheet can be created as and when a van gets loaded.

EFFECT CONFIRMATION

Runsheet is created as and when the van is getting loaded as the data is received on spot. As soon as the van is loaded, runsheet is created, wishmaster assigned and the van can leave out for delivery.

FOLLOW UP

A software similar to Scan-It to office app can be integrated into the field app used for other purposes in the company.

KAIZEN 4

4.2.2 Analyzing after implementation

After the kaizens were implemented, there was a reduction in the cycle time of the day start process in the cross dock. The movement of men and material also reduced to a greater extent.

This in turn lead to the vans leaving out for delivery faster. The time was extracted from the day start process and made available for the delivery process.

4.3 Carbon Emission Analysis

After the cities were classified based on the OPD and Beat distance, the possibility of using biker model was worked upon. In order to start with the biker model, the differences between a van delivery and a bike delivery were worked up on as shown in Table 4.1.

The average beat distance per van is around 40km. But that for bikes is higher, i.e., 70km, because the bikes have to undergo multiple runs for one beat due to limited number of orders which a biker can carry in one run. The mileage for vans is around 14km/l and that of bike is 70km/l. Based on these the fuel consumed was calculated. The Carbon emitted depends on the fuel consumed as follows:

- 1L Diesel - 2.64kg Carbon
- 1L Petrol - 2.39kg Carbon

Table 4.1: Vans vs Bikes Carbon emission comparison

	VANS	BIKES
Avg Distance / Beat	40 km	70 km
Mileage	14 km/L	70 km/L
Fuel	2.85 L Diesel	1 L Petrol
CO2 Emission	7.524 kg	2.39kg

This showed that there is great difference in the amount of carbon emitted by the bikes and the vans per beat. Hence, as the number of beats keeps increasing, the amount of carbon emitted can also be reduced drastically.

As the number of beats increases, the following trend is observed in the difference in the amount of carbon emitted as shown in Figure 4.7.

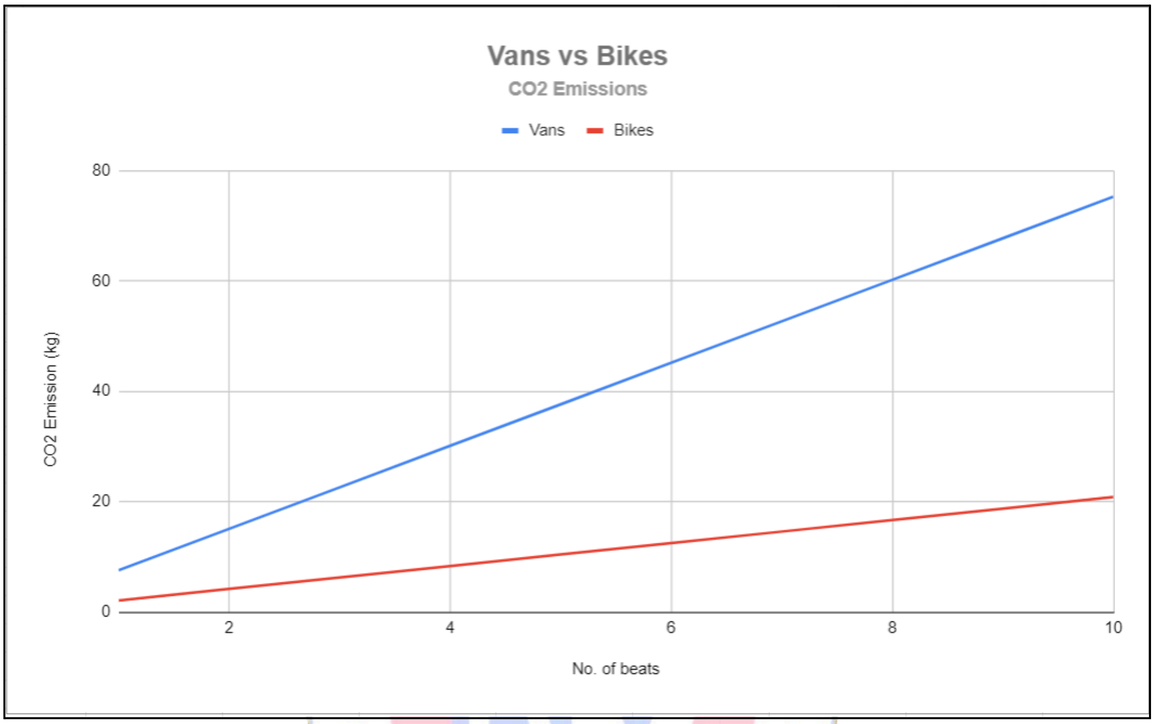


Figure 4.7: Vans vs Bikes Carbon Comparison

Based on figure 33, the cities which were more feasible for conversion to biker model was chosen.

