School of Higher Commercial Studies Algiers

Thesis Submitted in Partial Fulfilment of the Requirements for Master's Degree in Commercial Sciences

Major: Distribution & Supply Chain Management

Subject: Performance Optimisation of a 3PL Warehouse

Case study: UPS Algiers

Submitted by:

Samy BENACHOUR
Samy DOB

Supervised by:

Pr. Ouardia LAOUEDJ

11th Promotion

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Dedications:

To my dear parents, Rabha and Youcef

Your unwavering love and constant support have been the bedrock of my achievements. From the earliest days of my life, you've stood by me, guiding me through challenges and celebrating my successes. Your sacrifices, encouragement, and unwavering presence have fuelled my determination. Without you, none of my accomplishments would have been possible.

To my dear sisters, Chérine, Neïma, Sarah, and Nihel

Your unwavering help and support have been invaluable. Whether it was late-night study sessions, moral boosts, or simply being there to listen, your presence has been a source of comfort and motivation. You've shared in my journey, and I am grateful for each of you.

To my brother-in-law, Fahim.B

Thank you for your availability and invaluable assistance.

To my best friend, Douaoui.D

From high school to this very moment, your unwavering friendship has sustained me. Your encouragement, laughter, and shared memories have been pillars of strength.

Samy BENACHOUR.

To my dear parents, Ahcène and Yasmina,

Your unwavering love and constant support have been the foundation of my achievements. From the earliest days of my life, you have stood by me, guiding me through challenges and celebrating my successes. Your sacrifices, encouragement, and unwavering presence have fueled my determination. Without you, none of my accomplishments would have been possible.

To my dear sisters, Asma, Meriem, Amina, and Manel,

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To my best friend, Largat. N,

From the first year to this last chapter, your unwavering friendship has sustained me. Your encouragement, laughter, and shared memories have been pillars of strength.

Sammy DOB

Acknowledgments

In the pursuit of knowledge and scholarly achievement, we are indebted to those who have guided and supported us. With profound gratitude, I extend my thanks to the following individuals who have played pivotal roles in the completion of this thesis:

God, the Almighty Creator

For His unwavering guidance and blessings throughout my academic journey.

My Parents, Rabha and Youcef

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Your unwavering friendship and encouragement have sustained me from high school to this moment.

Supervisor Pr Laouedj.W

Your mentorship, valuable lessons, and guidance have shaped this thesis. Your commitment to education has left an indelible mark.

EHEC Professors

I express my sincere appreciation to the professors at EHEC. Their dedication to teaching and their valuable insights have significantly contributed to my academic growth.

Supervisor Kouach.T

Your expertise during the internship phase has been crucial. Your guidance has enriched my understanding.

The UPS Team

To all team members, thank you for sharing your experience and insights. Your collective wisdom has enhanced this work.

Samy BENACHOUR

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Supervisor, Pr. Laouedj W.

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Table of figures:

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Abbreviations list:

1. **1PL:** First-Party Logistics
2. **2PL:** Second-Party Logistics
3. **3PL:** Third-Party Logistics
4. **4PL:** Fourth-Party Logistics
5. **5PL:** Fifth-Party Logistics
6. **AI:** Artificial Intelligence
7. **CLM:** Council of Logistics Management
8. **DC:** Distribution Center
9. **ERP:** Enterprise Resource Planning
10. **GPS:** Global Positioning System
11. **IoT:** Internet of Things
12. **JIT:** Just-in-Time
13. **KPIs:** Key Performance Indicators
14. **POD:** Proof of Delivery
15. **RFID:** Radio Frequency Identification
16. **SCM:** Supply Chain Management
17. **TMS:** Transportation Management System
18. **UPS:** United Parcel Service
19. **VA:** Value-Adding
20. **VSM:** Value Stream Mapping
21. **WMS:** Warehouse Management System

Summary:

Abstract

This graduation thesis explores the optimization of logistics within a third-party logistics (3PL) service, focusing on UPS Algiers.

The initial chapters provide a theoretical foundation, covering key concepts in logistics, supply chain management, and warehousing. Given the rising importance of 3PL warehouses and warehousing in general, we conducted an internship at UPS Algiers at Cargo & Supply Chain Solutions department.

Our studies focused on lean management and optimization of a 3PL warehouse. In the subsequent section, we examine UPS Algiers, where key performance indicators (KPIs) are calculated to measure the performance of their 3PL warehouse. Through the application of KPIs, value stream mapping, and the Ishikawa diagram, significant performance improvements were achieved. This study demonstrates the effectiveness of these methodologies in enhancing the efficiency and productivity of 3PL services, contributing to the broader field of logistics optimization.

Résumé:

Cette thèse de fin d'études explore l'optimisation de la logistique au sein d'un service de logistique tierce partie (3PL), en se concentrant sur UPS Alger.

Les premiers chapitres fournissent une base théorique, couvrant les concepts clés de la logistique, de la gestion de la chaîne d'approvisionnement et de l'entreposage. Étant donné l'importance croissante des entrepôts 3PL et de l'entreposage en général, nous avons effectué un stage chez UPS Alger au département Cargo & Supply Chain Solutions.

Nos études se sont concentrées sur la gestion lean et l'optimisation d'un entrepôt 3PL. Dans la section suivante, nous examinons UPS Alger, où des indicateurs de performance clés (KPI) sont calculés pour mesurer la performance de leur entrepôt 3PL. Grâce à l'application des KPI, de la cartographie de la chaîne de valeur et du diagramme d'Ishikawa, des améliorations significatives de la performance ont été réalisées. Cette étude démontre l'efficacité de ces méthodologies pour améliorer l'efficacité et la productivité des services 3PL, contribuant ainsi au domaine plus large de l'optimisation logistique.

ملخص :

تستكشف أطروحة التخرج هته تحسين اللوجستيات ضمن خدمة لوجستيات الطرف الثالث(3PL) ، مع التركيز على UPSالجزائر. تونر النصول االولى أسا س نظر ًيا يغطي المفاهيم الرئيسية ني اللوجستيات وإدارة سلسلة التوريد والتخزين.

نظ ًرا لألهمية المتزايدة لمستودعات 3PL والتخزين بشكل عام، أجرينا تحليا ني شركة UPS الجزائر ني مسؤ حلول الشحن وسلسلة التوريد.

ركزت دراستنا على اإلدارة الرشيقة وتحسين مستودع 3PL. ني القسم التالي، تحص UPS الجزائر، حيث يتم حساب مؤشرات االداء الرئيسية (KPIs) لقياس أداء مستودع 3PL الخاص بهم. من خالل تطبيق مؤشرات االداء الرئيسية ورسم خرائط سلسلة القيمة ومخطط إيشيكاوا، تم تحديد تحسينات كبيرة ني االداء. تظهر هذه الدراسة فعالية هذه المنهجيات ني تعزيز كفاءة وإنتاجية خدمات 3PL ، مما يساهم ني المجال االوسع لتحسين اللوجستيات.

General introduction:

In today's globalized economy, logistics and supply chain management (SCM) are essential for the smooth operation of businesses and industries. Originally, logistics was primarily concerned with the transportation and storage of goods. However, advancements in technology, changes in consumer behaviour, and globalization have significantly transformed logistics. It is now a crucial part of SCM, which involves the overall management of processes that ensure efficient delivery of products from suppliers to customers.

The focus of this study is on optimizing a third-party logistics (3PL) warehouse during an internship at UPS Algiers. The main goal was to improve the performance of the 3PL warehouse by identifying inefficiencies and implementing targeted solutions. This internship provided valuable insights into the operations of a leading logistics provider, allowing for practical improvements in warehouse performance.

Third-party logistics (3PL) providers have become increasingly important in this field. These specialized firms offer services such as transportation, warehousing, inventory management, and order fulfilment. The growth of 3PL providers indicates a trend towards outsourcing logistics functions, allowing companies to benefit from their expertise, expand operations, and concentrate on their core activities.

Warehousing is a key component of SCM, acting as the central hub for storage, distribution, and additional services. The evolution of warehousing has included the adoption of advanced technologies and practices, such as warehouse management systems (WMS) and lean warehousing principles. These innovations help improve efficiency, reduce costs, and enhance service levels.

This thesis aims to provide a detailed exploration of logistics and SCM, with a focus on practical applications during the internship at UPS Algiers. By examining the historical context, core principles, and recent developments. The emphasis on optimizing 3PL warehouse performance at UPS Algiers highlights the dynamic nature of the field and the crucial role these components play in modern supply chains.

Aim of the Study

The aim of this study is to analyse and optimize the logistical performance of the 3PL warehouse managed by UPS Algeria.

Problematic:

To what extent could the company optimize the logistical performance of 3PL warehouses?

Sub-questions:

1. What are the key indicators for optimizing the lead times of the 3PL warehousing process?
2. How does proper slotting of products in a warehouse improve stock accuracy and subsequently optimize warehouse flows?

Hypothesis:

1. Streamlining inbound processes, particularly by expediting customs clearance through efficient document preparation, will effectively reduce lead times in the 3PL warehousing process.
2. Effective slotting practices enhance the alignment between physical inventory and warehouse management system (WMS) records, thereby improving stock accuracy and optimizing operational efficiency.

Objectives of the Theme

To achieve our study's objective, we have structured our work as follows:

Theoretical Aspect:

The aim is to present the conceptual framework of key concepts related to the theme, specifically focusing on the most significant aspects according to supply chain management (SCM) and logistics, particularly in warehousing.

Practical Aspect:

The aim is to present an interpretation of the results from analysing the optimization of logistical performance in a 3PL warehouse. This analysis is based on interviews, participant observation, organizational immersion, and the implementation of KPIs and lean management techniques (VSM, ISHIKAWA…) to evaluate the impact of various strategies and technologies on the productivity and efficiency of the 3PL warehouse.

Reasons for Choosing the Theme:

Our decision to focus on this theme stems from several significant considerations:

- ✓ **The Vitality of Logistics within Enterprises:** We recognize that logistics operations play a fundamental role in the overall performance and success of businesses. Effective logistics management, particularly in the realm of warehousing, can significantly enhance operational efficiency, reduce costs, and improve customer satisfaction. Therefore, our study aims to delve deep into the intricacies of warehousing management to uncover avenues for greater productivity.
- ✓ **The Growing Importance of 3PL Warehouses:** With the advent of third-party logistics warehouses, there has been a paradigm shift in the logistics landscape, particularly in Algeria. These warehouses offer a range of services, from storage and distribution to value-added processes, providing companies with flexible and cost-effective solutions. Understanding the nuances of managing 3PL warehouses is crucial for businesses to capitalize on their benefits fully. Hence, our study focuses on exploring the challenges and opportunities associated with the effective management of these facilities.
- ✓ **Maximizing Value from Warehousing Operations:** We are driven by the aspiration to extract maximum value from warehousing operations. In today's competitive business environment, efficient warehousing practices can serve as a strategic differentiator, enabling companies to streamline their supply chain processes, optimize inventory management, and respond swiftly to changing market demands. By scrutinizing and optimizing these operations, our study seeks to empower businesses with insights and strategies to unlock their full potential.

Chapter 01:
Foundations of Logistics and Supply Chain Management

CHAPTER 01: Foundations of Logistics and Supply Chain Management

1.1 Introduction:

In the complex world of business, ensuring that products reach customers on time and in good condition is essential. This process involves a lot of moving parts, from getting raw materials to factories, to storing finished products, to delivering them to stores or directly to consumers. This is where logistics and supply chain management come into play. Logistics deals with the practical side of things, like transportation and warehousing, while supply chain management takes a broader view, coordinating all the different steps involved in making and delivering products. Together, these fields ensure that companies can operate smoothly, save money by avoiding delays or excess inventory, and keep customers satisfied. This chapter lays the groundwork for a deeper dive into the world of logistics and supply chain management, exploring how they work together to drive success in today's competitive business environment.

1.2 Section 01: Logistics Providers Fundamentals

The dynamic realm of logistics is underpinned by the critical role of logistics providers, who are central to the uninterrupted functioning of supply chains across the globe. This chapter, entitled "Logistics Providers Fundamentals," explores the core elements and fundamental concepts that constitute the framework of logistics services. It classifies the diverse array of providers and sheds light on their essential role within the supply chain. Ranging from conventional courier services to advanced 3PL operations, logistics providers have developed into the fundamental pillars of international trade and commerce. They are instrumental not only in facilitating the effective transit of goods but also in providing businesses with a strategic edge by streamlining logistics processes and improving customer satisfaction.

1.2.1 History of Logistics: From logistics to SCM:

Where It Begins:

Logistics, in its earliest form, was predominantly associated with military operations, focusing on the procurement, maintenance, and transport of military materials. The concept of logistics, particularly in military contexts, was familiar to the ancient Greeks and Romans when it came to moving goods and supplies1. However, the scope of logistics expanded post-1950s to include a wider range of business operations, from the procurement of raw materials to delivering products to consumers1. The concept of physical distribution emerged as a distinct field to address conflicts and inefficiencies in costs and customer service within disjointed logistics functions1.

1) The Past:

The 1956 study by Lewis et al. underscored the importance of considering shipping from a total cost viewpoint, laying the foundation for subsequent logistics research and education1. The 1960s saw the establishment of logistics as an academic discipline, with the first textbook on the subject focusing on outbound goods movements, such as transportation and inventory management1. Over time, the focus expanded to include inbound logistics, giving rise to the term "business logistics"1. This era also acknowledged the impact of logistics costs at national and corporate levels, highlighting the need for managerial attention to physical distribution and logistics.[1]

2) The Shift to Supply Chain Management

In the contemporary business environment, there has been a significant transition from logistics to supply chain management (SCM). This shift represents a move towards a more holistic and integrated approach in managing product flows across various functions and between different channel members. Initially, logistics and physical distribution were integral components of this process. However, SCM has since emerged as a broader concept that encompasses a range of activities, including sourcing, procurement, conversion, and logistics management. This

[1] *Carleton University in 30 January 2016 (Pages 333-337)*

evolution underscores the importance of coordination and collaboration with various partners along the supply chain.

The Council of Supply Chain Management Professionals defines SCM as the planning and management of all activities related to supply and demand within and across companies. This definition distinguishes SCM from logistics, which is considered a subset of SCM focused on the efficient flow and storage of goods and services. SCM is characterized by activity and process administration, interfunctional coordination, and interorganizational coordination, all aimed at managing product flows across multiple enterprises. In contrast, logistics primarily focuses on product flow activities within a firm.

Despite the theoretical scope of SCM emphasizing collaboration and integration throughout the supply chain, current practices show limited implementation. Most firms concentrate on integration within their own walls or with first-tier suppliers. The challenge lies in translating the theoretical benefits of SCM into practical integration and collaboration across the entire supply chain channel. This translation is a critical area of focus in the ongoing evolution of SCM.[2]

3) The Future of Logistics and Supply Chain Management: A Technological Revolution

the future of logistics and supply chain management (SCM) is poised to be significantly shaped by advancements in technology, particularly in areas like AI, machine learning, and blockchain.

- **Enhanced Forecasting:** Advanced algorithms and machine learning models can analyse historical data and market trends to make accurate predictions about future demand. This predictive capability can lead to more efficient planning and resource allocation.

Optimized Inventory Management: Artificial intelligence can optimize inventory levels based on predicted demand. This can lead to significant cost savings and improved customer satisfaction.

[2] *by Carleton University in 30 January 2016 (Pages 337-341)*

- **Increased Transportation Efficiency:** AI and machine learning can optimize route planning for transportation. This can enhance the overall efficiency of the supply chain.
- **Greater Supply Chain Transparency:** Blockchain technology can provide a secure, immutable record of all transactions in the supply chain. This can increase trust and collaboration among supply chain partners.

Looking ahead, we can expect to see the rise of the 'smart' supply chain. Organizations will be able to respond quicker to day-to-day requests, proactively address problem solving, and reduce errors and inefficiencies. This will be enabled by a raft of technology developments, including generative AI, data analytics, automation, machine learning, Internet of Things (IoT), blockchain, and more. The 'smart' supply chain is well on its way to becoming the new normal.

This future promises autonomous, self-learning machines seamlessly managing the broader supply chain process. Organizations will need to intensely focus on mining relevant, clean, and well-governed data if they want to make the most of their new technology investments. Data will also be crucial as organizations are pressured to meet evolving ESG and Scope commitments.[3]

1.2.2 Logistics fundamentals:

"Supply chain management encompasses the planning, execution, and supervision of the movement and storage of goods, services, and related information from their inception to the final consumer in order to meet customer demands. This involves a strategic orchestration of processes to ensure efficiency and effectiveness in the delivery pipeline."[4]

1. Supply chain management definitions:

1. "That part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from

[3] *Shawn Tay, Mehdi Ouici, association for supply chain management, top 10 supply chain trends, 2024*
[4] *Council of Logistics Management, 2009*

the point of origin to the point of consumption in order to meet customers' requirements"[5]

2. SCM encompasses the critical integration of core business processes, extending from the end user back to the original suppliers. It involves the provision of products, services, and information that deliver added value to customers and other stakeholders.[6]

2. **Distinction Between SCM and Logistics**:

While SCM and logistics are often used interchangeably, they cover different but related activities. SCM is a broad concept that encompasses the entire production and delivery process, including sourcing, manufacturing, transporting, storing, and selling. Logistics, on the other hand, specifically focuses on the movement and storage of goods within this process.

Table 1: Main differences between logistics and supply chain management[7]

Logistics	Supply Chain
Logistics is one activity in supply chain management.	Supply chain management covers a wide range of activities, including planning, sourcing materials, labor and facilities management, producing and delivering those goods and services.
Logistics focuses on the efficient and cost-effective delivery of goods to the customer.	Supply chain management targets higher operational performance that will give the business a competitive advantage.
Logistics started with the military. Many say Alexander the Great, born 356 B.C., as a logistics master.	The modern practice of supply chain management started in the 20th century. The Ford Motor Company production lines perfected the concept. Many credit logistician Keith Oliver as the person who coined the term in the early 1980s.
Logistics are centered on the movement and transport of goods within a company	SCM oversees the development of raw materials into finished goods that move from the producer to the manufacturer. Those goods get distributed to retailers or directly to consumers.

[5] *The Council of Logistics Management (CLM) (1996)*

[6] *Stock & Lambert, strategic logistics management (2001)*

[7] *Abby JenkinsAbby Jenkins, Product Marketing Manager, July 25, 2022*

3. **The Relationship Between SCM and Logistics**

- **Integration:** Logistics is a critical component of SCM, providing the tactical execution necessary for SCM strategies.
- **Overlap and Distinctions:** Both SCM and logistics focus on the efficient movement of goods. SCM is strategic, involving high-level planning and coordination, while logistics is operational, focusing on the movement and storage within the SCM framework.

4. **Reverse Logistics in Service Industries:**

Reverse logistics in service industries refers to the process of managing the return of goods from customers back to the company. It includes activities such as handling returns, repairs, maintenance, recycling, and disposal. Unlike traditional manufacturing logistics, which primarily focuses on the forward movement of goods from production to consumption, reverse logistics in service industries emphasizes the return flow from the customer back to the service provider.

- **Importance of Reverse Logistics:**
- ✓ **Customer Satisfaction:** Efficient reverse logistics processes enhance customer satisfaction by providing hassle-free return and exchange services.
- ✓ **Cost Recovery:** Companies can recover value from returned products through refurbishing, recycling, or reselling.
- ✓ **Environmental Impact:** Properly managed reverse logistics processes help in reducing the environmental footprint by ensuring that products are recycled or disposed of responsibly.
- ✓ **Competitive Advantage:** Companies that excel in reverse logistics can differentiate themselves from competitors by offering superior service.[8] [9]

[8] *Rogers, D. S., & Tibben-Lembke, R. S. (1998). "Going Backwards: Reverse Logistics Trends and Practices". University of Nevada, Reno, Center for Logistics Management*

[9] *Govindan, K., Soleimani, H., & Kannan, D. (2015). "Reverse logistics and closed-loop supply chain: A comprehensive review to explore the future". European Journal of Operational Research, 240(3), 603-626.*

5. Logistics providers:

1. **First party logistics (1PL):** Currently, the company consistently relies on external services for the transportation of its merchandise. It contracts with a freight provider who receives payment according to the volume of goods or the distance covered.

2. **Second party logistics (2PL):** Outsourcing in the logistics sector has evolved to encompass not only transportation but also warehousing. Consequently, a second-level logistics (2PL) provider is now characterized as a carrier that offers additional storage solutions.

In the 2PL framework, payments are primarily determined by the cost per pallet or container. This applies to both transportation and storage services.