The cities with Low OPD and Low beat distance (3rd Quadrant) were more feasible for conversion to biker model as in the present case the vans are not utilized in an optimized manner due to low orders per day. In such cities, 1 van can be used to deliver only volumetrically bulk orders and all other orders can be delivered in bikes.

In the cities with Low beat distance and high orders per day (4th Quadrant) vans can be utilized up to their maximum space optimization. For beats in which the space in the vans can't be utilized completely, biker model of delivery has to be adopted.

In cities in the 2nd Quadrant, with low orders per day but higher beat distance a mixed model of delivery can be adopted where around 50% is done by biker and the rest by vans as shown in Figure 4.8.

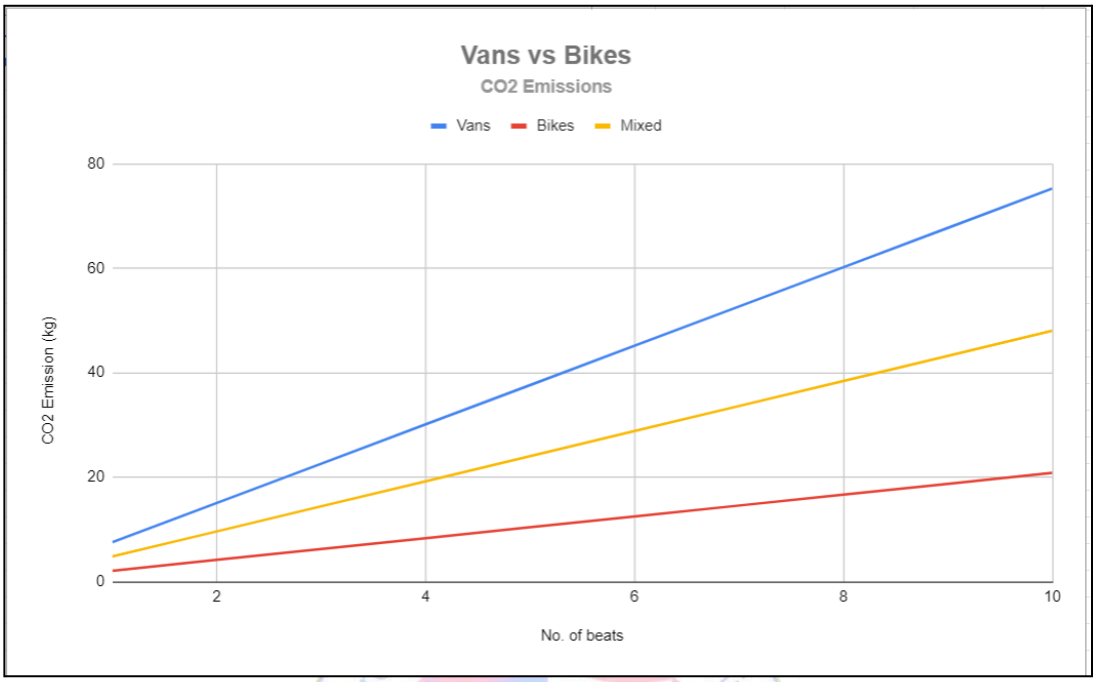


Figure 4.8: Hybrid model

The reduction in the carbon emitted can bring great environmental goodness. Based on the OPD and beat distance, as specified earlier, necessary changes in the processes were brought in using the biker model of delivery.

CHAPTER-5
RESULT AND DISCUSSION

CHAPTER 5
RESULT AND DISCUSSION

After the implementation of the modified processes in the cross-dock using Kaizens, the observations were made and results evaluated.

5.1 Van Validation

The process of van validation was automated to a greater extent. The automated process has so many advantages when compared to the earlier process.

Table 5.1: Difference in Existing and modified process

	Existing Process	**Modified Process**
Time	43 Mins	15 Mins 50 secs
Manual Intervention	High	Least
Manual Error	High	Very less
Transparency	No	Real Time visibility
Duplicate Processes	Yes	No

The results achieved after designing and implementing the new model of van validation in the grocery cross docks were:

a. The process of data entry when the vans arrive at the gate reduced from 38 secs to 17 secs per van.
b. The possibilities of entering wrong details by the security is reduced.
c. Data like reporting time of vans cannot be mishandled.
d. The hub team, central team and the vendors can have real time assess to the data captured making it transparent.
e. The chances of manual errors in calculation of distance and monthly pay are eliminated. Updation of tracker becomes easy by just copying and pasting the values.

Apart from these, there were considerable amount of cost savings too. Taking into consideration the pay of the securities, Shift In-charge and the Team Leaders; and the amount of time spent by them in this process per cross dock, a total annual savings of Rs10,000 is achieved per cross dock. Having 7 cross docks in Bangalore as shown in Figure 5.1, the annual savings in 1 city alone is Rs 70,000.

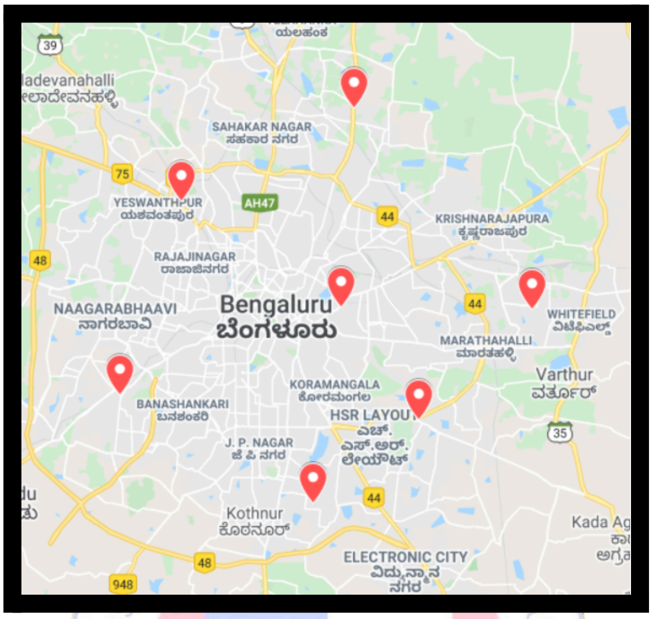


Figure 5.1: Cross Docks in Bengaluru

Considering all the cross docks spread out across the country as shown in Figure 5.2, the total number of cross docks is 70. Hence the total annual savings across all the cross docks in India will be close to Rs7,00,000.

Figure 5.2: Cross Docks in India

5.2 Day Start Process

In the day start process of grocery cross dock, the processes which could be improved were identified and few Kaizens were made and implemented. After the implementation of the Kaizens, the following results were achieved as shown in Table 5.2.

a. The total lead time in the cross dock decreased by 21 mins 52 secs.

b. The productivity of the cross dock increased by 1.46 units.

c. The percentage of value-added activities increased from 13.56% to 14.43%.

d. The movement of men and material within the cross dock decreased by a great extent.

e. All repetitive and duplicate processes were cut down and made simpler.

Table 5.2: Results of Kaizen implementation in Day Start Process

Kaizen	Output
	F OCESS

Kaizen 1	Reduces unnecessary movement of wishmasters to collect essentials 5mins reduced per shift Ensures safekeeping of the essentials in a pouch
Kaizen 2	Reduces unnecessary movement of wishmasters for checking the orders Optimum utilization of time while loading
Kaizen 3	Simultaneous loading of all the pallets Vans needn't wait long before getting loaded Pallets deep inside the canter can also be loaded easily
Kaizen 4	Real time transfer of pallet ID and van number data for runsheet creation Runsheet can be created as and when the vans are loaded

The future state Value Stream Mapping after all the processes were implemented was drawn as shown in Figure 5.3.