3. **Third party logistics (3PL**): The company outsources a range of logistics-related activities. In addition to fundamental logistics services such as transportation and warehousing (1PL and 2PL), the 3PL provider offers higher value-added services, including but not limited to:

   - ✓ Customs management and transit
   - ✓ Stuffing and unstuffing
   - ✓ Stock management on behalf of the company
   - ✓ Order preparation
   - ✓ Cross-Docking
   - ✓ Pre-manufacturing operations
   - ✓ post-manufacturing operations, such as labelling, packaging, localization/customization, and delayed differentiation (postponement)
   - ✓ Management of logistics information flow
   - ✓ Test benches
   - ✓ Other related services

These services are executed within a dedicated logistics platform. In the context of 3PL+, the service provider can also offer complete management of the supply chain.

4. **Fourth-party logistics (4PL):** Formulates and executes a complete solution tailored to the entire or specific segments of the logistics process. This solution is systematically organized, managed, and continuously enhanced, with adjustments made in response to shifts in market conditions or customer preferences. Moreover, a 4PL provider assumes the responsibility of selecting and supervising logistics service providers, ensuring tasks are carried out to consistently deliver the best value in terms of quality. Typically, a 4PL provider is non-asset-based; however, if it possesses assets, it is often regarded as a Lead Logistics Provider (LLP).

Consequently, the role of a 4PL provider is to orchestrate the interaction of various stakeholders across a company's supply chain, utilizing its own resources, capabilities, and technology, as well as those of other service providers, to engineer and oversee intricate supply chains**.**

5. **Fifth party logistics (5PL):** Fifth Party Logistics (5PL) encompasses logistics service providers who specialize in designing, organizing, and implementing logistics solutions for clients, with a particular emphasis on information systems. This concept marks the most recent evolutionary stage in logistics for businesses.

Moreover, 5PL services are dedicated to ensuring customer satisfaction through a range of offerings including consulting, auditing, support, and tailored developments. The primary objective of a 5PL provider is to consistently deliver more sophisticated and automated systems that improve the efficiency of the Supply Chain.

Furthermore, the realm of e-business, or online commerce, and its counterpart, e-logistics, are integral components of the 5PL framework.[10]

Challenges faced by logistics service providers:

[10] *Professor F. Boubakour, SCM 01 course (2022)*

1. **Increasing Customer Demands**: As the global supply chains expand, customer demands are also increasing. Logistics Service Providers (LSPs) need to adapt to these changes to ensure their organization's success.
2. **Fleet and Capacity Restrictions**: LSPs often face restrictions related to fleet and capacity. These restrictions can impact the ability of LSPs to meet customer demands.
3. **High Fixed and Variable Costs**: LSPs have to deal with high fixed and variable costs. These costs need to be effectively managed to maintain profitability.
4. **Visibility**: Understanding how shipments are progressing, providing real-time updates to clients, and centralizing information and data are crucial for LSPs.
5. **Customer Value**: Differentiating services with the client and building trust through customizing offerings is a challenge for LSPs.[11]

6. **Managing Data and Technology**: With the spread of contemporary technology and interconnected electronic networks, managing massive volumes of data has become critical.
7. **Capping Transportation Costs**: Transportation expenses, which are affected by factors such as fuel prices and driver shortages, can have a substantial impact on a logistics organization's budget.
8. **Understanding and Incorporating Compliance Laws and Standards**: Navigating the tangle of government laws, from federal, state, and local obligations to specialized environmental regulations, is essential in logistics management.[12]

9. **Compliance Management, Risk Management, and Supply Chain Disruptions**: About 32% of logistics service providers across the globe face challenges from these areas.
10. **Finding, Retaining, and Managing Skilled Labor**: About 70% of logistics service providers find it hard to manage this aspect.

[11] *The Blume Global Team, in July 12, 2019*

[12] https://www.inboundlogistics.com/articles/logistics-management-challenges/

11. **Rising Operational Costs**: About 63% of logistics service providers are grappling with this challenge[13]

1.2.3 Transport in supply chain management:

Transit in Logistics

Transit in logistics refers to the period during which goods are transported from one location to another. This period begins when the shipment is dispatched and ends when it arrives at its final destination. Transit time is a crucial metric in supply chain management, as it directly impacts delivery schedules, inventory management, and overall customer satisfaction.

Key Aspects of Transit Optimization

Transit Time Reduction

1. **Route Optimization:**
    - **Advanced Routing Software:** Utilizing sophisticated routing software that considers real-time traffic, road conditions, and delivery windows can significantly reduce transit times. These systems use algorithms to calculate the most efficient routes, ensuring timely deliveries and reducing fuel consumption [14] [15]
    - **Dynamic Routing:** Adjusting routes in real-time based on current traffic conditions and road closures helps avoid delays and ensures timely deliveries.

[13] *https://shipsy.io/blogs/top-six-challenges-global-logistics-service-providers-2023/*

[14] *Jociano Motta: Transit Time: Maximizing Efficiency In International Trade And Logistics, September 22, 2023 (Cheap2Ship)*

[15] *By Hari July 5, 2022,Maritime Law (Marine Insight).*

2. **Fleet Maintenance:**
    - **Regular Maintenance:** Conducting regular maintenance checks on vehicles helps prevent breakdowns and ensures they are operating efficiently. This includes routine inspections, timely servicing, and prompt repairs.
    - **Predictive Maintenance:** Using data analytics to predict potential vehicle issues before they occur can minimize downtime and keep the fleet running smoothly[16]
3. **Driver Training:**
    - **Efficient Driving Techniques:** Training drivers on efficient driving practices, such as optimal speed management, smooth acceleration, and braking, can help reduce transit times and improve fuel efficiency.
    - **Schedule Adherence:** Educating drivers on the importance of adhering to schedules and time management ensures timely deliveries and better route planning.

Monitoring and Reporting

- **Real-Time Monitoring:**
    - **IoT Devices:** Implementing Internet of Things (IoT) devices and telematics systems in vehicles allows for real-time tracking of goods in transit. These devices can monitor various conditions such as temperature, humidity, and vehicle performance metrics[17]
    - **Tracking Systems:** Using GPS and other tracking technologies provides visibility into the location and status of shipments, enabling proactive management of any issues that arise during transit [18]
- **Performance Metrics:**
    - **Key Performance Indicators (KPIs):** Tracking KPIs such as on-time delivery rates, transit times, and fuel efficiency helps identify areas for improvement. Analysing these metrics allows for strategic adjustments to optimize the transit process.

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[16] *Team Laconav, in April 18, 2022 (Loconav).*

[17] *By Hari July 5, 2022,Maritime Law (Marine Insight). (Marine Insight).*

[18] *Jociano Motta: Transit Time: Maximizing Efficiency In International Trade And Logistics, September 22, 2023 (Cheap2Ship)*

- **Data Analytics:** Leveraging data analytics to review historical transit data can uncover patterns and trends, helping to improve future performance and reduce transit times.

➢ **Importance of Transit Optimization**

Optimizing transit time is crucial for several reasons:

- **Customer Satisfaction:** Timely deliveries enhance customer satisfaction and loyalty.
- **Cost Efficiency:** Reducing transit times lowers fuel consumption and operational costs.
- **Competitive Advantage:** Efficient transit processes provide a competitive edge in the market by enabling faster and more reliable deliveries.
- **Inventory Management:** Shorter transit times reduce the need for large inventory holdings, leading to lower storage costs and reduced risk of obsolescence.

Import And Export Operations:

➢ **Import:**

The act of importation involves acquiring goods or services from external sources beyond national borders, primarily for trading or consumption within the importing country. This process encompasses the procurement of commodities or products from overseas manufacturers or vendors and their subsequent entry through international frontiers.

➢ **Export:**

Conversely, exporting denotes the commercial activity of selling and dispatching domestically produced goods or services to buyers in international markets. This practice includes the transfer of various products or goods from the country of origin to external markets for the purposes of trade or consumption.[19]

Procedures Involved in Import and Export Operations:

[19] *Bowersox, D.J., Closs, D.J., & Cooper, M.B. (2013). Supply Chain Logistics Management. McGraw-Hill Education.*

1. **Documentation and Compliance**:
    - Both import and export operations require extensive documentation to comply with customs regulations and international trade laws. This includes commercial invoices, packing lists, certificates of origin, import/export licenses, and other relevant paperwork.
2. **Customs Procedures**:
    - Customs procedures vary by country but generally involve the declaration of imported or exported goods to customs authorities. This includes providing accurate descriptions, values, and classifications of goods, as well as paying any applicable duties, taxes, or tariffs.
3. **Transportation and Logistics**:
    - Import and export operations involve the transportation of goods across international borders. This may include selecting appropriate transportation modes (e.g., air, sea, road, rail), arranging freight forwarding services, and managing logistics such as packaging, labelling, and tracking shipments.
4. **Inventory Management**:
    - Effective inventory management is essential for import and export operations to ensure the availability of goods for export and to manage inventory levels of imported products. This includes inventory forecasting, stock control, and optimization of storage and distribution processes.
5. **Risk Management**:
    - Import and export operations are subject to various risks, including regulatory compliance, transportation delays, currency fluctuations, and geopolitical instability. Effective risk management strategies are necessary to identify, assess, and mitigate these risks to ensure the smooth flow of goods across borders.[20]

[20] *Waters, D. (2009). Global Logistics: New Directions in Supply Chain Management. Kogan Page Publishers.*

Importance of 3PL Services in Import-Export Operations:

- Third-party logistics (3PL) providers play a crucial role in facilitating import and export operations for businesses. Their services include:
    1. Customs brokerage and compliance assistance to ensure adherence to import/export regulations.
    2. Freight forwarding and transportation management to optimize shipping routes and reduce transit times.
    3. Warehousing and distribution services to store, consolidate, and distribute goods efficiently.
    4. Technology solutions for supply chain visibility, tracking, and inventory management.
    5. Risk management expertise to identify and mitigate potential disruptions in the supply chain.[21]

1.3 Section 02: The 3PL Rise in the Supply Chain

During the 1980s, third-party logistics (3PL) services were somewhat narrow in their range. However, as demand for such services expanded, 3PL providers began to offer a more integrated suite of logistics activities. Additionally, with the growth in outsourcing logistics services, the function of 3PLs within the supply chain evolved significantly.

The transformation of the role involved a shift from providing mere transportation services to delivering a comprehensive package of services. This package now encompasses warehousing, inventory management, packaging, cross-docking, and managing technology solutions.

[21] *The International Chamber of Commerce (ICC) website (iccwbo.org) offers resources and publications on trade finance, customs procedures, and global supply chain management.*

1.3.1 Theoretical support for the role of 3PL:

Transaction cost economics:

Transaction Cost Economics (TCE) theory posits that a firm's decision to own or outsource is predicated on the goal of minimizing the total of its transaction and production costs.

With the burgeoning demand for outsourced logistics services, Third-Party Logistics providers (3PLs) have expanded their service offerings. As 3PLs have taken on a more significant role, they have managed to acquire assets and generate synergies through serving a diverse clientele, thereby reducing transaction costs for firms. TCE suggests that outsourcing to 3PLs is economically viable as long as it presents cost benefits, allowing these providers to coordinate a broader range of supply chain activities.

Additionally, the decision-making process is influenced by the firm's ability to concentrate on its core competencies while outsourcing other organizational functions, an approach supported by the Resource-Based Theory (RBT).

Resource-based theory:

The principles of Resource-Based Theory (RBT) indicate that an organization must ensure an effective aggregation and deployment of the appropriate resources from its environment to not only survive but also enhance its operational performance.

A competitive advantage may arise from the possession or accessibility of a unique asset, innovation, or resource barriers. Consequently, RBT is particularly beneficial in facilitating outsourcing and the role of Third-Party Logistics (3PLs). Companies depend on outsourcing to tap into the valuable resources of other firms within the competitive market. However, the mere provision of access to supplementary resources does not comprehensively account for the increasing trend of companies outsourcing functions to 3PLs, which leads to the introduction of Network Theory (NT).

Network theory:

From the Network Theory (NT) viewpoint, outsourcing is a strategic approach that allows a firm to manage its supply chain holistically by fostering relationships and coordinating activities across the network.

In the context of Third-Party Logistics (3PLs), NT emphasizes the importance of developing relationships, organizational frameworks, and strategic alliances.

An organization that excels in network coordination establishes a foundation for significant competitive advantage, further underlining the theoretical rationale for the integration of 3PLs

Table 2: Underpinnings of social science theories relative to the role of 3PL[22]

THEORY	**THEORY FOUNDATION**	**Support for outsourcing to a 3PL**
Transaction cost economics (TCE)	Firms exist to maximize profit by reducing their transaction costs	Minimizes a firm's transaction costs; as 3PLs grow in capability they offer services at lower costs further supporting their use
Resource-based theory (RBT)	Firms are comprised of bundles of resources that gives them a competitive advantage	Maximizes a firm's ability to access a range of resources; as 3PLs grow they can increasingly offer a wider range of resources

[22] *Underpinnings of social science theories relative to the role of 3PLs*

Network theory (NT)	Firms seek efficiency of an entire network through interactions with other firms	Maximizes a firm's ability to leverage relationships; as 3PLs become responsible for a larger number of supply chain members their ability to offer greater network interactions increases

Technology also plays a crucial role in the evolution of 3PL services. Technologies such as Global Positioning System (GPS), barcodes, Radio Frequency Identification (RFID), drones, Internet of Things (IoT), Artificial Intelligence (AI), cloud computing, robotics, and blockchain are being used to minimize manual labour in the supply chain process. Service as a Software (SaaS) technology helps 3PL service providers overcome major challenges in the logistics industry, such as reducing transportation costs, streamlining business processes, improving customer service, and increasing supply chain visibility.

1.3.2 3PL service advantages:

1. **Cost Savings:**
   - **Reduced Overheads:** Outsourcing logistics operations to a 3PL can eliminate the need for businesses to invest in warehousing, transportation, and logistics technology.
   - **Economies of Scale:** 3PL providers often have bulk shipping discounts and can leverage economies of scale to reduce shipping and handling costs.
2. **Scalability and Flexibility:**
   - **Adjustable Capacity:** 3PL services can scale operations up or down based on demand fluctuations, providing businesses with the flexibility to adapt to market changes without incurring unnecessary costs.

- **Resource Allocation:** Companies can allocate resources more effectively, focusing on core business activities like product development and marketing.

3. **Risk Management:**
    - **Mitigation of Disruptions:** 3PL providers can offer contingency planning and risk management strategies to handle disruptions in the supply chain, ensuring continuity of operations.
    - **Compliance:** They ensure compliance with various regulatory requirements, reducing the risk of legal issues and fines.
4. **Technological Integration:**
    - **Advanced Systems:** Many 3PL providers use sophisticated Warehouse Management Systems (WMS), Transportation Management Systems (TMS), and other logistics technologies that offer real-time visibility and tracking of shipments.
    - **Data Analytics:** These technologies can also provide valuable data analytics and insights to improve decision-making and operational efficiency.
5. **Focus on Core Competencies:**
    - **Strategic Focus:** By outsourcing logistics to a 3PL, businesses can concentrate on their core competencies, such as innovation, marketing, and customer service, leading to overall business growth.

Third-party logistics (3PL) providers optimize operational workflows, resulting in expedited order processing, precise inventory control, and dependable shipping services. These improvements contribute to heightened customer satisfaction, bolstered brand credibility, and reinforced customer retention.

For enterprises engaging in international commerce, 3PL providers deliver comprehensive networks and specialized knowledge in global logistics, encompassing customs procedures and international trade laws. This empowers companies to venture into emerging markets while mitigating intricacies and uncertainties.[23]

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[23] *By MONICA Logistics Innovators September 23, 2023*

More recently, however, the 3PL has taken on a more comprehensive strategic role as supply chain activities become more critical to the business.[24]

The increase in third-party logistics (3PL) services is driven by the growing need for swift delivery solutions and the burgeoning e-commerce sector. These service providers present multiple benefits to businesses, including cost savings, improved operational efficiency, superior supply chain management, and elevated customer satisfaction. Future 3PL companies are expected to skilfully manage the demands of an e-commerce-driven market, focusing on comprehensive freight management.

1.4 Section 03: Concepts of a Warehouse:

"Warehousing is a set of activities that are involved in receiving and storing goods and preparing them for reshipment".

Robert Hughs,

The history of warehousing and inventory storage extends to ancient civilizations. Warehouses have been operational since the time of the Indus Valley Civilization, notably in Harappa. An example is the discovery of a warehouse in Lothal, which is now part of modern-day Gujarat, dating back to around 2600 BC and was utilized for Naval Trade. The Industrial Revolution in Europe, spanning the 18th and 19th centuries, marked a pivotal period for warehouses as they evolved to serve more specialized roles within industries. This era saw significant enhancements in the accessibility and efficiency of warehouses, particularly in the facilitation of goods movement.

[24] *Zach G. Zacharia Journal of Business Logistics, Vol. 32, No. 1, 2011*

1.4.1 What is a logistics warehouse?

The term logistics warehouse is approached in different ways in the literature. As part of our study project, we focus on three complementary aspects that allow us to better understand this concept:

As an infrastructure:

" Warehouses are commonly used to store or buffer products (Materials raw materials, products in progress, finished products) at points of origin and points of consumption, as well as between these two points."

According to the author, the logistics warehouse is a building where goods are received, stored and distributed to meet supply, production and distribution needs.

As a Link in the Supply Chain:

The warehouse occupies a crucial place in the supply chain. The author site Werling, who, his role as warehouse has evolved in recent years, with more emphasis on customer satisfaction and visibility of the entire supply chain. Studies on warehousing costs reveal that in Europe they represent 24% of total logistics costs, while in the United States they reach 22%. These results demonstrate the significant impact of supply chain performance.

As a service provider:

The warehouse can be viewed from three different angles: processes, resources and organization.

Products arriving in a warehouse then go through several stages called processes. Resources refer to all means, equipment and personnel necessary to operate a warehouse.

Finally, the organization includes all the planning and control procedures used to manage the system. This definition allows us to consider the logistics warehouse as an activity in its own right, encompassing the management of processes, human and material resources, as well as the organization of procedures.

Nowadays, companies are becoming more and more aware of the importance of this activity within their supply chain.

In order to optimize costs and better meet customer expectations, they often outsource this activity by relying on specialized logistics providers. Our work takes this type of service into account by trying to improve its performance for an optimized supply chain

1.4.2 The importance of warehouses:

The importance of warehouses is explained as follows:

- They enable the storage of raw material, finished goods, semi-finished goods, goods in transit, seasonal goods, etc.
- They enable the efficient distribution of goods; for example, storage of crops after harvesting to distribution in the areas where there are shortages.
- They also ensure stable prices, as stored output can be used during the time of low production.
- They also enable grading, picking and branding of goods.
- They also provide perfect space for the preservation of perishable commodities. For example, storage of meat, vegetables and fruits in cold storage.
- They are also used to improve the quality of products as they mature, for example, wine storage.
- They ensure proper supply during the breakdown in production or during the unpredictable increase in demand.
- They are used to protect goods during unfavourable climate conditions.
- They reduce the risks of theft and damage of products[25]

[25] *Logistics and Warehousing Management, Page 98*

1.4.3 Typical warehousing operations:

1. **Receiving:**

- The process begins with notification of the arrival of goods.
- Activities include unloading, counting, identifying, quality control, and acceptance inspection.
- Receipt issuance depends on delivery status, quality, and adherence to the planned schedule.
- The receiving process accounts for approximately 10% of operating costs.[26]

2. **Storing:**

- Distribution of goods to storage areas or direct transportation to shipping (cross-docking).
- Identification and assignment of storage bin.
- Put-away is the determination of a storage bin concerning the physical dimensions and weight of goods.
- Storage monitoring is part of management systems to track available goods and their locations.

3. **Put-away:**

- A process requiring a strictly determined storage location.
- Essential for the information system to track available storage locations, specific goods locations, and each pallet's storage.
- This process requires about 15% of operating costs due to numerous transfers from the gate to the storage place.[27]

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[26] *J. J. Bartholdi and S. T. Hackman, Warehouse & Distribution Science. Georgia Institute of Technology, School of Industrial and Systems Engineering, The Supply Chain and Logistics Institute, August 22 2011, latest release: version 0.95.*

4. Picking/Retrieving:

- A pick-list is given to an employee.
- Picking takes about 55% of warehouse operating costs and consists of:[28]
    - **Traveling** (55%)
    - **Searching** (15%)
    - **Extracting** (10%)
    - **Paperwork** (20%)
- Picking can be homogeneous (whole pallets) or heterogeneous (specific quantities and units).
- Heterogeneous picking is more frequent due to customer needs but incurs higher costs due to smaller units.
- Pick-lists are often paper-based, but some warehouses use smart devices like Bar-Code Readers and PDAs.

5. Shipping:

- May include sub-tasks such as consolidation (if batching, grouping, or zoning is applied), order checking, packing, and shipping.