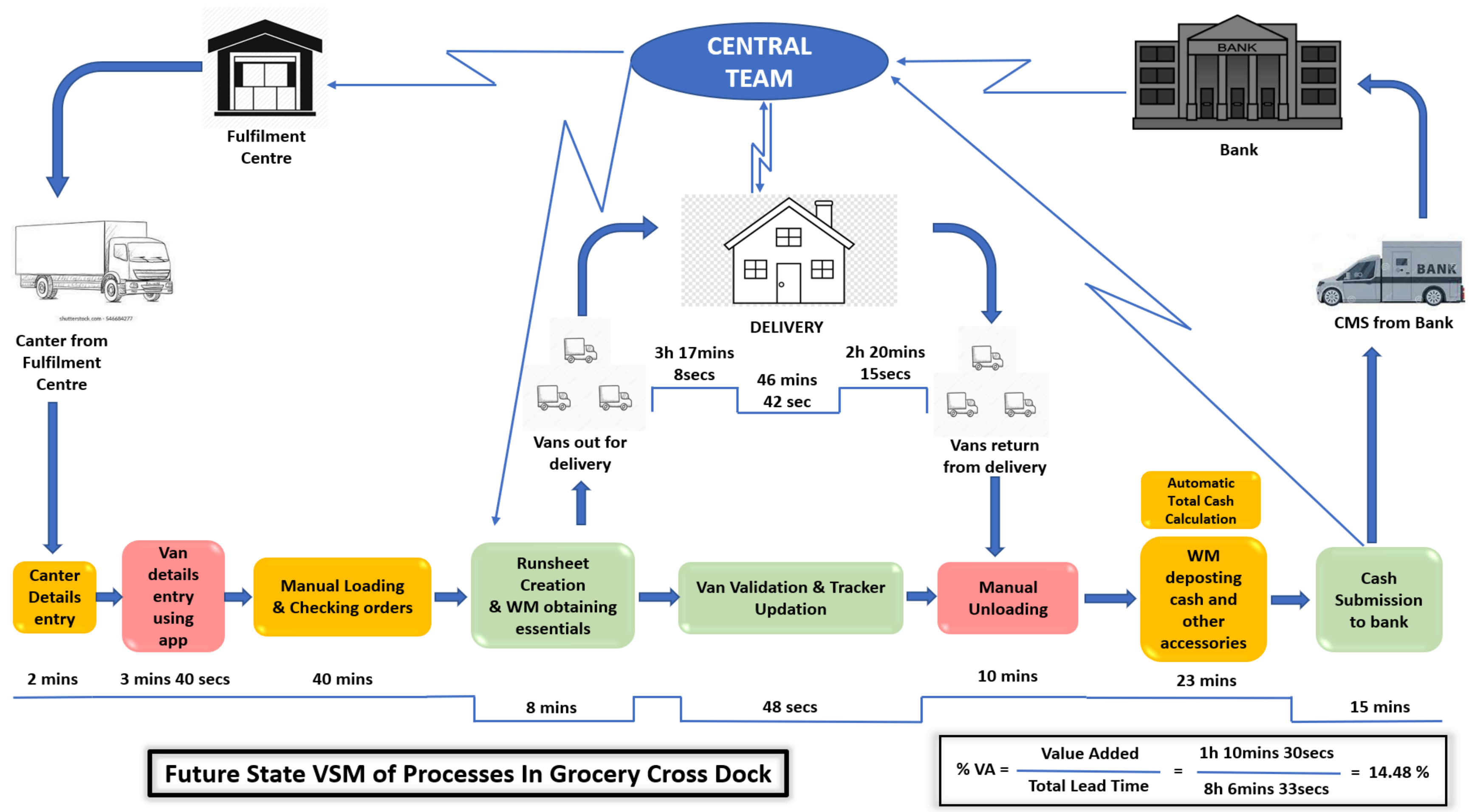


Figure 5.3: Future State Value Stream Mapping

5.3 Carbon Emission Analysis

The carbon emitted by the grocery last mile across India in the year 2020 turned out to be a huge number as depicted in Figure 5.4.

All the cross docks and Fulfilment centers across India produced 69,28,012.228kg of carbon in the year 2020.

The table 5.3 below shows the detailed information about the amount of carbon emitted:

Table 5.3: Carbon Emissions in 2020

Region	Carbon Emitted	Remarks
Across India	69,28,012.228 kg	-
NCR	21,07,576 kg	Highest Emission
Chennai	8,57,706 kg	Lowest Emission