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[27] *J. J. Bartholdi and S. T. Hackman, Warehouse & Distribution Science. Georgia Institute of Technology, School of Industrial and Systems Engineering, The Supply Chain and Logistics Institute, August 22 2011, latest release: version 0.95.*

[28] *J. J. Bartholdi and S. T. Hackman, Warehouse & Distribution Science. Georgia Institute of Technology, School of Industrial and Systems Engineering, The Supply Chain and Logistics Institute, August 22 2011, latest release: version 0.95.*

- Cross-docking is described as a special warehouse operation where goods are directly transferred from receiving to shipping without long-term storage.

6. Optimization and Efficiency:

- Travel time is an increasing function of travel distance, with strategies to reduce blocking and congestion.
- Order-picking efficiency is evaluated by travel distance, with congestion being a normal situation in systems with multiple order-picking and dozens of workers.

7. Technological Integration:

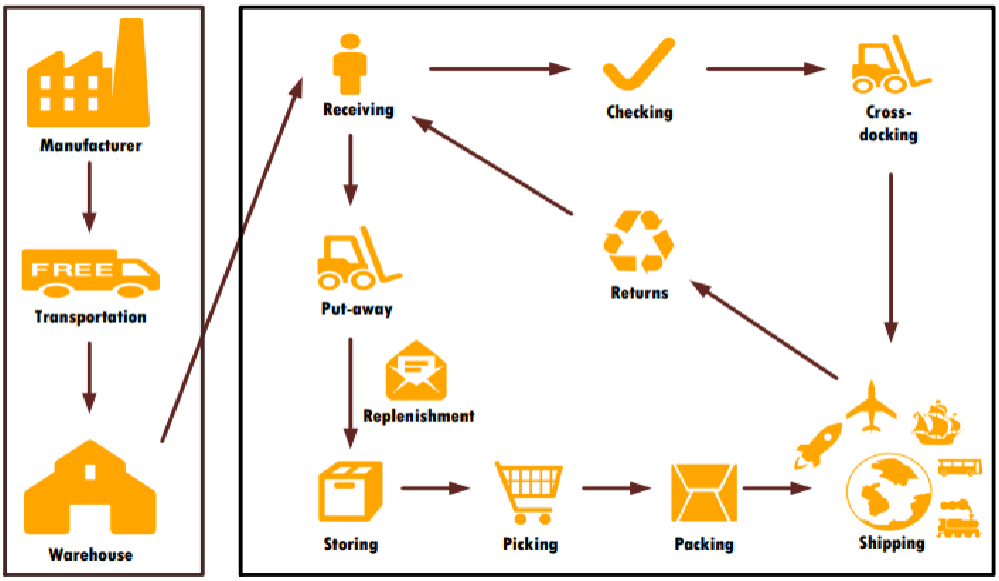
- Use of smart devices for efficient picking.
- Implementation of routing algorithms for managing picker routes and congestion.

8. Research and Development:

- Heuristic methods investigated to outperform storage assignment policies in multiple picker environments.
- Batch construction heuristics proposed to minimize total travel distance and improve picking truck utility.

Figure 1: The Logistic Process Flow in Warehouse[29]

[29] *Jan Karasek, in 2013, The International Journal of Advances in Telecommunications, Electrotechnics, Signals and Systems, pages 114-115 (An Overview of Warehouse Optimization)*



1.4.4 Types of warehouses:

Warehouses serve various purposes in the supply chain, from storage to inventory management and order fulfilment. There are three main types of warehouses: private, public, and contract. Private warehouses are owned by manufacturers, producers, or traders for exclusive stock storage, often near their manufacturing units. Public warehouses offer storage facilities on a rental basis for various businesses, including manufacturers, wholesalers, exporters, importers, and government agencies. Contract warehouses provide receiving, storage, and shipping services to clients under long-term contracts, allowing businesses to expand and contract efficiently. Apart from these three, there are other types of warehouses:

By activities:

- **Bonded warehouses**: Secure areas for storing imported goods before customs duty is paid.
- **Co-operative warehouses:** Owned, managed, and handled by cooperative societies for low-cost storage.
- **Raw material and component warehouses:** Store raw materials for production, like coal in thermal power plants.
- **Work-in-progress warehouses:** Provide storage for semi-finished products, such as raw wine or non-ripened fruits.

- **Finished goods warehouses:** Store finished products before distribution or sale, like two-wheelers in an automobile manufacturing plant.
- **Distribution warehouses:** Store items for distribution, often maintained by manufacturing organizations.
- **Fulfilment warehouses:** Receive, package, and ship orders for e-commerce businesses.
- **Local warehouses:** Commonly used by organizations with sales point systems or franchise systems.
- **Value-added service warehouses:** Offer storage and value-added services like assembly, kitting, and packaging.

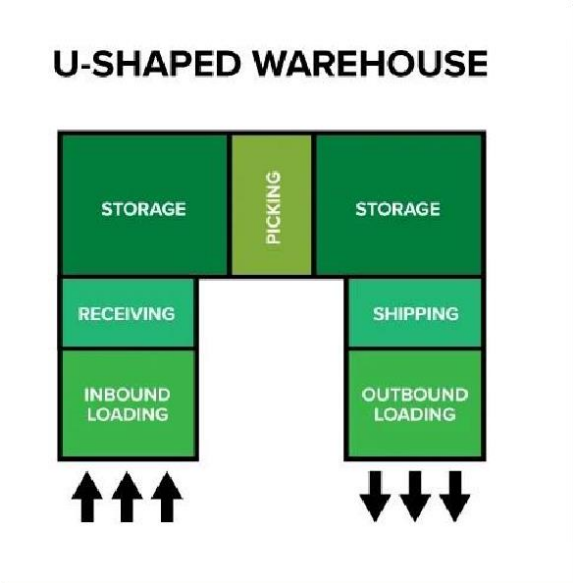
Warehouses are a vital component of the supply chain, facilitating the seamless movement of goods and materials. They offer a range of services designed to enhance operational efficiency and satisfy consumer requirements.[30]

[30] *Logistics-and-Warehousing-Management, P 99-100*

by shapes:

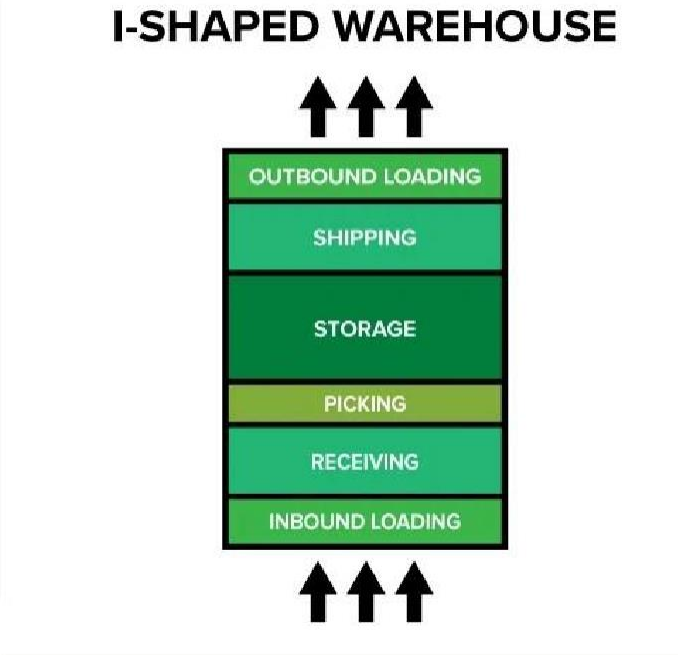
1. **U-shaped warehouse layout**: This layout is common and efficient. In a U-shaped layout, the shipping and receiving docks are located next to one another, offering shared utilization of dock resources such as personnel and material handling equipment. This layout minimizes product handling, offering high cross-docking capability.

Figure 2: U shaped warehouse



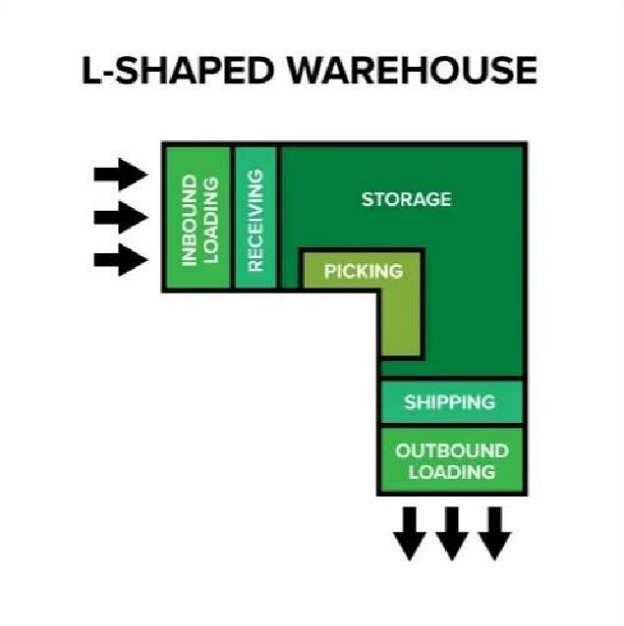
2. **I-shaped warehouse layout**: The I-shaped layout allows for product flow to move from one end to the other, in a straight line. In an I-shaped layout, storage is located directly in the middle of each loading and unloading dock. I-Shaped warehouses are ideal for operations that require high-volume storage.

Figure 3: I shaped warehouse



3. **L-shaped warehouse layout:** L-shaped warehouse layouts are designed for shipping and receiving areas to be located on adjacent walls of the warehouse. This design allows for products to be stored in-between the designated shipping and receiving docks, expanding storage to the back of the warehouse.

Figure 4: L shaped warehouse



4. H-Shape Warehouse:

This layout features two parallel storage wings connected by a central spine, with docks located on either side of the spine. This design facilitates the separation of different functions within the warehouse and can efficiently handle large volumes of goods. The central spine often houses administration and support functions, creating a central hub for operations while the wings are dedicated to storage. This layout maximizes space utilization and enhances workflow by centralizing critical operations and maintaining easy access to storage areas.

5. T-Shape Warehouse:

This layout consists of a main central section with a perpendicular wing, forming a "T" shape. This layout is particularly useful for operations that require distinct inbound and outbound processes. The top of the "T" typically centralizes receiving or shipping functions, ensuring these critical areas are easily accessible. The stem of the "T" extends to provide ample storage space, allowing for efficient organization and retrieval of goods. This design helps streamline operations by separating receiving and shipping activities from storage areas, reducing congestion and improving workflow efficiency.

6. E-Shape Warehouse:

This layout features three parallel storage wings connected by a central spine, forming an "E" shape. This design is suitable for large operations with multiple distinct processing areas. The central spine provides a hub for administrative and support functions, while the three wings maximize storage space and allow for the separation of different types of inventory or functions. This layout is effective in managing large volumes of goods and ensures efficient flow and organization within the warehouse.[31]

[31] *Rother M, Shook J 1999 Learning to see: value stream mapping to add value and eliminate MUDA. The Lean Enterprise Institute, Brookline, MA.*

Regarding E, H, and T shaped warehouse layouts, these are not standard terms used in the field of warehouse design and layout. However, warehouse layouts can be highly customized based on the specific needs of the operation. Therefore, it's possible that some warehouses may have layouts that could be described as E, H, or T shaped, even if these are not standard terms.

1.4.5 Warehouse management system:

A warehouse management system (WMS) is a specialized computerized system designed to manage and control the operations of a distribution center (DC), with the primary goal of meeting the inherent needs of these operations.[32]

A Warehouse Management System (WMS) is a software-driven solution that enhances distribution center operations by streamlining information management and task execution, thereby achieving heightened levels of inventory control and precision.[33]

The data that fuels a Warehouse Management System (WMS) is sourced from a variety of entities including transport companies, manufacturers, corporate information systems, as well as customers and suppliers. This data forms the foundation for the WMS processes such as receiving, inspection, storage, retrieval, packaging (when necessary), and the dispatching of goods, thereby streamlining operations and enhancing efficiency.[34]

[32] *Fábio Marques de Souza, Published in 2007*

[33] *BANZATO, 2003; apud RIBEIRO; SILVA; BENVENUTO, 2005, p. 8.*

[34] *RIBEIRO; SILVA; BENVENUTO, 2005*

1.4.6 Benefits of a Warehouse Management System

Enhanced operational efficiency: WMS systems automate and streamline warehouse processes from inbound receipts to outbound deliveries, leading to improved efficiency, smoother operations, and the capacity to handle greater volumes.[35]

Inventory Visibility: A warehouse management system provides visibility into accurate, real-time inventory levels.

Space Optimization and Reduced Operating Costs: Warehouse management systems enhance the flow of the warehouse by determining the most effective use of floor space based on task and material characteristics.

Enhanced Customer Service: A robust WMS system streamlines all aspects of warehouse management, from receiving and put-away to picking, packing, shipping, inventory tracking, and replenishment.

1.4.7 Challenges in Implementing a Warehouse Management System

Finding the ideal system: Each business is unique, necessitating customization of the chosen WMS to fit the specific needs of the organization.[36]

Preparation for WMS implementation: Successfully implementing a WMS in an advanced smart warehouse requires fulfilling numerous prerequisites.[37]

Technical issues and unforeseen requirement changes: These can result in delayed timelines, increased costs, and potentially abandoned projects.

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[35] *Abby Jenkins, Product Marketing Manager, in September 24, 2020*

[36] *Andrey Kazakevich, 26 May 2023*

[37] *Team Hopstack, December 29, 2023*

1.4.8 Future Trends in Warehouse Management Systems

AI Integration: Artificial Intelligence is expected to play a pivotal role in the future of warehouse management systems.[38]

Robotics and Automation: An upcoming trend in warehouse management is the assignment of manual, labour-intensive, or hazardous tasks to robots.

Cloud-Based WMS: Cloud-based systems provide flexibility, rapid deployment, and consistent updates, making them a cost-effective choice for warehouse management.[39]

IoT Integration: Integrating IoT devices provides real-time visibility throughout the entire supply chain, not just within the warehouse. [40]

Data Analytics and Predictive Insights: Real-time data can also be leveraged for predictive maintenance of warehouse equipment, minimizing downtime, and extending the lifecycle of valuable assets[41]

1.4.9 Warehouse international standards:

International standards for a logistics warehouse should include the following:

- **Building and Construction**: The construction of the warehouse ought to utilize materials that are non-combustible or fire-resistant, including steel and sealed concrete. For the interior and exterior walls, options such as glass, ceramic, stone tile, or stucco are recommended. The design should feature ceilings with a minimum height of 13 meters, support columns spaced no less than 12 meters apart, and clear spans reaching at least 24 meters to meet diverse inventory storage needs.[42]

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[38] *Juliet D'cruz, on: July 24, 2023*

[39] *The Future of Warehouse Management: Trends and Innovations (bbmatrix.ai)*

[40] *https://snorable.org/the-future-of-warehouse-management-systems-predictions-and-trends/*

[41] *https://www.bbmatrix.ai/blog/future-of-warehousing*

[42] *Logistics-International Features Certification.*

- **Storage and Handling**: A warehouse must be equipped with a minimum of one automatic docking gate per 500 square meters of internal area. Additionally, it should provide ample exterior space to accommodate large trucks and employee vehicles. Essential features for the warehouse include climate control systems, comprehensive fire safety mechanisms, robust security monitoring with alarms, high-speed internet infrastructure, and an electrical substation to meet power requirements.
- **Safety and Compliance:** The warehouse should adhere to safety regulations, including occupational safety and health administration guidelines, inventory management rules, and compliance with local building codes. The warehouse should also comply with transportation safety regulations, international trade and customs regulations, and data protection and privacy regulations.
- **Innovation and Technology:** The integration of automation technologies, including drones, robots, and composite panels, is essential for enhancing energy efficiency and optimizing warehouse operations.

Regarding warehouse rules and regulations, it is imperative to implement comprehensive policies for employees, encompassing safety measures, access restrictions, and data encryption practices. To uphold data protection standards, regular audits must be performed to verify adherence to relevant laws.

- **Sustainability and Digitization:** A logistics warehouse must integrate sustainable and digital strategies into its pest management systems. Compliance with international standards ensures operations are conducted efficiently, safely, and in adherence to regulatory requirements, while also embracing cutting-edge technologies and eco-friendly practices.[43]

warehouse flows:

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[43] *Warehousing-ITF Global International Transport Federation.*

"Warehouse processes" or "warehouse flows." These terms encompass the movement of goods, materials, and products into and out of a warehouse or distribution center.

1.4.10 Inbound logistics:

Inbound logistics comprises all activities that secure the supply for manufacturing and assembly or sales. These activities range from order placement and order allocation between suppliers to a chosen delivery and transportation concept for the receipt and storage or immediate use of the materials. When multiple plants or warehouses of a company and multiple suppliers are involved, we consider a many-to-many logistics system; when multiple suppliers deliver to a single warehouse, it is a many to-one system. The large amount and increasing variety of goods received by plants and warehouses led to different delivery and transportation concepts that will be introduced in the following. The evaluation of and choice between concepts is typically based on the following key performance indicators:[44]

• Transportation costs

• Handling costs

• Inventory costs

• Service level agreements

• Inventory costs

• Service level agreements

[44] *Operations, Logistics and Supply Chain Management pp 234–235*

1.4.11 Outbound logistics:

Outbound logistics is the process of storing, transporting, and delivering your goods to their end customers. In other words, it's all about how your business moves finished inventory out of your supply chain – and fulfils customers' orders.

Many elements go into a successful outbound logistics process for a business. These include inventory management, order management, packaging procedures, and distribution networks. Preparing each order and delivering it on-time to the appropriate location is critical for a successful sale – and with a streamlined outbound logistics process, you'll get it done every time.[45]

"The process involving the movement and storage of goods from the end of the production line to the final consumer is known as outbound logistics".[46]

This encompasses all activities required to transfer the finished product and associated information from the manufacturing facility to the end user."

1.4.12 Cross Docking:

Cross-docking is a logistical strategy that streamlines the transfer of products by moving them directly from incoming to outgoing transportation vehicles, eliminating the necessity for interim storage.[47]

Objective: The goal of this process is to enhance supply chain efficiency, diminish storage expenses, and boost shipping effectiveness. This is achieved by either eradicating or significantly

[45] *by Shannon Bambling, Nov 10, 2022*

[46] *CSCMP (Council of Supply Chain Management Professionals) (2013) Supply Chain Management: Terms and Glossary.*

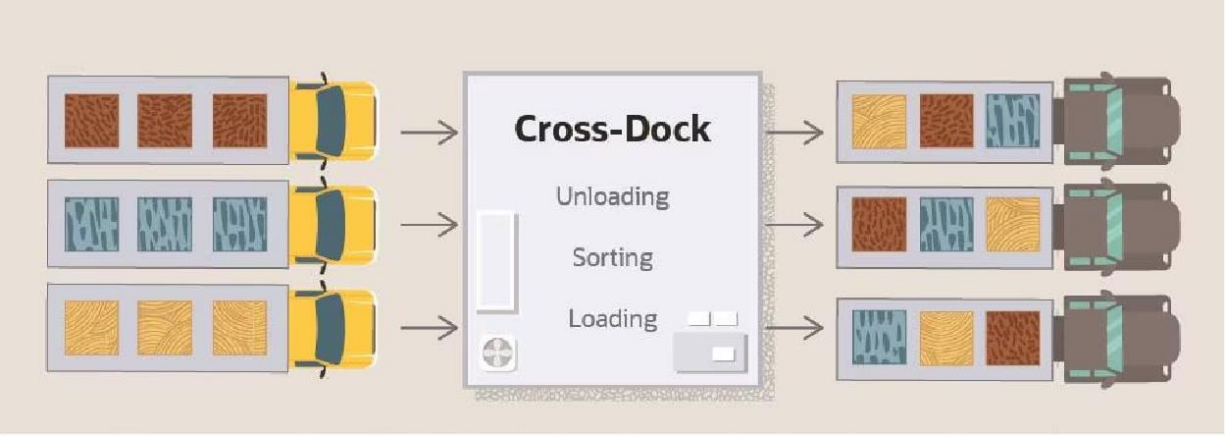
[47] *https://www.inboundlogistics.com/articles/cross-docking/*

reducing the costs associated with warehouse storage, the space needed for inventory, and the handling of stock. Effective strategies include optimizing inventory levels, improving warehousing operations, and streamlining order fulfilment processes, which can lead to lower operational costs and better customer satisfaction.

Uses: Cross-docking is carried out in a specialized area of a warehouse, designed to streamline the flow from receiving inbound goods to loading them onto outbound transport. Goods are sorted on arrival according to their end destination and promptly transferred to delivery vehicles. This method is especially advantageous for items requiring swift transportation, those pre-sorted and labelled for customers, products that bypass quality checks, or goods with consistent demand levels.

Cross-docking serves as a strategic method in multiple industries such as retail distribution, manufacturing, and eCommerce fulfilment. It is instrumental in accelerating the delivery process, elevating efficiency, and reducing costs associated with the transportation of goods throughout the supply chain.

Figure 5: Cross docking steps



Cross Docking Steps:

Cross docking is a logistical method that includes several critical steps:

1. **Planning and Alignment:** This involves planning ahead for the alignment of inbound and outbound shipments. It requires consideration of arrival and departure times, destinations, volumes, and types of goods. Additionally, the availability of dock doors, equipment, and staff must be taken into account.

2. **Communication:** Effective communication with transportation and delivery partners is crucial. Sharing cross-docking plans and expectations, as well as updates on any changes or delays, is essential. Tools like GPS tracking, electronic proof of delivery (POD), and barcode scanning enhance communication and visibility.

3. **Sorting and Consolidation:** Goods must be sorted and consolidated based on their destinations, priorities, and specifications. Efficient and safe material handling is supported by a clear layout and signage in the cross-dock area, along with the right equipment, quality control, and security measures.

4. **Loading and Unloading:** The loading and unloading of trucks should be executed swiftly and safely. Adequate dock doors and space for trucks are necessary, along with proper assignment to zones and lanes. Trained and skilled staff equipped with personal protective equipment (PPE) and safety devices are vital. Automation can also help minimize errors and injuries.

5. **Performance Tracking and Monitoring:** It's important to track and monitor the performance and outcomes of cross-docking activities. Key performance indicators (KPIs) such as cycle time, dock-to-stock time, fill rate, and accuracy rate are used for this purpose. Data and analytics tools are employed to gather and analyse cross-docking data and insights.

6. **Adaptation and Improvement:** Cross-docking operations should be adapted and improved in response to changing market and customer demands. This requires maintaining flexibility and agility in cross-docking processes and being open to adopting new technologies, methods, or standards.[48]

1.5 Conclusion:

logistics providers are the backbone of the global supply chain, offering a spectrum of services that are vital for the seamless flow of goods worldwide. As explored in this chapter, "Logistics Providers Fundamentals," these entities not only ensure the physical movement of products but also contribute significantly to the operational efficiency and competitive advantage of businesses. Their evolution from basic courier services to sophisticated 3PL solutions exemplifies their growing importance in fostering international trade and enhancing customer experiences. The indispensable role of logistics providers in today's interconnected economy cannot be overstated, as they continue to adapt and innovate in response to the ever-changing demands of global commerce.

[48] *https://www.inboundlogistics.com/articles/cross-docking/*

Chapter 02:

Metrics and Lean Solutions

2 CHAPTER 02: Metrics and Lean Solutions

2.1 Introduction:

In the dynamic field of logistics, the pursuit of efficiency and effectiveness is relentless. This chapter delves into the critical aspects of optimizing third-party logistics (3PL) services, focusing on the dual pillars of performance measurement tools and lean warehousing. The convergence of these methodologies not only drives operational excellence but also serves as a catalyst for continuous improvement in the 3PL landscape. Through a detailed exploration of key performance indicators (KPIs) and lean principles, this chapter aims to provide a strategic roadmap for organizations seeking to enhance their logistics operations and gain a competitive edge.

2.2 Section 01: Lean Warehousing: Optimizing Efficiency and Productivity

In the dynamic field of logistics and supply chain management, the "lean" philosophy has become increasingly prominent, especially within warehousing operations.

Lean warehousing adopts the lean manufacturing principles and tailors them to the warehousing context, aiming to eradicate waste, optimize processes, and enhance operational efficiency on an ongoing basis.

The core aim of lean warehousing is to maximize customer value while minimizing resource utilization. This objective is pursued through the deployment of a range of lean strategies and instruments, each targeted at identifying and rectifying distinct forms of waste and inefficiency prevalent in warehouse settings.

2.2.1 Lean methods:

1. **5s method:**

The 5S methodology is a cornerstone of lean practices in warehousing, encapsulating five principles: Sort, Set in Order, Shine, Standardize, and Sustain. This methodical framework is instrumental in cultivating an orderly, pristine, and streamlined work setting, which significantly diminishes the time and labour needed to find and retrieve items. Adoption of the 5S strategy

enables warehouses to curtail superfluous activities, enhance safety standards, and promote an ethos of perpetual enhancement.[49]

2. Warehouse Management System (WMS)

A Warehouse Management System (WMS) is a software solution designed to optimize the operational processes within a warehouse. It facilitates the management of inventory, storage locations, order picking, and shipping, among other functions. The WMS ensures that inventory is accurately tracked and managed in real-time, improving inventory visibility and control, reducing errors, and enhancing overall efficiency.

3. Waste Removal in Internal Manufacturing Context

Building on the capabilities provided by the WMS, it is crucial to address waste removal within the warehouse operations to drive competitive advantage. This approach is rooted in the principles pioneered by Toyota's chief engineer, Taiichi Ohno, and sensei Shigeo Shingo, who emphasized productivity improvements as a means to expose and subsequently eliminate waste and quality problems. According to Monden, operations within the warehouse can be categorized into three types:

1. **Non-Value Adding (NVA) Operations**: These operations are pure waste and involve unnecessary actions that should be completely eliminated. Examples include waiting time, stacking intermediate products, and double handling.

2. **Necessary but Non-Value Adding (NNVA) Operations**: Although these operations are wasteful, they are currently necessary under existing procedures. Examples include walking long distances to pick up parts, unpacking deliveries, and transferring tools from one hand to another. Eliminating these operations would require significant changes to the operating system, such as new layouts or changes in supplier delivery practices.

[49] *Elia Oey et Maulana Nofrimurti. "Lean implementation in traditional distributor, warehouse-A case study in an FMCG company in Indonesia". In: International Journal of Process Management and Benchmarking 8.1 (2018), p. 1-15.*

3. **Value-Adding (VA) Operations**: These operations involve the conversion or processing of raw materials or semi-finished products, such as sub-assembly of parts, forging raw materials, and painting bodywork.

4. The Seven Wastes in the Toyota Production System (TPS)

In the context of the Toyota Production System, seven types of waste have been identified, which should be systematically addressed:

1. **Overproduction**: Producing more than is needed or before it is needed, leading to excess inventory and potential obsolescence. Overproduction is regarded as the most serious waste as it discourages a smooth flow of goods or services, inhibits quality and productivity, and leads to excessive lead and storage times. This can result in undetected defects, product deterioration, and artificial pressures on work rates. Overproduction also causes excessive work-in-progress stocks, leading to physical dislocation of operations and poorer communication. Bonus systems that encourage the push of unwanted goods exacerbate this issue. Toyota's pull or kanban system helps to overcome this problem.

2. **Waiting**: Idle time while waiting for the next step in the process, which can be caused by machine downtime, unbalanced workload, or material shortages. This waste occurs whenever goods are not moving or being worked on, affecting both goods and workers. The ideal state is no waiting time, ensuring a faster flow of goods. Waiting time for workers can be utilized for training, maintenance, or kaizen activities without leading to overproduction.

3. **Transport**: Unnecessary movement of products or materials, which does not add value and increases the risk of damage and loss. While minimizing transport rather than total removal is usually sought, double handling and excessive movements can cause damage and deterioration. Distance between processes affects the time it takes to provide feedback on poor quality and to take corrective action.

4. **Inappropriate Processing**: Using overly complex solutions for simple procedures, such as employing a large, inflexible machine instead of several small, flexible ones. This over-complexity discourages ownership and encourages overproduction to recover the

large investment in the complex machines, leading to poor layout, excessive transport, and poor communication. The ideal is to use the smallest possible machine capable of producing the required quality, located next to preceding and subsequent operations. Inappropriate processing also occurs when machines are used without sufficient safeguards, allowing poor quality goods to be made.

5. **Unnecessary Inventory**: Holding excess inventory, which ties up capital, increases storage costs, and raises the risk of obsolescence. Unnecessary inventory increases lead time, prevents rapid identification of problems, and discourages communication. Problems are hidden by inventory and can be corrected only by reducing inventory, which also reduces storage costs and increases competitiveness.

6. **Unnecessary Motion**: Any movement of people or machinery that does not add value, such as stretching, bending, or picking up when these actions could be avoided. This waste is tiring for employees, leads to poor productivity, and often results in quality problems.

7. **Defects**: Producing defective products, which require rework or scrapping, leading to wasted materials and labour. Defects are direct costs and should be regarded as opportunities for improvement rather than something to be traded off against poor management. In the Toyota philosophy, defects prompt immediate kaizen activities. Continuous and iterative analysis of system improvements using the seven wastes results in a kaizen-style system where most improvements are small and incremental rather than radical breakthroughs.

5. Waste Removal Inside Value Streams:

Building on the capabilities provided by the WMS, it is crucial to address waste removal within warehouse operations to drive competitive advantage. The focus of value stream mapping (VSM) includes both value-adding and non-value-adding processes from the conception of a requirement through to the raw material source and back to the consumer's receipt of the product. Extending internal waste removal to the entire supply chain is essential but challenging due to visibility issues along the value stream and the lack of appropriate tools to create this visibility.

The waste terminology has traditionally come from a manufacturing environment, specifically the automotive industry, and from a Japanese perspective. To adapt this terminology to other parts of the value stream and industries in non-Japanese settings, a contingency approach is necessary. This means modifying the terminology and methods to fit different contexts and environments.

6. Contingency Approach and Adaptation

Considerable work at the Lean Enterprise Research Centre has focused on applying these principles to various industry sectors. Hines applied the kyoryoku kai supplier association to UK-based industries, while Jones introduced the Toyota production system philosophy to a warehouse environment. Jones demonstrated that the traditional seven wastes needed rewording to fit an after-market distribution setting, retitling them as follows:

1. **Faster-than-necessary Pace**: Producing goods more quickly than necessary, leading to excess inventory and potential quality issues. This waste can result in overproduction, causing excess stock that might deteriorate over time and require additional handling and storage, thereby increasing costs.

2. **Waiting**: Idle time when goods or workers are waiting for the next process step. This waste occurs whenever goods are not moving or being processed, affecting both inventory and worker productivity. Waiting can be minimized by streamlining processes and ensuring a balanced workload.

3. **Conveyance**: Unnecessary movement of goods within the warehouse. While some movement is inevitable, excessive transport does not add value and increases the risk of damage and loss. Minimizing conveyance involves optimizing the layout of the warehouse and ensuring that goods are stored in locations that reduce the need for long-distance transport.

4. **Processing**: Using inappropriate or overly complex processes for tasks. Inappropriate processing occurs when unnecessary steps are included in the workflow or when unsuitable equipment is used. Simplifying processes and using the right tools for each task can reduce this waste.

5. **Excess Stock**: Holding more inventory than necessary, tying up capital and storage space. Unnecessary inventory increases lead time, prevents rapid identification of problems, and increases storage costs. Reducing excess stock requires accurate demand forecasting and efficient inventory management practices.

6. **Unnecessary Motion**: Any movement by workers that does not add value, such as searching for tools or parts. Unnecessary motion is tiring for employees and leads to poor productivity and potential quality issues. Ergonomic workstation design and organized storage solutions can minimize unnecessary motion.

7. **Correction of Mistakes**: Addressing defects or errors, which adds additional cost and time to processes. Defects are direct costs and should be viewed as opportunities for improvement. Implementing quality control measures and fostering a culture of continuous improvement can help reduce the occurrence of defects.

By systematically addressing these seven types of waste and leveraging the capabilities of a WMS, warehouse operations can achieve significant improvements. The integration of these principles leads to increased efficiency, reduced error rates, and enhanced overall performance. Ultimately, this approach fosters a leaner and more competitive warehouse operation, contributing to the overall success of the supply chain.

7. Fishbone diagram (or Ishikawa diagram):

The Fishbone Diagram, credited to quality management expert Kaoru Ishikawa, is a visual tool designed to identify and categorize potential causes of a problem or effect. It offers a systematic method for root cause analysis by organizing causes into categories such as people, process, equipment, materials, environment, and management. By systematically exploring these factors, teams can understand the intricate web of influences contributing to a particular issue, thus enabling them to devise effective solutions.[50]

Why Choose the Ishikawa Diagram?

In the realm of logistics and supply chain management, identifying areas for improvement is paramount to eliminating waste and optimizing processes. Among various problem-solving tools

[50] *Author: Joseph M. Juran*

like the 5 Whys and benchmarking, the Ishikawa diagram, also known as the Fishbone diagram, stands out for its structured approach to root cause analysis.

Method:

The Ishikawa diagram, commonly referred to as the Fishbone diagram, is indispensable in logistics and supply chain management for its systematic problem-solving approach. By categorizing potential causes under key factors like Manpower, Machinery, Material, Method, and Environment, the diagram facilitates a comprehensive analysis of root causes. Through collaborative brainstorming sessions, teams can delve into the interconnectedness of these factors, identifying underlying issues affecting logistics operations' efficiency and reliability.

Visualizing these relationships aids in prioritizing improvement areas and crafting targeted action plans. Moreover, the diagram's adaptability allows customization to suit specific logistics challenges, ensuring its relevance and effectiveness. In essence, the Ishikawa diagram serves as a powerful tool for driving continuous improvement initiatives, enhancing operational efficiency, and optimizing performance throughout the supply chain.

8. Value Stream Mapping (VSM):

Value Stream Mapping (VSM) is an essential tool in supply chain management, used to visualize and analyse the flow of materials and information across the entire supply chain network. It provides an overview of operations, from raw material procurement to the delivery of finished products to customers. By documenting each step in the value stream, including production processes, transportation, storage, and distribution, VSM enables experts to identify inefficiencies, bottlenecks, and waste. These may include excessive lead times, inventory buildup, transportation delays, and redundant activities.[51]

[51] *Rother M, Shook J 1999 Learning to see: value stream mapping to add value and eliminate MUDA. The Lean Enterprise Institute, Brookline, MA*

Method:

The Value Stream Mapping (VSM) method involves the following steps:

1. **Scope Definition**: Define the scope of the value stream to be mapped, considering all stages of the supply chain, including suppliers, manufacturers, distributors, and customers.
2. **Current State Mapping**: Collaborate with stakeholders to create a detailed map of the current state of operations, depicting the flow of materials and information throughout the supply chain. This involves identifying key processes, cycle times, lead times, inventory levels, and transportation routes.
3. **Analysis of Current State**: Analyse the current state map to identify inefficiencies, bottlenecks, and areas of waste within the supply chain. Common types of waste may include excess inventory, overproduction, unnecessary transportation, and waiting times.
4. **Future State Design**: Based on the analysis of the current state, develop a future state value stream map that aims to eliminate waste, streamline processes, and improve overall efficiency. This may involve implementing lean principles such as just-in-time production, demand-driven replenishment, and optimized transportation routes.
5. **Implementation of Improvement Initiatives**: Implement improvement initiatives identified during the development of the future state map. This may require collaboration with suppliers, manufacturers, logistics providers, and other partners within the supply chain network.
6. **Monitoring and Continuous Improvement:** Continuously monitor the performance of the value stream to ensure that improvements are sustained and additional opportunities for optimization are identified. Regularly update the value stream map to reflect changes in processes, technology, or market conditions.

9. Kaizen Method:

Kaizen, originating from Japanese and meaning "continuous improvement," is a foundational principle of lean philosophy, particularly crucial in the context of lean warehousing. It embodies the concept of making incremental improvements to processes, workflows, and systems continuously. Kaizen emphasizes the involvement of every individual within the organization, fostering a culture of continuous improvement and innovation.

Method:

Kaizen events, also known as Kaizen blitzes or workshops, are structured problem-solving sessions integral to the implementation of Kaizen principles in lean warehousing. These events engage warehouse personnel at all levels, encouraging collaboration and ownership of improvement initiatives. The Kaizen method typically follows a systematic approach:

1. **Problem Identification and Analysis:** The Kaizen event begins with the identification and analysis of problems or inefficiencies within warehouse operations. This involves gathering data, observing processes, and identifying areas for improvement.
2. **Brainstorming and Implementing Solutions:** Teams collaborate to generate ideas and solutions to address the identified problems. These solutions focus on eliminating waste, improving efficiency, and optimizing processes. Implementation plans are developed, and changes are implemented rapidly.
3. **Evaluation and Reflection:** Following the implementation of solutions, the effectiveness of the changes is evaluated through performance metrics and feedback mechanisms. Teams reflect on the outcomes of the Kaizen event, identifying successes, challenges, and opportunities for further improvement.

Employee engagement is central to the success of Kaizen initiatives. Frontline workers often possess valuable insights into operational inefficiencies and bottlenecks, making their participation essential. By empowering employees to contribute ideas and participate in continuous improvement initiatives, Kaizen fosters a culture of innovation, collaboration, and ownership within the workforce.

10. Push/Pull Systems:

Push and pull systems represent contrasting methodologies for managing inventory and production within warehouse operations. Each system has its own distinct set of advantages and challenges, impacting operational efficiency and responsiveness to customer demand.

- **Push System:** In a push system, goods are produced or procured based on forecasted demand and pushed through the supply chain to the warehouse. While push systems may offer economies of scale and production efficiency, they often result in excessive inventory levels, increased storage costs, and the risk of obsolescence due to overproduction.

- **Pull System:** Conversely, in a pull system, goods are produced or procured based on actual customer demand, triggering production or replenishment only when needed. Pull systems, aligned with lean principles, aim to minimize inventory levels, reduce lead times, and enhance responsiveness to customer needs. Just-in-time (JIT) delivery, kanban systems, and demand-driven replenishment are common strategies utilized in pull-based approaches to lean warehousing.

Method:

Successful implementation of push/pull systems within lean warehousing requires a holistic approach that encompasses physical processes, organizational culture, and mindset. Key components of this method include:

1. **Understanding Demand:** Analyse historical demand data and customer forecasts to determine the appropriate approach (push or pull) for managing inventory and production.
2. **Inventory Management:** Implement inventory control measures to optimize stock levels and reduce excess inventory, particularly in push systems where overproduction is a concern.
3. **Production Planning:** Align production schedules with customer demand, leveraging pull-based strategies to minimize lead times and improve responsiveness.

4. **Lean Principles:** Embrace lean principles such as continuous improvement, waste reduction, and value stream mapping to drive efficiency gains and enhance overall performance.
5. **Cross-Functional Collaboration:** Foster collaboration between departments, suppliers, and logistics partners to streamline processes, improve communication, and align objectives.
6. **Employee Training:** Provide training and education on lean principles, push/pull methodologies, and best practices in warehouse management to empower employees and foster a culture of continuous improvement.

By adopting a comprehensive approach that addresses both physical and organizational aspects, businesses can successfully implement push/pull systems within their warehousing operations, driving efficiency, reducing waste, and enhancing customer satisfaction. Cross-functional collaboration, employee training, and a commitment to continuous improvement are essential for achieving sustainable results in lean warehousing initiatives.

11. Muda method:

Muda, a foundational concept in lean manufacturing, encapsulates waste or inefficiencies within processes that hinder productivity and fail to add value to the end product or service. The identification and elimination of Muda constitute essential components of lean management, aiming to streamline operations, reduce costs, and enhance overall efficiency. Muda can manifest in various forms, including overproduction, waiting times, excess inventory, unnecessary movement, defects, and unnecessary processing.[52]

[52] *Adam Henshall January 19, 2023 https://vww.process.st/muda/*

Types of Muda:

1. **Waste of Overproduction:** This represents the largest waste and occurs when goods are produced in excess of demand, leading to unnecessary inventory buildup, increased storage costs, and the risk of obsolescence.
2. **Waste of Time on Hand (Waiting):** Waiting times, whether due to equipment downtime, process delays, or idle employees, represent wasted time and resources that could be better utilized elsewhere.
3. **Waste of Transportation:** Unnecessary movement of materials or products between workstations or facilities adds no value and can lead to increased lead times, transportation costs, and the risk of damage or loss.
4. **Waste of Processing Itself:** This refers to unnecessary or inefficient processing steps that do not contribute to the quality or functionality of the end product. Streamlining processes and eliminating non-value-added activities can help reduce this type of waste.
5. **Waste of Stock at Hand:** Excess inventory ties up capital, occupies valuable space, and increases the risk of obsolescence or damage. Just-in-time (JIT) principles and inventory optimization techniques can help mitigate this type of waste.
6. **Waste of Movement:** Excessive movement of people, equipment, or materials within the workspace can lead to inefficiencies, increased cycle times, and heightened risk of accidents or injuries.
7. **Waste of Making Defective Products:** Defects or errors in products or services result in rework, scrap, customer dissatisfaction, and increased costs. Implementing quality control measures and error-proofing techniques can help minimize this type of waste.

Application of Muda Method:

By categorizing waste into different types and addressing each systematically, organizations can optimize their processes, improve resource utilization, and deliver greater value to customers. The concept of Muda underscores the importance of continuous improvement, waste reduction, and a focus on value-adding activities to drive operational excellence and competitiveness in today's dynamic business environment. Organizations can leverage tools such as value stream mapping, 5S methodology, and Kai

zen events to identify, prioritize, and eliminate Muda from their operations, thereby enhancing efficiency, quality, and customer satisfaction.