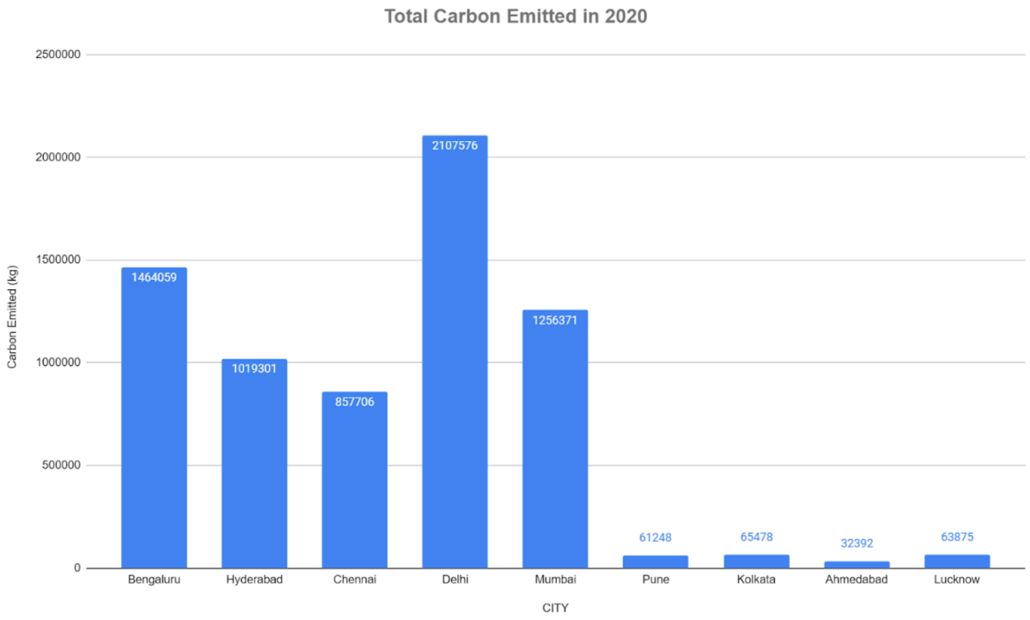


Figure 5.4: City wise Carbon Emissions in 2020

After analyzing the data of carbon emissions by grocery last mile, the results achieved were: Vans should be utilized to their maximum capacity. In cases where the space in the vans is not utilized to their optimum capacity, the biker model of delivery is adopted. In cities with low Orders per day (OPD) and low beat distance all the orders can be delivered through biker model. In case of volumetrically bulk orders only, vans can be utilized. In cities with High Orders per day (OPD) and low beat distance, 70%-80% of the orders can be delivered through biker models. In cities with Low Orders per day (OPD) and high beat distance, a hybrid model of 50% bikes and 50% vans can be used.

By doing so, a lot environmental goodness can be contributed by the last mile delivery process.

CHAPTER-6

CONCLUSION AND FUTURE SCOPE

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

Flipkart Pvt Ltd, Bangalore is one of the top e-commerce industries in India. The project was carried out in Flipkart Grocery, one of the 4 business units of Flipkart. The project was mainly focused on improving the productivity of the Grocery Cross Docks (Last Mile). For the project, 5 processes in the cross dock were chosen. The processes were streamlined in a better way making it more transparent, faster and efficient.

It was very essential to be on ground, to observe the processes clearly, and identify the problems and muda occurring at cross docks. After observing the processes, they were classified into Value-added activities and non-Value-added activities. The required data were collected and studied using Time and Motion Study (TMS) and Value Stream Mapping (VSM). After analyzing the processes, it was seen that the non-value-added time in the cross-dock was high, certain processes were repetitive and there wasn't enough transparency in few processes. The time and effort spent in certain processes were more than required.

The process of van validation which involves vendor payment, making it sensitive, had lots of manual interference. To overcome this challenge, the process of van validation was automated using a mobile application called "Scan-It to Office" for data capturing and transmission. This speeded up the process and made it more transparent by giving real time visibility to the stakeholders. The vendor payment was also aligned into it. The process became error-free as all calculations were shifted from manual to automated.

Other than van validation, 4 more processes were identified in the Day start process, which could potentially be optimized in order to make it more efficient. These processes were closely observed and the critical steps were noted down. Few Kaizens were thought about so that the processes were reorganized and streamlined in a better manner. The Kaizens were implemented on a trial basis and the loopholes were addressed. The improved process in the form of Kaizens, were then implemented in a full-fledged manner. The cycle time of the processes reduced greatly. The unwanted movement of men and material within the cross dock reduced to a greater extent. After successful implementation of all the Kaizens, time was extracted from the Day start process and utilized in the delivery process. This improved the productivity of the cross dock by 1.46 units. Added to that, the percentage of value-added activities in the cross dock increased from 13.56% to 14.43%.

When last mile deliveries are concerned, though it's changing the lives of millions in a better way, there's always a negative side of it affecting the environment. The carbon emissions by the grocery last mile in the year 2020 was calculated and analyzed. Since the present delivery process included only vans, the idea of delivery using bikes was thought about. The carbon emitted by vans and bikes per beat were worked out and analyzed. Based on the orders per day and the beat distance, the cities were classified and analyzed. After thorough analysis, biker model of delivery was adopted in cities where it is feasible.

After implementing all the projects, certain areas were identified where there were large scope for improvement. The Automated Van Validation using the Scan It to Office App can be integrated into other business units of Flipkart and also to other E-Commerce industries. RFIDs can be used as a data capturing device in the Last Mile hubs in the future. Changes can be made in the Beat Planning, taking into account the biker model of delivery where pin codes can be further divided into smaller regions for better area coverage using bikes. A hybrid model where orders can be taken up to a distance in vans and then distributed to bikes for a better network like coverage. Switching majority of the delivery process to Electric Vehicles will make it greener.

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