Embracing the principles of lean warehousing not only promises a reduction in operating costs and enhanced inventory management but also cultivates a culture of continuous improvement, leading to heightened customer satisfaction and a more engaged workforce. As the logistics industry undergoes constant transformation, the adoption of lean practices in warehousing emerges as a cornerstone for maintaining competitiveness and driving sustainable growth. By prioritizing efficiency, waste reduction, and employee empowerment, organizations can unlock a wealth of benefits, positioning themselves for success in an increasingly dynamic and demanding marketplace.

2.3 Section 02: Integrated Logistics

2.3.1 Enhancing Supply Chain Efficiency and Performance

The advent of integrated logistics epitomizes the strategic orchestration of all facets pertaining to the flux of goods, information, and finances from inception to consumption. In an epoch marked by burgeoning complexity and interconnectivity within supply chains, the imperative for integrated logistics looms larger than ever. This essay embarks on a journey to underscore the pivotal role of integrated logistics in streamlining operations, curtailing costs, enhancing service levels, and nurturing collaboration across supply chain cohorts.

2.3.2 Key Components of Integrated Logistics:

1. **Process Integration:** The harmonization and synchronization of myriad processes encompassing procurement, production, inventory management, warehousing, transportation, and distribution underpin a seamless flow of goods within the supply chain.

2. **Information Integration:** Leveraging cutting-edge technologies such as Enterprise Resource Planning (ERP) systems, Warehouse Management Systems (WMS), Transportation Management Systems (TMS), and Internet of Things (IoT) devices foster real-time visibility, data sharing, and informed decision-making throughout the supply chain continuum.

3. **Resource Integration:** The optimization of resources, spanning labour, equipment, facilities, and inventory, engenders maximal efficiency while minimizing wastage and redundancy.

2.3.3 Benefits of Integrated Logistics:

1. **Enhanced Efficiency:** Streamlined operations and the eradication of redundancies culminate in expedited order fulfilment and diminished lead times.

2. **Cost Savings:** Enhanced coordination precipitates diminished inventory carrying costs, reduced transportation expenses, and optimized resource utilization.

3. **Augmented Customer Satisfaction:** Timely deliveries, precise order processing, and streamlined communication contribute to elevated customer satisfaction indices.

4. **Competitive Advantage:** Integrated logistics confers upon organizations the agility to promptly respond to market vicissitudes, innovate, and carve out distinct niches vis-à-vis competitors.

2.3.4 Challenges and Best Practices:

1. **Data Security and Privacy:** Safeguarding the confidentiality and integrity of shared information mandates the implementation of robust cybersecurity protocols.

2. **Interoperability:** Mitigating compatibility snags among disparate systems and technologies facilitates the seamless exchange of data.

3. **Collaboration:** Cultivating robust partnerships and fostering open communication among supply chain allies are pivotal in realizing mutual objectives.

4. **Continuous Improvement:** Embracing a culture of perpetual learning, adaptability, and innovation serves as a lodestar in navigating the mercurial contours of the business milieu.

Integrated logistics emerges as the linchpin of contemporary supply chain management, endowing organizations with a strategic blueprint to optimize operations, elevate customer

satisfaction, and fortify competitive moorings. Embracing the tenets of integration, organizations can deftly navigate the labyrinthine contours of global trade, mitigate risks, and seize nascent opportunities in an ever-evolving marketplace. The assimilation of integrated logistics as a linchpin business strategy is indubitably imperative for charting a trajectory of sustainable growth, resilience, and triumph in today's interconnected paradigm.

2.3.5 Integrated Supply Chain in Logistics Providers:

Third-Party Logistics (3PL) providers have emerged as pivotal orchestrators in modern supply chain management, offering an array of services encompassing transportation, warehousing, inventory management, and order fulfilment. By entrusting these logistical functions to 3PL providers, businesses can streamline operations, curtail costs, and channel resources towards their core competencies. This essay delineates the symbiotic relationship between integrated supply chain practices and lean warehousing within the realm of 3PL providers, elucidating how these interconnected frameworks bolster operational efficiency, regulatory compliance, and customer satisfaction.

2.3.6 Integrated Supply Chain Services by 3PL Providers:

The integration of warehousing operations and transportation services epitomizes the essence of contemporary third-party logistics. 3PL providers proffer a comprehensive suite of integrated supply chain services, empowering businesses to scale and tailor solutions to align with their strategic imperatives for the movement, storage, and fulfilment of products and materials. Furthermore, 3PLs play a pivotal role in ensuring regulatory compliance, particularly in industries such as medical devices, where stringent tracking and chain of custody protocols are paramount for adherence.

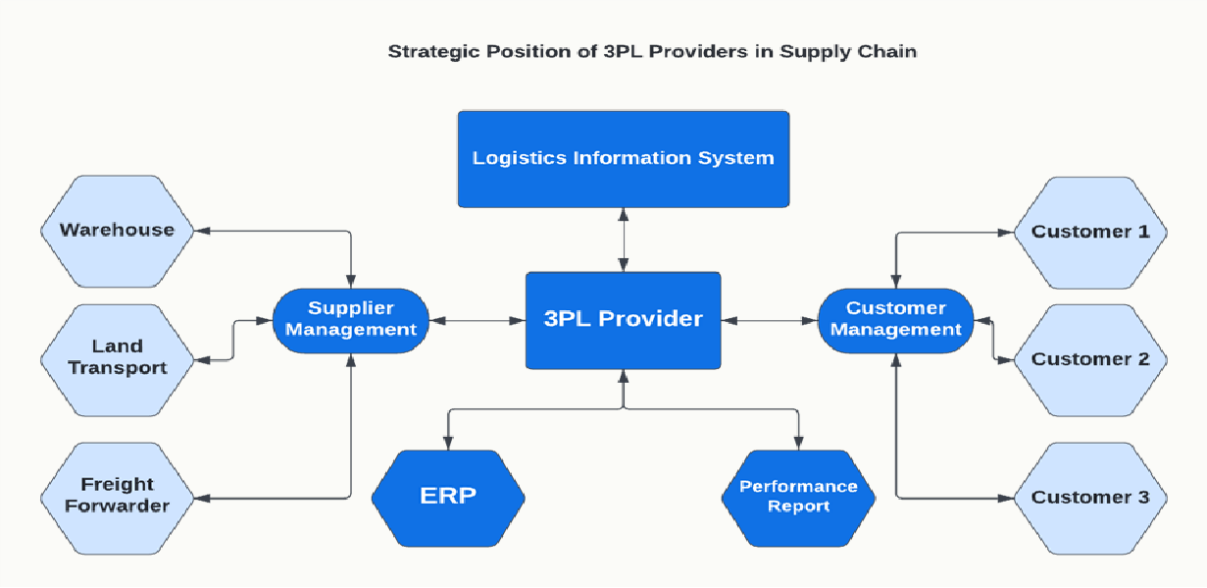
Enhancing Customer Experience and Market Competitiveness: The utilization of 3PL services enables businesses to proffer expedited and cost-effective shipping options to their clientele, a pivotal determinant in the hyper-competitive landscape of modern e-commerce. Swift and affordable delivery mechanisms not only augment customer satisfaction but also fortify market positioning, fostering loyalty and brand equity in an era marked by discerning consumer preferences.

2.3.7 The Nexus of Lean Warehousing and Integrated Logistics:

Research underscores a robust nexus between the paradigms of lean warehousing and integrated logistics within the purview of 3PL providers. Lean warehousing transcends mere optimization of internal warehouse operations, necessitating a holistic, integrated approach that synergizes warehouse functions with broader supply chain and logistics endeavours. The crux lies in the realization that the full benefits of lean principles manifest when warehouses seamlessly integrate into lean supply chains, thereby catalysing operational excellence and efficiency across the continuum.

The convergence of integrated supply chain practices and lean warehousing augurs well for the operational efficacy, regulatory compliance, and market competitiveness of third-party logistics providers. By harnessing the synergies between these paradigms, 3PL entities can navigate the exigencies of modern commerce with finesse, surmounting challenges and capitalizing on opportunities to deliver unparalleled value to their clientele. Embracing an integrated approach to supply chain management, augmented by lean principles in warehousing, epitomizes the panacea for 3PL providers seeking to carve out a niche in the dynamic and ever-evolving logistics landscape.

Figure 6: -3pl-logistics-solutions-guide-2023-



2.4 Section 03: Optimizing a 3PL Service:

In this section we will explore strategies to optimise third party logistics (3PL) services, focusing on Key Performance Indicators (KPI's) that measure efficiency and effectiveness.

We will discuss layout optimisation to enhance space utilisation, localisation strategies to improve service delivery, slotting optimisation for better inventory placement, and inventory volume management, to maintain optimal stock levels.

These approaches aim to streamline operations, reduce costs, and enhance overall warehouse performance.

2.4.1 Key performance indicators:

Table 3: Table of KPIs[53]

Category	KPIs	
Quality	Order lead time	The duration from when an order is placed until it is fulfilled.
	Receiving time	The time taken to accept incoming goods or materials.
	Put-away time	The duration from receiving goods to storing them in their designated location.
	Order picking time	The time required to gather items for an order from inventory.
	Shipping time	The duration taken to send out an order once it's been picked.
	On-time delivery	A measure of how often deliveries are made by the promised date.
Time	Dock-to-stock cycle time	The total time from when goods arrive at a dock until they are stocked in inventory.
	Customer satisfaction with delivery time	A measure of how satisfied customers are with the time it takes for their orders to be delivered.
	Equipment downtime	The amount of time that equipment is not operational due to failures, maintenance, or repairs.
	On-time stock replenishment	A measure of how often stock is replenished before it runs out.
	Fill rate	The percentage of customer orders that can be fulfilled from existing inventory.
Cost	Stockout rate	The frequency at which an item is not available in stock when an order is placed.
	Picking accuracy	The percentage of orders that are picked without errors.
	Physical inventory accuracy	The degree to which the physical inventory matches the inventory recorded in the system.
	Storage accuracy	The accuracy of the storage process in terms of storing items in their correct locations.
	Delivery accuracy	The percentage of orders delivered to the correct location and recipient without errors.
Support	Scrap rate	The percentage of materials that become waste during the manufacturing or assembly process.
	Cargo damages	The percentage of goods that are damaged during transportation or storage.
	Percent of on-time parts orders	The percentage of orders for parts that are delivered on time.
	Inventory cost as a % of sales	The cost of holding inventory expressed as a percentage of sales.
	Order processing cost	The cost associated with processing customer orders.
	Cost as a % of sales	The total cost of operations expressed as a percentage of sales.
	Distribution cost as a % of sales	The cost of distribution activities expressed as a percentage of sales.
	Maintenance costs	The costs associated with maintaining and repairing equipment and facilities.
	Labor costs	The costs associated with compensating employees for their work.

[53] *Francielly Hedler Staudt et al. "Warehouse performance measurement: a literature review". In: International Journal of Production Research 53.8 205, p. 5524-5544*

1) Definition of Key Performance Indicators (KPIs):

Key Performance Indicators (KPIs) are quantifiable metrics utilized within organizational frameworks, particularly in the realm of supply chain management, to gauge the effectiveness and efficiency of diverse business operations. Serving as pivotal performance benchmarks, KPIs offer a tangible measure of organizational prowess against predefined business objectives. Their fundamental role lies in furnishing a clear, objective snapshot of an organization's overall performance across multifarious operational facets, facilitating informed decision-making and strategic planning.

2) Role of KPIs in 3PL Warehouse Optimization:

In the context of third-party logistics (3PL) warehouse management, KPIs assume a paramount role as guiding principles, steering 3PL providers towards heightened operational excellence and efficiency. Through meticulous monitoring and analysis of pertinent metrics, 3PLs can navigate towards optimizing routes, streamlining warehouse operations, minimizing costs, and enhancing service quality. KPIs function as indispensable tools for assessing and augmenting the overall efficacy of warehouse operations, providing valuable insights into various dimensions of warehouse activities.

3) Advantages of KPIs:

1. **Informed Decision-Making:** KPIs furnish organizations with empirical data, thereby serving as a foundation for strategic decision-making processes within the supply chain realm.
2. **Problem Identification:** Continuous monitoring of KPIs enables businesses to promptly identify operational bottlenecks or inefficiencies, facilitating proactive problem-solving and operational optimization.
3. **Goal Alignment:** KPIs play a pivotal role in ensuring alignment between individual teams, departments, and organizational objectives within the supply chain ecosystem, fostering cohesion and synergy.
4. **Performance Enhancement:** The iterative tracking and analysis of KPIs facilitate ongoing performance evaluation and improvement initiatives, propelling organizations towards heightened operational efficiency and effectiveness over time.

5. **Stakeholder Communication:** Transparently showcasing performance through KPIs fosters trust and confidence among stakeholders, including clients and partners, affirming the organization's commitment to excellence and reliability in supply chain management.

4) Disadvantages of KPIs:

1. **Loss of Direct Involvement:** Entrusting logistics operations to third-party providers may yield efficiency gains but entails a concomitant loss of direct involvement in the logistics process. Organizations must navigate through the intermediary of 3PL providers, relinquishing direct control over logistics operations.
2. **Risk of Tracking Inappropriate KPIs:** Neglecting the strategic delineation and definition of relevant KPIs within the 3PL context exposes organizations to the risk of tracking incongruous or misaligned metrics. Such oversight can engender a false sense of efficiency and hinder the attainment of optimal supply chain performance outcomes.[54]

2.4.2 Layout Optimization:

The layout of a warehouse is the backbone of its operations. It dictates the flow of goods, accessibility of inventory, and efficiency of material handling. An optimal layout is meticulously designed to consider the dynamics of product flow, storage capacity, picking routes, and strategic use of space.

- **Product Flow**: The layout is designed to facilitate a smooth and logical flow of goods from the receiving area to the storage locations, and finally to the dispatch area. This reduces unnecessary movement and handling of goods, thereby minimizing the chances of damage and errors.
- **Storage Capacity**: The layout is planned to maximize the storage capacity of the warehouse. This involves the strategic placement of racks and shelves, efficient use of vertical space, and consideration of special storage requirements for certain types of goods.
- **Picking Routes**: The layout is organized to create efficient picking routes. This involves arranging goods in a way that minimizes travel time for pickers, reduces congestion in the aisles, and facilitates faster order fulfilment.

[54] *Snapl Solutions Inc., August 19, 2023*

- **Strategic Use of Space**: The layout also considers the strategic use of space for other important areas such as packing stations, quality control areas, and returns processing zones.

2.4.3 Localization Strategies:

Localization strategies in a warehouse involve the strategic placement of high-demand items near shipping zones, clustering of similar products, and organization of inventory according to access frequency.

- **High-Demand Items**: High-demand items are placed near the shipping zones to reduce the travel time for pickers. This not only speeds up the order fulfilment process but also reduces labour costs.
- **Clustering of Similar Products**: Similar products are grouped together in the warehouse. This makes it easier for pickers to locate items, reduces the chances of picking errors, and improves the efficiency of order fulfilment.
- **Inventory Organization**: Inventory is organized according to access frequency. Items that are frequently accessed are placed in easily accessible locations, while items that are rarely accessed are stored in less accessible areas. This optimizes the use of space and improves picking efficiency.

2.4.4 Slotting Optimization:

Slotting in warehouse management refers to the strategic placement of inventory within a warehouse to optimize picking efficiency, minimize travel time, and improve overall operational productivity. It involves determining the most suitable locations for different products based on factors such as demand frequency, product size, and handling requirements.

Slotting in a warehouse involves allocating products to designated storage spots based on factors like size, weight, demand, and seasonal trends.

- **Size and Weight**: Items are slotted based on their size and weight. Heavier items are placed on lower shelves to ensure safety, while smaller items are placed in bins or drawers to optimize space usage.

- **Demand**: High-demand items are placed in easily accessible locations to speed up the picking process. On the other hand, low-demand items are stored in less accessible areas.
- **Seasonal Trends**: Seasonal items are strategically slotted to ensure they are easily accessible during their peak demand period. During off-peak periods, these items are moved to less accessible areas to make way for other high-demand items.

2.4.5 Importance of Slotting in a Warehouse:

1. Increased Picking Efficiency:

Slotting significantly enhances the efficiency of the picking process by strategically placing high-demand items in easily accessible locations. By reducing the travel time and distance for pickers, slotting allows them to retrieve items more quickly and efficiently. This is especially critical in warehouses with a high volume of orders, where picking represents a substantial portion of labour costs.[55]

2. Improved Inventory Management:

Proper slotting ensures that items are stored in an organized and systematic manner, which helps in maintaining accurate inventory levels. This organization reduces the chances of misplacing items, leading to fewer stockouts and overstock situations. Accurate inventory management is crucial for meeting customer demand and maintaining optimal stock levels.[56]

3. Enhanced Space Utilization:

Effective slotting maximizes the use of available warehouse space by strategically placing items based on their size, weight, and demand frequency. This ensures that every inch of storage space is used efficiently, potentially delaying the need for costly warehouse expansion. Good slotting practices allow for better vertical and horizontal space utilization, accommodating more products within the same footprint.[57]

4. Reduced Operational Costs:

By optimizing the picking routes and minimizing the distance travelled by warehouse staff, slotting helps to lower labour costs. Additionally, improved picking efficiency reduces the

[55] *Bartholdi, J. J., & Hackman, S. T. (2011). Warehouse & Distribution Science. Georgia Tech.*

[56] *Tompkins, J. A., White, J. A., Bozer, Y. A., & Tanchoco, J. M. A. (2010). Facilities Planning. John Wiley & Sons.*

[57] *Bartholdi, J. J., & Hackman, S. T. (2011). Warehouse & Distribution Science. Georgia Tech.*

wear and tear on equipment such as forklifts and conveyors, leading to lower maintenance costs. The reduction in time spent on picking also allows warehouse operations to process more orders within the same timeframe, increasing overall productivity.[58]

5. **Improved Safety:**

Slotting enhances warehouse safety by ensuring that heavy or bulky items are stored in locations that minimize the risk of injury during retrieval. For instance, placing heavier items at waist height reduces the need for lifting from high or low positions, thereby lowering the risk of strains and sprains. Additionally, an organized warehouse layout reduces clutter and obstacles, further enhancing safety.[59]

6. **Faster Order Fulfilment:**

With a well-slotted warehouse, order fulfilment times are significantly reduced. When items are readily accessible, and pick paths are optimized, orders can be processed and shipped out more quickly. This not only improves customer satisfaction by providing faster delivery times but also allows the warehouse to handle a higher volume of orders during peak periods.[60]

7. **Adaptability to Demand Fluctuations:**

Dynamic slotting techniques allow warehouses to adapt to changing demand patterns. By continuously analysing sales data and adjusting slotting arrangements in real-time, warehouses can ensure that high-demand items are always in the most accessible locations. This adaptability is crucial for handling seasonal variations and promotional activities effectively.[61]

2.4.6 Inventory Volume Management:

Managing inventory volume is a critical aspect of warehouse optimization. It involves maintaining a delicate balance between storage capacity, inventory levels, and order volumes.

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[58] *Tompkins, J. A., White, J. A., Bozer, Y. A., & Tanchoco, J. M. A. (2010). Facilities Planning. John Wiley & Sons.*

[59] *Bartholdi, J. J., & Hackman, S. T.*

[60] *Tompkins, J. A., White, J. A., Bozer, Y. A., & Tanchoco, J. M. A.*

[61] *Bartholdi, J. J., & Hackman, S. T.*

- **Storage Capacity**: The storage capacity of the warehouse is regularly reviewed and adjusted based on the volume of inventory. This ensures optimal space utilization and prevents overstocking or understocking situations.
- **Inventory Levels**: Inventory levels are closely monitored to ensure they align with demand. This involves regular stock counts, cycle counts, and inventory audits.
- **Order Volumes**: Order volumes are tracked and analysed to identify trends and patterns. This information is used to adjust inventory levels and storage configurations.

By implementing these warehouse optimization strategies, 3PL providers can significantly improve their operational efficiency, reduce costs, and enhance customer service. These strategies are not static but are continuously reviewed and adjusted based on changing business needs and market conditions. This ensures that the warehouse remains agile and responsive to the dynamic nature of the logistics industry.

In conclusion, warehouse optimization is a complex but crucial aspect of 3PL operations. It involves a combination of strategic planning, efficient processes, and advanced technologies. By mastering these elements, 3PL providers can deliver superior logistics solutions that add value to their clients' businesses.

2.5 Conclusion:

The journey through the intricate terrain of 3PL optimization has revealed the indispensable role of precise performance metrics and the adoption of lean warehousing practices. As the logistics sector evolves, these elements will remain pivotal in shaping the future of 3PL services. The insights garnered from this chapter underscore the importance of a systematic approach to measuring, analysing, and refining logistics processes. It is through such rigor and commitment to operational excellence that 3PL providers can achieve unparalleled service levels, delivering value that resonates across the entire supply chain.

Chapter 03:
Study case

3 CHAPTER 3: Study Case:

3.1 Introduction:

In this chapter, we will examine the methodology we applied to improve the performance of Conexlog UPS 3PL warehouse. We will begin by presenting the host company and the study case. Then, we will be identifying the data collection methods that will later be used to construct the Value Stream Map (VSM). This construction will take place in four steps, starting with the identification of the object of study and ending with the reconstruction of the final state of VSM. Each point mentioned will be explained in detail in the following sections.

3.2 Section 01: Presentation of the host company

3.2.1 UPS History:

Founded on August 28, 1907, in Seattle, Washington, with an initial investment of $100, started as the Merchants Parcel Delivery. The founders, Jim Casey and Evert McCabe, merged their businesses in 1913, setting the stage for what would become a leading entity in the global package delivery and logistics industry.

The significant expansion beyond Seattle took place in 1919 when it adopted the name United Parcel Service. By 1953, UPS had expanded its services to all 48 contiguous states of the U.S. The company's international presence began in 1975 with its entry into Canada, followed by Europe and the Middle East in the late 1980s.

In 1988, UPS further developed its transportation network by launching its own airline, which led to faster and more dependable delivery services. By 2007, UPS had grown into a vast corporation with 430,000 employees, operating 2,000 flights daily, and generating $43 billion in revenue.

Today, UPS operates in over 220 countries and territories, handling an astounding 15.6 million packages daily. It boasts the largest private fleet of alternative fuel vehicles, underscoring its dedication to sustainability.

CHAPTER 3: Study Case:

In 2015, UPS acquired Coyote Logistics, further solidifying its leadership in the logistics industry. UPS continues to invest in enhancing its logistical and technological capabilities to facilitate global trade and address the changing needs of its broad customer base.

In its presentation, UPS is portrayed as a formidable force in logistics and package delivery, employing over 500,000 people globally and serving 10.6 million customers. It manages an annual delivery volume of 5.2 billion packages.

The company's logistical efficiency is backed by a robust fleet that includes 265 aircraft, managing 2,000 flights daily, ensuring prompt and effective air transport. On land, UPS operates 123,000 package cars, 6,700 tractors, and 22 ,100 trailers dedicated to freight transportation.

In summary, UPS's extensive infrastructure, expansive workforce, and sophisticated fleet enable it to deliver unparalleled logistics solutions on a global scale.

3.2.2 Conexlog Presentation:

Established in 2016, EURL CONEXLOG serves as the exclusive provider of UPS-branded services in Algeria. Since September 19, 2017, CONEXLOG has been delivering UPS-branded services in Algeria under specific contracts and licenses between CONEXLOG and UPS.

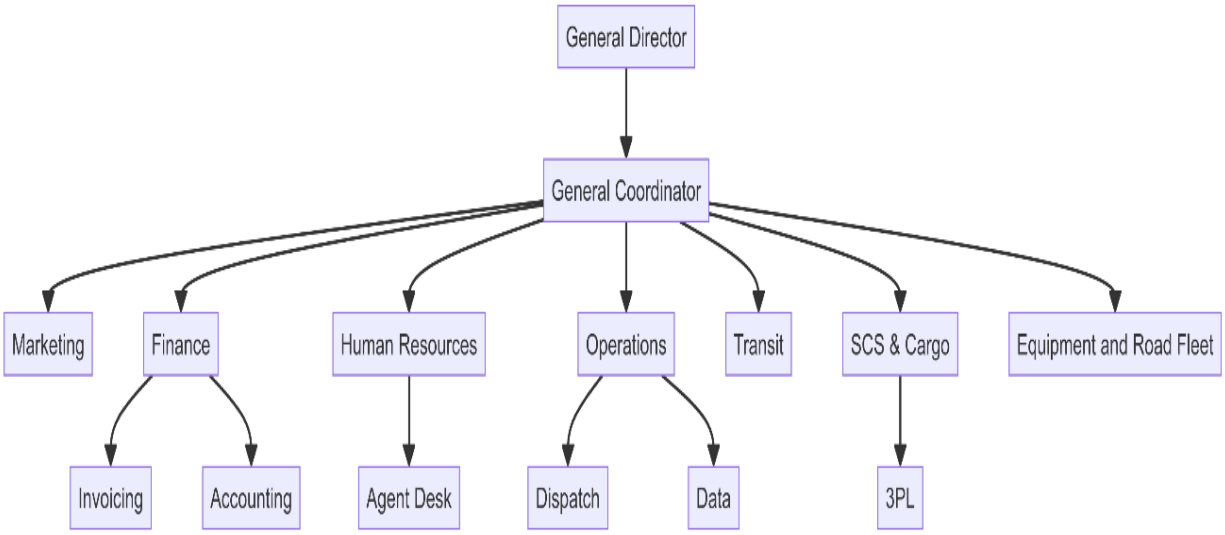
Conexlog's infrastructure includes:

- 197 UPS-branded vehicles
- 417 employees
- 57 desks
- A customs-bonded store and warehouse spanning 2000 m²

Mission:

CONEXLOG's mission revolves around expanding its range of services to include critical offerings that facilitate the seamless operation of businesses, ensuring efficiency and reliability in logistics solutions.

Figure: Conexlog (UPS Algiers) organizational chart



Source: Conexlog Company (UPS)

3.2.3 Services Provided by UPS:

1. **Express Courier Services:**
    - UPS offers a comprehensive range of express delivery options, including same-day, next-day, or two-day delivery services, ensuring the right balance between deadlines and costs.
    - UPS delivers envelopes and packages to all major cities in the United States swiftly.
    - In Europe, UPS guarantees delivery on the second business day before 10:30 a.m. or noon in certain cities, including customs clearance and door-to-door delivery.
    - UPS's distribution network in Asia, including its distribution center in the Philippines, enhances reliability and speed.
    - Reliable delivery times are ensured between major destinations in Mexico, Central and South America, and Africa.
2. **Supply Chain Solutions:**
    - UPS offers global air freight services catering to key business centers worldwide, leveraging decades of experience, an extensive network, and a vast air freight portfolio to meet demanding logistics chain needs.
3. **Customs Clearance Services:**

    - CONEXLOG provides comprehensive customs clearance services tailored to the unique requirements of Algeria and other countries, ensuring quick and accurate customs processing for imported shipments.
4. **Warehousing:**

CONEXLOG operates a UPS customs bonded warehouse in Oued Smar, ALGER, allowing for the storage of goods under customs control, suspending duties, taxiss, and economic prohibition measures.

5. **Third-Party Logistics (3PL):**

CONEXLOG offers third-party logistics services aimed at reducing costs and transit time, providing seamless storage, processing, and distribution solutions to meet the needs of businesses.

6. **Domestic Express:**

Domestic express services offer unmatched reliability, ensuring guaranteed delivery to every address nationwide, bolstered by UPS's renowned brand reputation for reliability and trustworthiness.

CONEXLOG, as the exclusive provider of UPS-branded services in Algeria, offers a comprehensive suite of logistics solutions, leveraging UPS's global expertise and network to cater to the diverse needs of businesses in Algeria and beyond.

3.2.4 Third-Party Logistics (3PL) for Dell Computers:

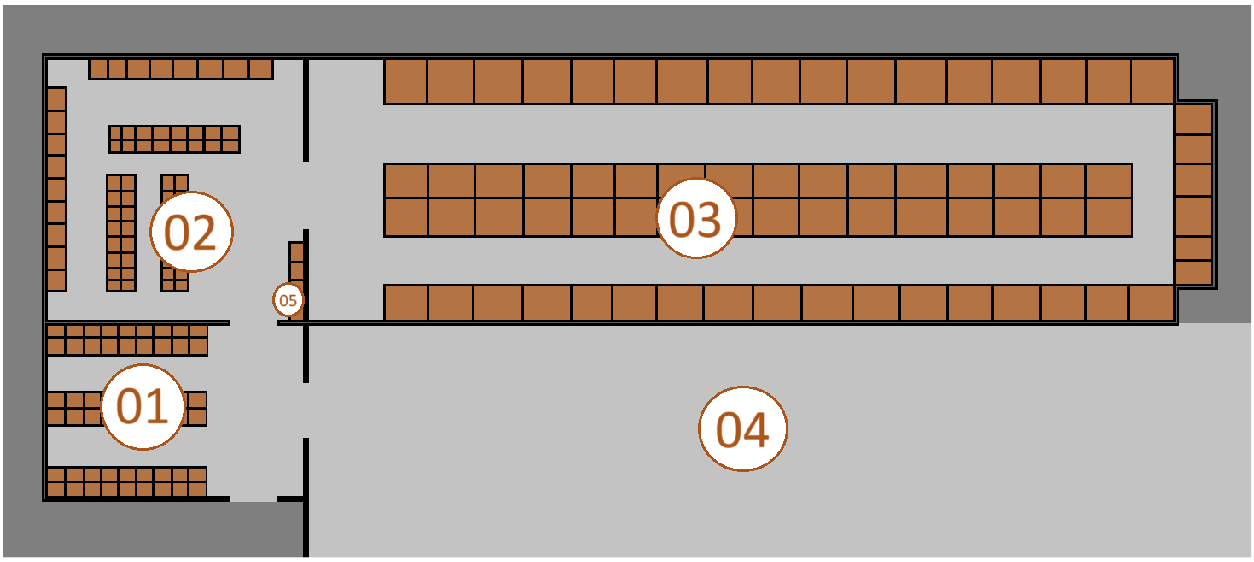
A significant example of CONEXLOG's third-party logistics services is its partnership with Dell Computers. Dell has subcontracted all their work in Algeria to UPS (CONEXLOG), entrusting them with the responsibility of managing their supply chain operations in the country. This partnership involves a comprehensive suite of services, including inventory management, warehousing, order fulfilment, and transportation. The operations are carried out in CONEXLOG's customs bonded warehouse in Oued Smar, ALGER, which spans 2000 m². This warehouse is specifically designed to accommodate Dell's products, ensuring optimal storage and quick retrieval of goods.

The warehouse layout includes designated areas for different operations:

1. **E-commerce Warehouse (Area 1)**: This area is dedicated to storing products sold through e-commerce platforms. It is designed to handle high-volume, high-velocity operations typical of e-commerce businesses.
2. **Dell's Returns (Area 2)**: This area is set aside for handling returned goods from Dell's customers. The returned items are inspected, sorted, and either restocked or disposed of, as appropriate.
3. **Dell Principal Warehouse (Area 3)**: This is the main storage area for Dell's products. It is organized to ensure easy access and quick retrieval of goods.

4. **Dispatch Area (Area 4)**: This area is where goods are prepared for shipment. It includes packing, labelling, and staging areas where orders are assembled and prepared for dispatch.
5. **High Value Area (Area 5)**: this section of the warehouse is designed to store items such as expensive electronics, luxury goods, and sensitive materials, ensuring their safety and integrity. The high-value area is crucial for maintaining the security and condition of valuable items throughout the logistics and storage processes.

Figure 7: Layout of the conexlog warehouse



Source: made by the students

The layout of the warehouse is meticulously planned to facilitate efficient movement of goods, reducing handling time and costs. It includes designated areas for receiving, storage, packing, and shipping, with clear pathways for the movement of goods and personnel. Advanced warehouse management systems are employed to track inventory levels and manage order fulfilment, ensuring accuracy and timeliness in deliveries.

Through this partnership, Dell Computers is able to focus on its core competencies, while CONEXLOG handles the complexities of logistics and supply chain management. This

arrangement not only reduces costs and transit time for Dell but also ensures seamless storage, processing, and distribution of their products in Algeria.

In conclusion, CONEXLOG's third-party logistics services provide a strategic advantage to businesses like Dell Computers, enabling them to operate more efficiently and effectively in the Algerian market. This is a testament to CONEXLOG's capabilities as a leading provider of UPS-branded services in Algeria.

3.3 Section 02: Methodology

3.3.1 Data Collection

Data collection is a crucial step in studying warehouse performance, allowing us to obtain the necessary information and data to answer the research questions and achieve the set objectives.

To collect the data, we used a combination of qualitative and quantitative methods to obtain coherent, and significative results. These methods include:

- **Conducting Interviews**: Interviews with warehouse staff to gather qualitative information about processes, work practices, and encountered challenges.
- **Direct Observations with a Stopwatch**: Precise measurement of task execution times through direct observations to obtain quantitative data on the warehouse's operational performance.
- **Data Extraction from the Warehouse Management System (WMS)**: Using the data recorded in the WMS to obtain detailed information about warehouse operations.
- **Utilizing Existing Data**: Analysing activity reports and pre-existing historical data to complement our understanding of the warehouse's performance.

By using these different data collection methods, we were able to obtain a comprehensive and balanced view of the warehouse's performance.

3.3.2 Interview responses:

1st interviewed person

1st AXIS: Interviewed Presentation

Sure, my name is Kouach Taki Eddin, and I'm the Cargo Director at Conexlog Algeria. In this role, I oversee the management of stocks, operations, and logistics within our warehouse facility.

2nd AXIS: Experience with DELL Warehouse (3PL warehouse)

Dell chose to subcontract their stock management to Conexlog due to our expertise and capabilities in efficient logistics management. They opted not to manage it externally themselves because they recognized the advantages of outsourcing to a specialized third-party logistics provider like us, which allows them to focus on their core business activities.

Currently, we use a combination of Tundra, a comprehensive computer program for stock management, and our Warehouse Management System (WMS). These systems help us efficiently manage different transactions within the Dell warehouse, from receiving to dispatching orders.

The implementation of these actions in the warehouse involved thorough planning and coordination between our team and Dell's representatives. We customized our systems to meet Dell's specific requirements and integrated them seamlessly into their operations.

3rd AXIS: Pros Observed

Since adopting these programs, we have observed significant improvements in various aspects of inventory management. Stock accuracy has increased due to the precision of our systems, leading to fewer discrepancies and errors. The speed of replenishment processes has also improved, enabling us to fulfil orders more efficiently.

One of the key benefits we've observed is enhanced efficiency in overall inventory management. With streamlined processes and accurate data tracking, we can optimize stock levels, minimize stockouts, and reduce excess inventory, leading to cost savings and improved customer satisfaction.

4th AXIS: Cons and Difficulties

While implementing these programs, we encountered challenges such as compatibility issues with existing systems, particularly during the integration phase. Additionally, ensuring staff proficiency with the new technologies required comprehensive training programs and ongoing support.

Resistance to change was another hurdle we faced, especially among employees accustomed to traditional methods. Overcoming these challenges required effective communication, training, and demonstrating the benefits of the new systems to gain buy-in from all stakeholders.**5th**

5th AXIS: Impact on Work Processes

The adoption of these actions has transformed our inventory management processes within the warehouse. With real-time data tracking and automated workflows provided by our systems, we have improved visibility, control, and efficiency throughout the entire supply chain.

Specific changes observed in daily activities include faster order processing, accurate stock picking, and seamless coordination between different departments. Communication and collaboration between stakeholders have also improved significantly, thanks to the transparent sharing of data and information facilitated by our technologies.

6th AXIS: Recommendations

To further enhance the use of these programs in warehouse inventory management, we recommend continuous training and upskilling of staff to maximize proficiency and utilization of the systems. Additionally, ongoing system updates and enhancements should be implemented to address evolving business needs and technological advancements.

We also suggest exploring additional features such as advanced analytics capabilities to gain deeper insights into inventory trends and performance metrics. Furthermore, integrating IoT (Internet of Things) devices for real-time monitoring of warehouse conditions and inventory tracking could offer valuable benefits in terms of efficiency and accuracy.

Conclusion

Thank you for the opportunity to share our insights and experiences. Should you have any further questions or require additional information, please feel free to reach out. We appreciate your time and cooperation in our study.

2nd interviewed person:

1st AXIS: Interviewed Presentation "Hello, my name is Rebib Nassim, and I have been working with UPS for a year as a Warehouse Data Agent. My role involves overseeing the data management aspects of our warehouse operations."

2nd AXIS: Experience with DELL Warehouse (3PL Warehouse) "Dell's decision to subcontract their stock management to Conexlog likely stemmed from a strategic move to leverage Conexlog's specialized expertise in logistics, which can often result in cost savings and efficiency improvements. At our warehouse, we manage Dell's transactions using a system called Tundra, which has significantly facilitated stock management and flow. The implementation of these actions in the warehouse was a structured process that involved careful planning and coordination with all stakeholders."

3rd AXIS: Pros Observed "Since the adoption of Tundra and our Warehouse Management System (WMS), we've observed notable improvements in stock accuracy and the speed of replenishment processes. The error rate has decreased, leading to a more reliable inventory management system. These programs have brought about enhanced efficiency and a smoother operational flow within the warehouse."

4th AXIS: Cons and Difficulties "We did encounter some challenges, particularly with staff training and adapting to the new system. The training process was not as optimal as we had hoped, and there was some initial resistance to change. However, we addressed these challenges by providing additional support and resources to our staff, ensuring they were comfortable and proficient with the new technology."

5th AXIS: Impact on Work Processes "The introduction of these technologies has transformed our inventory management processes. We've seen specific changes in daily activities, such as more streamlined stock-taking and replenishment tasks. Communication and collaboration have improved as well, with clearer visibility and control over inventory, which has facilitated better decision-making and coordination among different teams."

6th AXIS: Recommendations "To further enhance the use of these programs, I would recommend continuous training and support for staff to ensure they are fully adept at using the

new systems. Additionally, integrating more advanced analytics features could provide deeper insights into inventory trends and help predict future needs."

Conclusion "In conclusion, our continuous efforts to enhance stock management have been pivotal. The integration of systems like Tundra and our WMS has been instrumental in increasing the performance and accuracy of our stock management. It's essential to maintain a keen focus on the efficiency of stock replenishment processes, the precision of our inventory counts, and the effectiveness of our order picking and shipping operations. These elements are vital for the smooth functioning of our warehouse and contribute significantly to the overall success of our logistics operations. If there are any further inquiries or additional insights you wish to discuss, I'm here to continue the conversation."

3rd interviewed person:

1st AXIS: Interviewed Presentation "Hello, I've been part of the UPS team since 2018, serving as a Shipping Agent. My expertise lies in managing and optimizing the transit processes to ensure timely delivery of goods."

2nd AXIS: Experience with DELL Warehouse (3PL Warehouse) "DELL's collaboration with Conexlog for stock management is a strategic decision that likely capitalizes on specialized logistics services. In my role, I focus on the transit aspect, ensuring that the movement of goods is both efficient and reliable."

3rd AXIS: Pros Observed "Through my experience, I've seen significant enhancements in the speed and reliability of shipping processes. The systems we've implemented have streamlined transit operations, leading to improved delivery times."

4th AXIS: Cons and Difficulties "While the adoption of new systems has brought many benefits, it also presented challenges, particularly in training staff to adapt to new transit procedures. However, we've managed to overcome these by emphasizing the importance of time in our operations, which is often more critical than cost."

5th AXIS: Impact on Work Processes "The actions we've taken have profoundly changed the way we manage transit. We've seen improvements in the efficiency of moving goods from the

dock to their final destinations, and the time-sensitive nature of our work has become a focal point for our team."

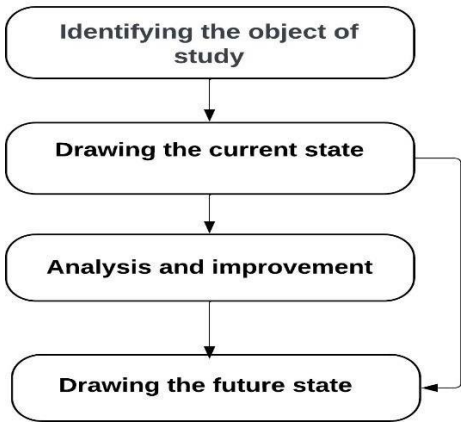
6th AXIS: Recommendations "In terms of recommendations, I would stress the need for ongoing analysis and refinement of our processes. It's essential to keep a close eye on the duration it takes for goods to be processed upon arrival and how swiftly they reach their storage or shipping points. These elements are crucial for maintaining an edge in the fast-paced world of logistics."

Conclusion "I appreciate the chance to discuss these matters. It's important to continuously reflect on our operational efficiency, especially in areas that directly affect the flow of goods. By focusing on the timely processing of shipments and the quick transition of goods through various stages, we can ensure a high level of service that meets the demands of our clients and the market."

3.3.3 Construction of a VSM:

In this section, we will describe the setup and implementation of the Value Stream Mapping (VSM) method on a real case, named Conexlog UPS located in Oued Smar Algiers. The objective is to successfully implement this method by following the four key steps of the process shown in the following figure.

Figure 8: steps of construction of a VSM[62]



Source: made by the students

First of all, we will identify the object of study for our VSM. This involves determining the associated processes on which we will apply the method. This step is crucial as it will allow us to focus our analysis efforts on the key activities of UPS.

Next, we will move on to the design of the current VSM. To do this, we will collect relevant data on the processes, material flows, information flows, processing times, delays, and inventories. Using this data, we will create a graphical representation of the current value stream. This will allow us to visualize the different steps of the process, identify bottlenecks, and highlight improvement opportunities.

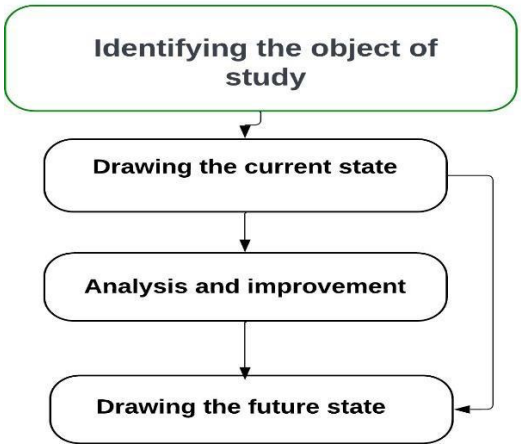
Once the current VSM is established, we will proceed to analysis and improvement. We will start by calculating KPIs to evaluate the current performance of each process. Then, we will use Ishikawa analysis to identify and understand the root causes of problems and propose targeted improvements.

Finally, we will proceed to drawing the final VSM. Based on the identified improvements, we will estimate the potential gains and create a new graphical representation of the improved value stream. This future vision of the process will allow us to visualize the expected benefits, communicate the proposed changes, and facilitate their implementation.

[62] *SKPN Silva. "Applicability of value stream mapping (VSM) in the apparel industry, in Sri Lanka". In: International journal of lean thinking 3.1 (2012), p. 36-41.*

I. Identifying the object of the study:

Figure 9: identifying the object of study



Source: made by the students

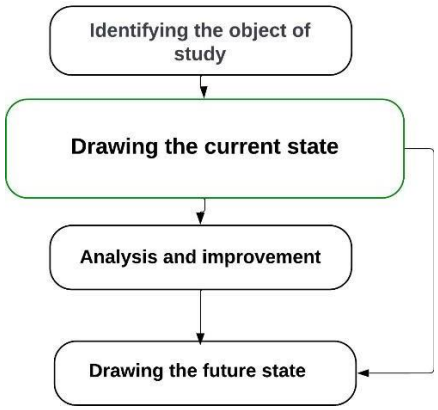
The choice of the study level is a crucial step in the construction of the VSM map. It involves determining the scope of the study, whether at the level of the entire company, specific processes, or a group of related processes. This decision is based on the objectives we wish to achieve.

To define these objectives, it is essential to consult the company's managers. Their knowledge and expertise will provide a better understanding of the issues and key areas for improvement. In the case of UPS, after in-depth interviews, we decided to focus our study and improvement efforts on the four key processes of the warehouse: receiving, storage, order preparation, and shipping.

By studying these key processes, we will be able to analyse the value streams associated with each step and identify potential problems, bottlenecks, and improvement opportunities. This targeted approach will allow us to concentrate our resources and efforts on areas where significant gains can be achieved, thereby contributing to the overall optimization of UPS's warehouse operations.

II. Drawing the current state:

Figure 10: drawing the current state of a VSM



Source: Made by the students

In order to develop a current value stream map of the UPS warehouse, it is necessary to gather information on the present situation. Here are the general steps to follow to collect this information: [63]

Observation: Visit the UPS warehouse to directly observe the ongoing operations and processes. This will allow us to see how activities are carried out, identify material and information flows, and observe potential problems.

Data Collection: Collect quantitative data ourselves using a stopwatch to measure processing times, delays, inventories, etc. This collection will provide precise data that will be useful later. Being able to note, erase, and correct easily.

Flow Mapping: It is recommended to start with a quick observation of the entire value stream to understand the sequence of flows. Then, it is possible to go back to each step to gather detailed information on individual processes.

Start from downstream to upstream: Begin at the shipping point and move upstream to first identify the processes related to the customer.

Use a pencil: Draw the map by hand with a pencil on a single A3 or A4 sheet to be able to note, erase, and correct easily.

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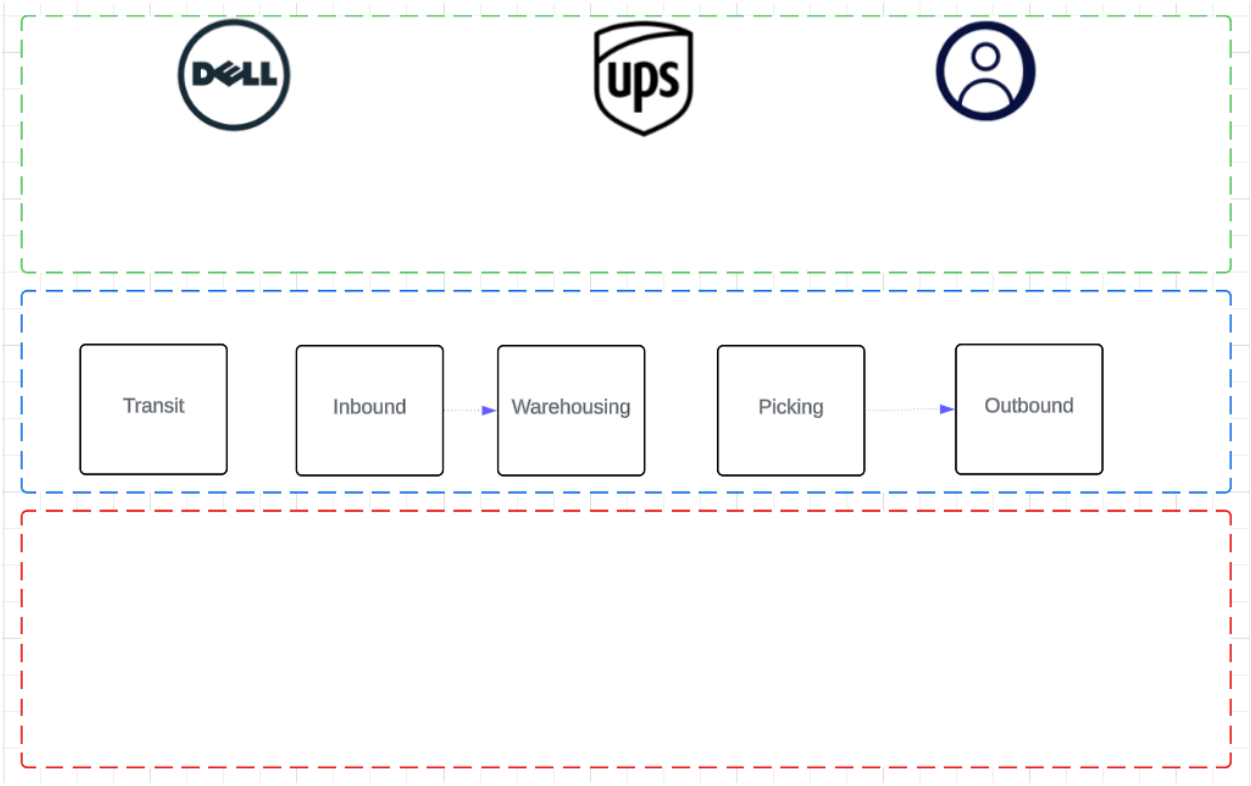
[63] *David Garnier. "Value Stream Mapping: A Tool for Process Representation and Reflection for Lean Improvement Applied to the Pharmaceutical Industry". Doctoral Thesis, Joseph Fourier University, 2010.*

The phases of creating the current VSM drawing:

• **Phase 1**: Representation of the customer on the right side of the map, followed by the representation of the four processes to be studied in the warehouse, namely: Transit, Inbound, Warehousing, Picking, Outbound. Also, don't forget to represent the supplier on the left side of the map.

• **Phase 2**: Trace material and information flows between the different stages using icons and arrows presented in the form of appropriate symbols to differentiate materials from information.

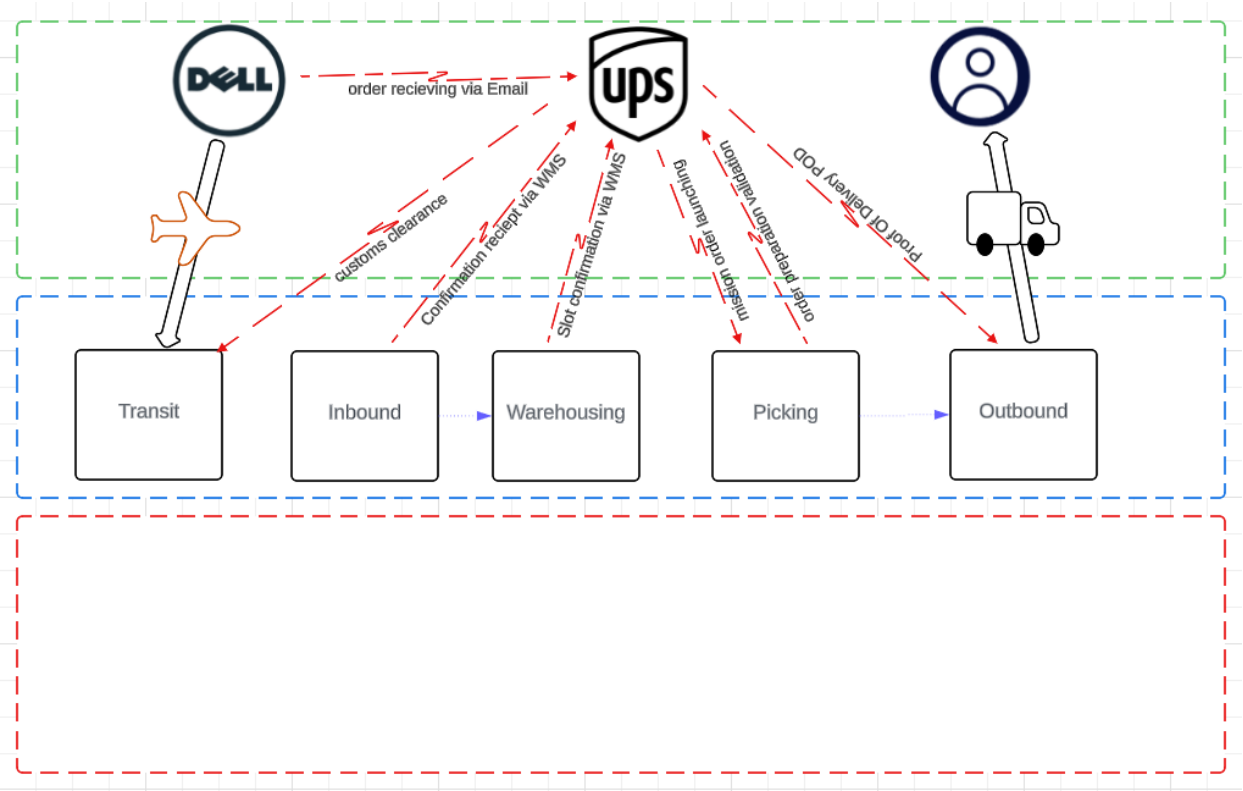
Figure 11: Phase 01 of the design



Source: Made by the students

Ps: *these figures are made with Lucid Chart*

Figure 12: Phase 02 of the Design



Source: Made by the students

Phase 3: Measure the times for each step of the process. This is done using a process flowchart to record the time required for each step, clearly and precisely on the map.

Once the process flowchart is established, it is possible to deduce various time-related data. Here are some commonly used measures:

→ **Cycle Time (CT):** This is the duration required for the transformation or inspection of a pallet. Cycle Time = Transformation Time + Inspection Time

→ **Lead Time:** It represents the total time required for a product or service to move through all stages of the process. Lead Time = Value-Added Time + Non-Value-Added Time

→ **Value-Added Time (VAT):** It is the measure of the total duration dedicated to operations that directly add value to the product or service. In the context of the process flowchart, the "Operations" category is the only one representing this added value. VAT = Total time of value-added operations

→ **Non-Value-Added Time (NVAT):** Includes all activities that do not directly add value to the product or service. In the process flowchart, these activities are represented by the categories

"Warehousing", "Control", "Transport", and "Deadlines". NVAT = Total time of warehousing activities + Total time of control activities + Total time of transport activities + Total time of delays

→ **Process Efficiency:** Measures the proportion of total time spent on value-added operations compared to the total time required to traverse the entire process. A higher efficiency indicates a more effective use of working time for value-generating activities. Process Efficiency = (Total Value-Added Time / Lead Time) × 100

→ **Process Effectiveness:** Measures the proportion of process steps that are value-added operations compared to the total number of steps, whether value-added or not. A higher effectiveness indicates a more optimized process, with a higher number of steps generating added value compared to non-productive steps. Process Effectiveness = (Number of Value-Added Steps / Total Number of Value-Added Steps + Total Number of Non-Value-Added Steps) × 100

In the following, we present a series of figures illustrating the analysis of the process flow for each studied process, with the calculation of times as mentioned earlier, within the UPS company.

Figure 13: Process Flowchart- Transit -

TRANSIT		VALUE STREAM MAPPING VSM1							
N	Phase	Transport	Storing	Operations	Control	Deadlines	Time (min)	Min	Max
1	Traveling from airport to customs desk	★					15	13	20
2	Wait for Unloading					★	7	5	30
3	Unloading		★				2	5	25
4	Wait for customs clearance					★	7200	60	1j
5	Customs Clearence				★		1440	60	1j
6	Inbound Confirmation via customs			★			5	1	10
	Total	15	2	5	1440	7207	8669		
	%	0.17%	0.02%	0.06%	16.61%	83.14%	100%		

Process efficasity = nb VA phases/nb VA phases+ NVA phases	17%	**VAT (min)**	5	
Lead Time = VA +NVA	8669	**NVA (min)**	8664	
Process efficience = Σ VA (min)/Lead time	0.001	**CT (min)**	1445	

Source: Made by the students

Figure 14: Process Flowchart - Inbound –

Inbound		VALUE STREAM MAPPING VSM1							
N	Phase	Transport	Storing	Operations	Control	Deadlines	Time (min)	Min	Max
1	Wait for order to access					★	480	1	180
2	Access to staging area	★					15	5	20
3	Dispatch	★					25	10	60
4	Conformity Control				★		25	10	60
5	Data entry via WMS			★			240	60	360
6	Slotting		★				15	15	30
	Total	40	15	240	25	480	800		
	%	5.00%	1.88%	30.00%	3.13%	60.00%	100%		

Process efficasity = nb VA phases/nb VA phases+ NVA phases	17%	**VAT (min)**	240
Lead Time = VA +NVA	800	**NVA (min)**	560
Process efficience = Σ VA (min)/Lead time	0.30	**CT (min)**	265

Source: Made by the Students

Figure 15: Process Flowchart -Warehousing-

Warehousing		VALUE STREAM MAPPING VSM1							
N	Phase	Transport	Storing	Operations	Control	Deadlines	Time (min)	Min	Max
1	Product scan by Tundra			★			0.5	0.3	1
2	Storing in slots	★					15	5	20
	Total	15	0	0	0	0.5	15.5		
	%	96.77%	0.00%	0.00%	0.00%	3.23%	100%		

Process efficasity = nb VA phases/nb VA phases+ NVA phases	50%	**VAT (min)**	0.5
Lead Time = VA +NVA	15.5	**NVA (min)**	15
Process efficience = Σ VA (min)/Lead time	0.03	**CT (min)**	0.5

Source: Made by the Students

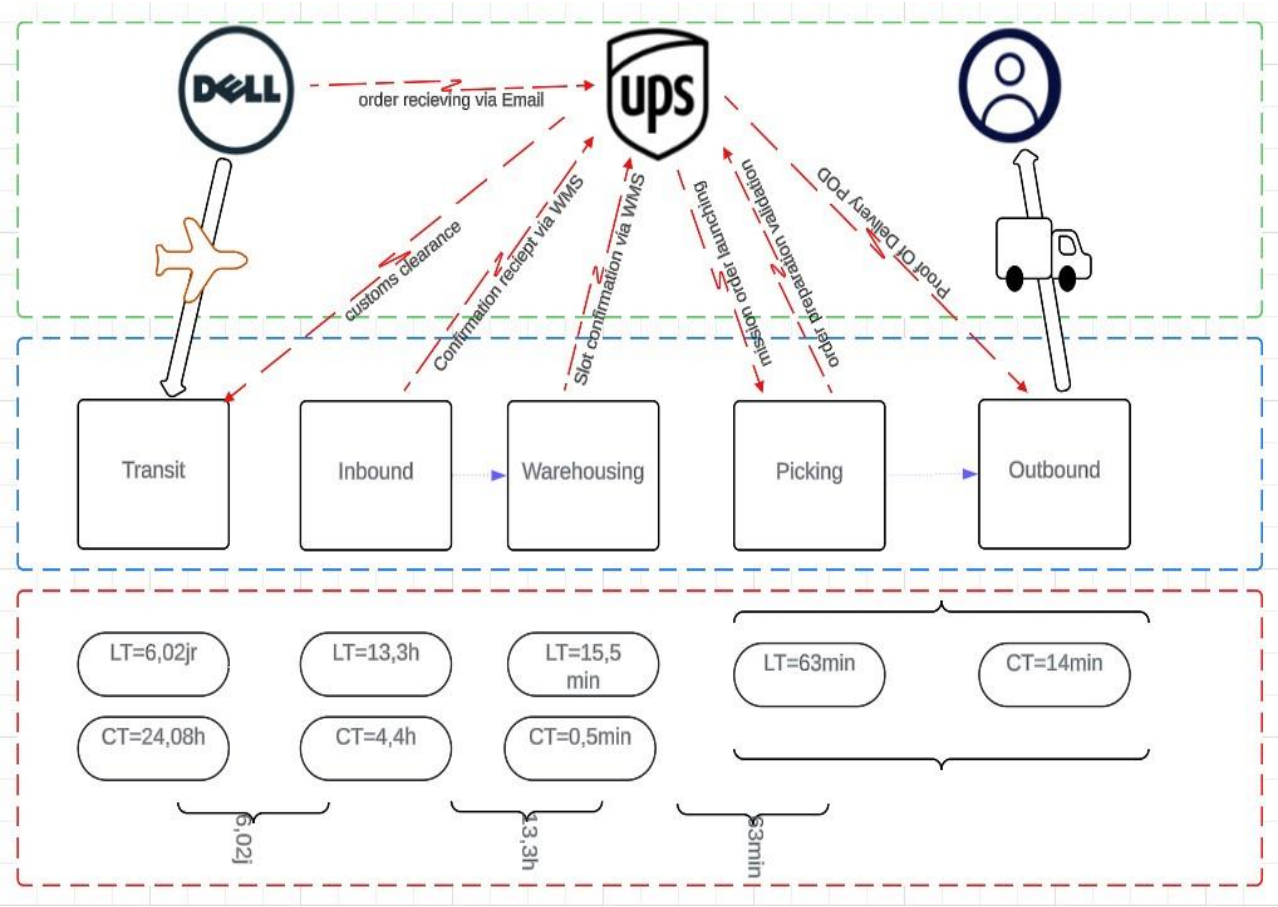
Figure 16: Process Flowchart -Outbound-

Outbound		VALUE STREAM MAPPING VSM1							
N	Phase	Transport	Storing	Operations	Control	Deadlines	Time (min)	Min	Max
1	Order reception via Email			★			7	5	15
2	Wait for picking order					★	12	5	30
3	Picking	★					30	5	15
4	Packing	★					5	3	10
5	Outbound Scan			★			7	3	8
6	Traveling to expedition area		★				2	1	5
	Total	42	2	7	5	7	63		
	%	66.67%	3.17%	11.11%	7.94%	11.11%	100%		

Process efficasity = nb VA phases/nb VA phases+ NVA phases	33%	**VAT (min)**	14	
Lead Time = VA +NVA	63	**NVA (min)**	49	
Process efficience = Σ VA (min)/Lead time	0.11	**CT (min)**	14	

Source: Made by the Students

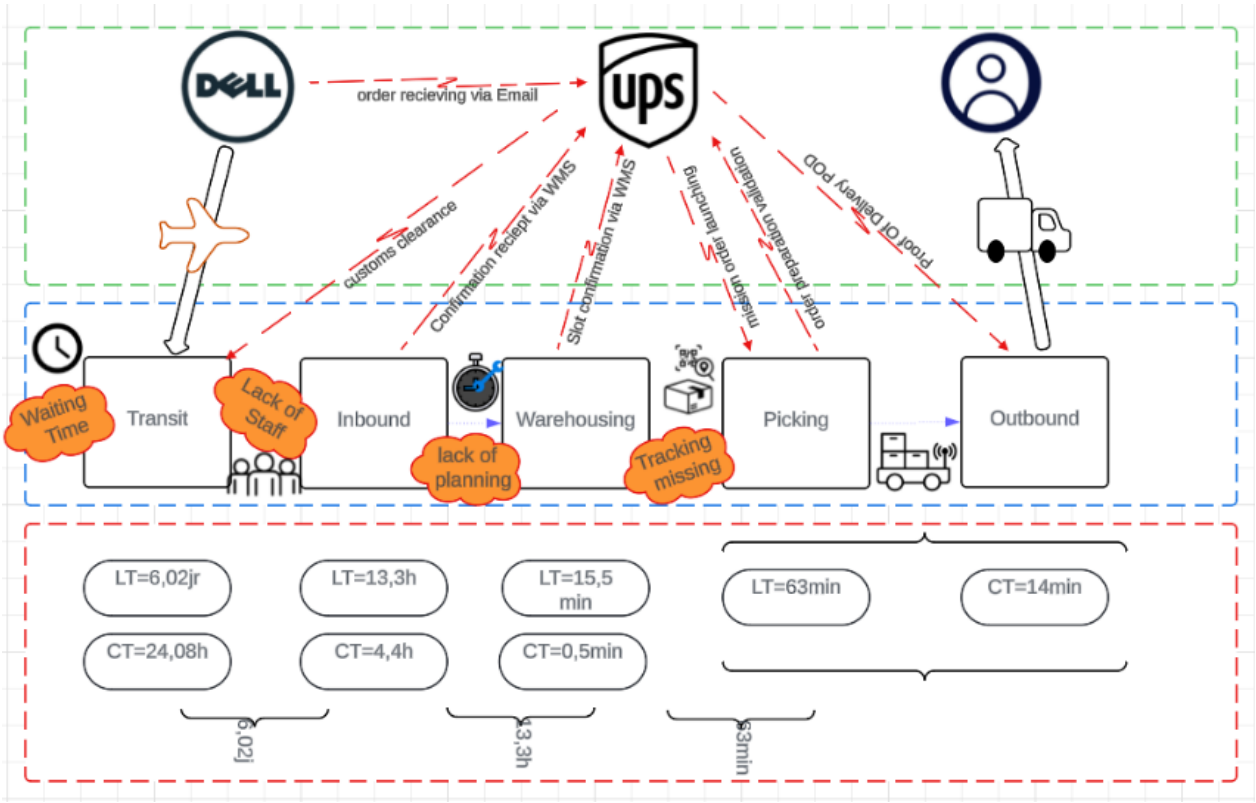
Figure 17: Phase 03 of the Design



Source: Made by the students

Phase 4: Identify critical flows and waste in the process.

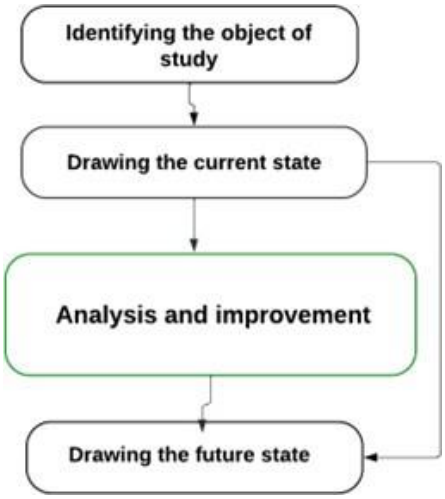
This step consists of identifying the stages of the process which slow down the fluidity of the activities and identify non-productive activities that generate wasted time and resources. These elements are then represented on the VSM map under form of appropriate icons or symbols, which makes it possible to clearly visualize the problem areas requiring improvement.



Source: Made by the students

III. Analysis and improvement

Figure 18: Analysis and improvement



Source: made by the students

The third step of VSM is analysis and improvement. Before starting this part, it is important to ask yourself the following questions:

why and what analyse?

The answer is this: we must analyse the current situation to think about the future. Following the implementation of the current VSM of the warehouse, we have already been able to identify and develop ideas on critical flows, activities that threaten fluidity, warehouse efficiency and performance.

The analysis in this step is done at several levels. First of all, it is important to review in detail the map of UPS's current value chain. This includes examining men of material flows, information flows and times associated with each step of the process. It is essential to understand how different activities interact and where the threats lie. To deepen this analysis, warehouse management KPIs serve as support, because they provide quantitative measurements on the effectiveness of each process studied. By using these KPIs, it becomes possible to compare actual performance with objectives set and identify areas that require improvement. Furthermore, these KPIs can also be used to measure improvements over time, by assessing progress against previous performance.

With this in mind, we will use key performance indicators to evaluate read every process in the warehouse. The choice of these KPIs was based on two criteria:

- ✓ The first criterion is based on the results of the current VSM: The selected KPIs

are based on the information collected during the analysis of the current map of the company. This allows us to take into account the most important performance measures more relevant and specific to warehouse activities.

- ✓ The second criterion comes from the exchange with those responsible: We took into account take into account their views and recommendations. They expressed the domains keys to track and control, which helped us determine the appropriate KPIs to evaluate performance and measure progress.

Once the key performance indicators have been selected, they are measured according to the method indicated in the following chapter. After the measurements, we compare them to set objectives and benchmarks to assess the degree of effectiveness. Next, we identify the causes of inefficiencies using a diagram of cause and effect. This diagram allows us to highlight the factors responsible gaps in order to propose solutions and targeted recommendations to improve or even correct the situation.

Based on the detailed response provided, several key performance indicators (KPIs) can be identified:

- **Dock to Stock**: This KPI measures the **time interval** from when goods are received at the warehouse dock until they are stocked in their designated location. It's a critical metric for assessing the efficiency of the receiving and storage processes. A lower dock to stock time indicates a more efficient operation.
- **Receiving Efficiency**: This metric evaluates the **speed and accuracy** with which incoming shipments are received, documented, and prepared for storage or shipment. High receiving efficiency means less time is wasted, and goods are processed correctly, reducing the likelihood of errors.
- **Stock Accuracy**: Stock accuracy refers to the **consistency** between the recorded inventory and the actual physical inventory. It is crucial for maintaining reliable data for order fulfilment and planning. High stock accuracy minimizes discrepancies and potential stockouts or overstock situations.

- **Order Picking Time**: This KPI tracks the **duration** it takes for workers to pick and prepare items for an order from the warehouse inventory. Efficient order picking is essential for timely customer deliveries and overall customer satisfaction.
- **Shipping Accuracy**: Shipping accuracy measures the **correctness** of orders shipped to customers. It includes ensuring that the right items are picked, the correct quantities are packed, and the appropriate documentation is included. High shipping accuracy leads to higher customer trust and fewer returns.
- **Transit Time**: Transit time is the **total time** that elapses from when a shipment leaves the facility until it reaches its destination. It's a vital indicator of the efficiency of the transportation process and impacts customer satisfaction regarding delivery times.
- **Waiting Time for Put Away**: This KPI measures the **waiting period** before goods are moved from the receiving area to their storage location. Minimizing this time is important for freeing up dock space and improving the overall flow within the warehouse.
- **Inventory Visibility and Control**: This refers to the **ability to monitor and manage** inventory levels, locations, and movements throughout the warehouse in real-time. Good inventory visibility and control help prevent loss, theft, and misplacement, ensuring that inventory is available when needed.
- **Wait Time for Inspection**: This metric indicates the **time goods spend** awaiting quality inspection before they can be stored or shipped. Efficient inspection processes reduce this time, allowing for quicker inventory turnover.
- **Scrap Rate**: The scrap rate is the **percentage of materials** that are deemed unusable due to defects, damage, or expiration and must be discarded. A lower scrap rate indicates better quality control and less waste.

These KPIs collectively provide insights into the performance and impact of the actions taken to optimize inventory management in the warehouse. Monitoring these indicators allows for continuous improvement and adjustment of strategies to meet business objectives effectively.

3.3.4 KPI Analysis for Logistics Optimization

1. Stock Accuracy

Definition and Importance: Measures the accuracy of inventory records compared to the actual physical inventory. Essential for preventing stockouts and overstock.

Method of Calculation:

$$Stock\ Accuracy = \left(\frac{Number\ of\ accurate\ inventory\ records}{Total\ number\ of\ inventory}\right) \times 100$$

1. Error Reduction Rate

Definition and Importance: Evaluates the effectiveness of measures implemented to reduce operational errors such as picking, packing, and shipping errors.

Method of Calculation:

$$Error\ Reduction\ Rate = \frac{(Number\ of\ errors\ at\ the\ beginning\ of\ the\ period) - (Number\ of\ errors\ at\ the\ end\ of\ the\ period)}{(Number\ of\ errors\ at\ the\ beginning\ of\ the\ period)} \times 100$$

2. Resistance to Change

Definition and Importance: Measures the ability of the organization and its staff to adapt to new technologies and processes.

Method of Calculation: Often assessed qualitatively through surveys and feedback.

3. Inventory Visibility and Control

Definition and Importance: Indicates the ability to track and manage inventory in real-time, crucial for effective demand planning.

Method of Calculation: Percentage of inventory accurately tracked and visible in the system.

$$Inventory\ Visibility = \left(\frac{(Number\ of\ items\ tracked\ in\ real\text{-}time)}{(Total\ number\ of\ items)}\right) \times 100$$

4. **Order Picking Time**

Definition and Importance: Measures the time taken to pick an order, impacting overall efficiency and customer satisfaction.

Method of Calculation: Average time taken to pick an order.

$$Order\ Picking\ Time = \frac{(Total\ time\ to\ pick\ all\ orders)}{(Number\ of\ orders\ picked)} \times 100$$

5. **Physical Inventory Accuracy**

Definition and Importance: Compares physical inventory counts to system records to ensure reliability.

Method of Calculation:

$$Physical\ Inventory\ Accuracy = \frac{(Number\ of\ items\ accurately\ counted)}{(Total\ number\ of\ items\ counted)} \times 100$$

6. **Shipping Accuracy**

Definition and Importance: Measures the rate at which orders are shipped correctly, crucial for customer satisfaction and reducing returns.

Method of Calculation:

$$Shipping\ Accuracy = \frac{(Number\ of\ correctly\ shipped\ orders)}{(Number\ of\ shipped\ orders)} \times 100$$

7. **Picking Accuracy**

Definition and Importance: Assesses the accuracy of items picked for orders, impacting customer satisfaction and operational efficiency.

Method of Calculation:

$$Picking\ Accuracy = \frac{(Number\ of\ accurately\ picked\ items)}{(Total\ number\ of\ items\ picked)} \times 100$$

8. **Scrap Rate**

Definition and Importance: Indicates the percentage of products that are damaged or deemed unusable, affecting cost and inventory levels.

Method of Calculation:

$$Scrap\ Rate = \frac{(\ Number\ of\ scrapped\ items)}{(Total\ number\ of\ items)} \times 100$$

9. **Dock to Stock Time** $= \frac{\Sigma(\text{Time items recieved at Dock-Time items Available for Use})}{(\text{Total Number of items})}$

10. **Transit Time**$= \frac{\Sigma(Delivery\ Time\text{-}Dispatch\ Time)}{(Total\ number\ of\ Shipments)}$

Table 4: Selected warehouse KPI's

	Transit	Inbound	Warehousing	Picking	Outbound
KPI's	Dock to stock	Receiving Efficiency	Stock Accuracy	Order Picking Time	Shipping Accuracy
	Transit Time	Waiting Time for Put Away	Inventory visibility and control		
		Wait time for inspection	Scrap rate		

Table 5: KPI's calculations, and remarks

KPI's- Transit			
Measure	**Formula**	**Value**	**Remark**
Dock to Stock	$\frac{Transit\ time}{Total\ Inbound\ Time})\times 100$	**76,76%**	**The time spent in Transit operations represents 76,76% from total inbound time, which is an alarming situation that may generate inefficiencies in other processes**
Transit Time	$\frac{Delivery\ time\text{-}clearance\ time}{Total\ number\ of\ items\ received})\times 100$	**56,7 min**	**The average time taken for each item to travel (excluding clearance time) is 56,7 minutes. This indicates that the logistic process in transit is not efficient, there is an important delay which has to be eliminated.**

KPI's- Inbound			
Measure	**Formula**	**Value**	**Remark**
Receiving Efficiency	Items received/total hours in receiving working $(\frac{Number\ of\ items\ received}{Total\ hours\ of\ working\ at\ receiving})\times 100$	**64,63%**	**For every hour worked in the receiving area, approximately 64.63 items are processed. This suggests that there might be inefficiencies in the receiving process, as the efficiency is not close to 100%.**
Waiting time for Put Away	$(\frac{Time\ for\ putaway}{Total\ Inbound\ Time})\times 100$	**60%**	**A significant portion of the inbound process time (60%) is dedicated to moving goods from the receiving area to their storage location. This portion is relatively high, in this case, some actions need to be done in order to streamline and optimize the**

			inbound's efficiency.
Wait time for inspection	$(\frac{Time\ for\ Inspection}{Total\ Inbound\ Time})\times 100$	**3,125%**	**A small portion of the total inbound process time (3.125%) is dedicated to inspecting the items. This suggests that the control process is relatively quick and efficient compared to other stages of the inbound phase.**

KPI's- Warehousing			
Measure	**Formula**	**Value**	**Remark**
Stock Accuracy	$\frac{\text{Number of accurate inventory records}}{\text{Total number of inventory}})\times 100$	**82,01%**	**This metric suggests that there's a significant portion of the warehouse's records that are not accurate. (17,99%). This accuracy rate means that there's a room for improvement in the inventory management.**
Inventory visibility and control	$\frac{(\text{Number of items tracked in real-time})}{(\text{Total number of items})}\times 100$	**99,86%**	**This high percentage suggests a very efficient and up-to-date warehouse management system that allows for immediate visibility of inventory levels and locations.**

Scrap rate	$\frac{(\text{Number of scrapped items})}{(\text{Total number of items})} \times 100$	**4,25%**	**Out of all items handled, 4.25% are being defective or missed.**

KPI's- Outbound			
Measure	**Formula**	**Value**	**Remark**
Order Picking Time	$\frac{(\text{Total time to pick all orders})}{(\text{Total number of orders picked})} \times 100$	**4,28min**	**On average, each item takes 4.28 minutes to be picked from the inventory. This indicated that the order picking process is relatively slow.**
Shipping Accuracy	$\frac{(\text{Number of correctly shipped orders})}{(\text{Number of shipped orders})} \times 100$	**91,55%**	**A shipping accuracy of 91.55% indicates a fairly high level of accuracy in the shipping process, but there is still room for improvement to reduce errors and improve customer satisfaction.**

Source: Made by the Students

Thanks to these metrics, we were able to validate the inefficiencies already identified in the initial VSM. Here are some specific examples:

Lack of coordination: This inefficiency was identified through the "Transit Time and Receiving Efficiency" indicators. It revealed delays and coordination issues between the unloading of shipments and their storage.

Waiting and delays: By using the KPIs "Dock to Stock and Waiting Time for Put away" we have confirmed the presence of waiting and delays in the progress of the Inbound operations.

Picking process efficiency: This inefficiency was confirmed through the KPI "order picking time," which measures the time required to process an order from its receipt to its availability in the shipping area.

Stock accuracy: The precision of product placement in the inventory relatively to the recorded data. A non-accuracy can lead to various problems within the warehouse, such as additional costs, operational delays, and inefficiencies in the inbound processes.

As we mentioned before, and to understand the causes of the problems above, we used the Ishikawa method. The details will be explained in the following title.

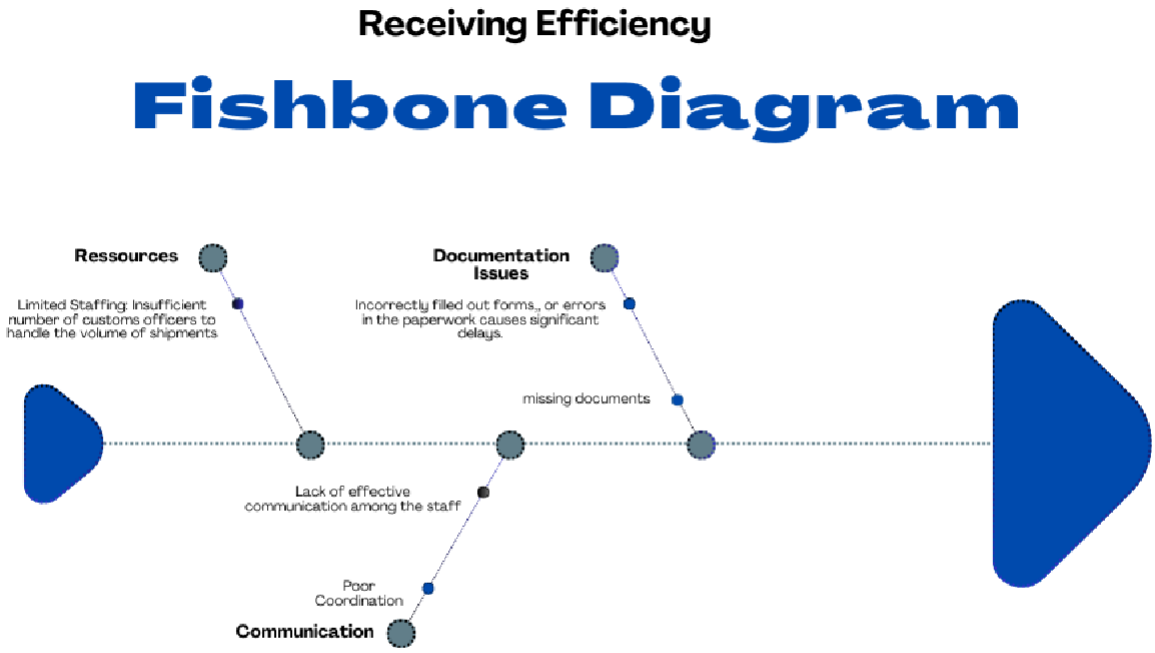
3.3.5 Ishikawa Diagram:

Once the inefficiencies were detected, it was essential to identify the underlying causes in order to formulate precise recommendations for improvement. To this end, we developed Ishikawa diagrams, which allowed us to analyse in detail the possible causes of each identified problem. These diagrams were created after observations and brainstorming sessions with the UPS team to consider all potential causes.

It is important to note that only the KPIs showing inefficiencies are selected for the application of the Ishikawa diagram which are:

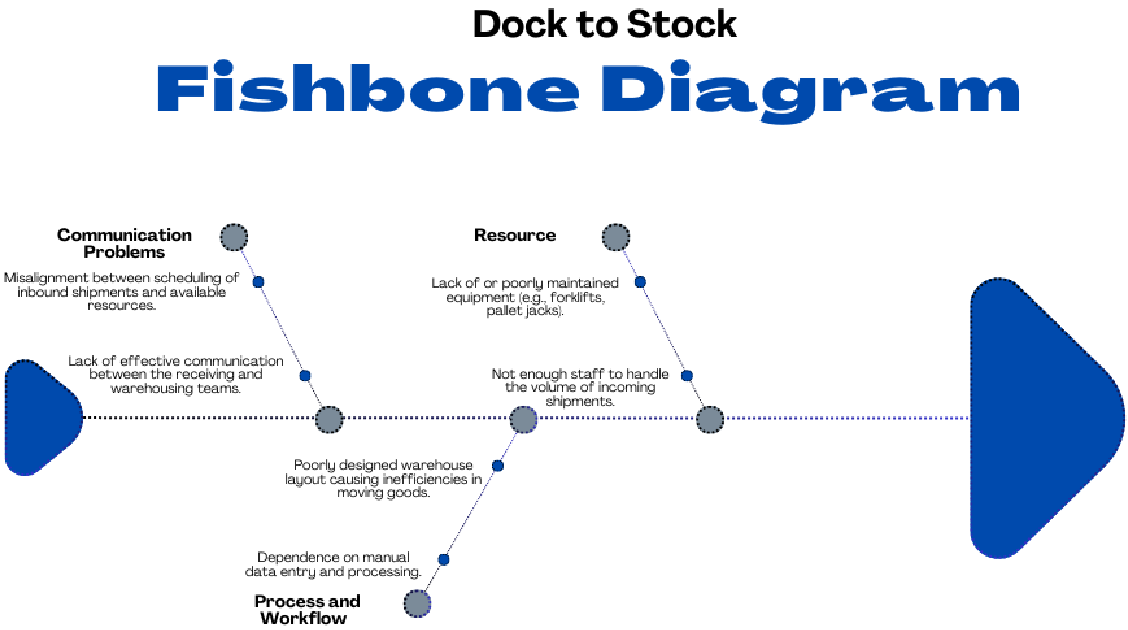
- Receiving Efficiency
- Dock to Stock
- Stock accuracy

Figure 19: Ishikawa Diagram -Receiving Efficiency-



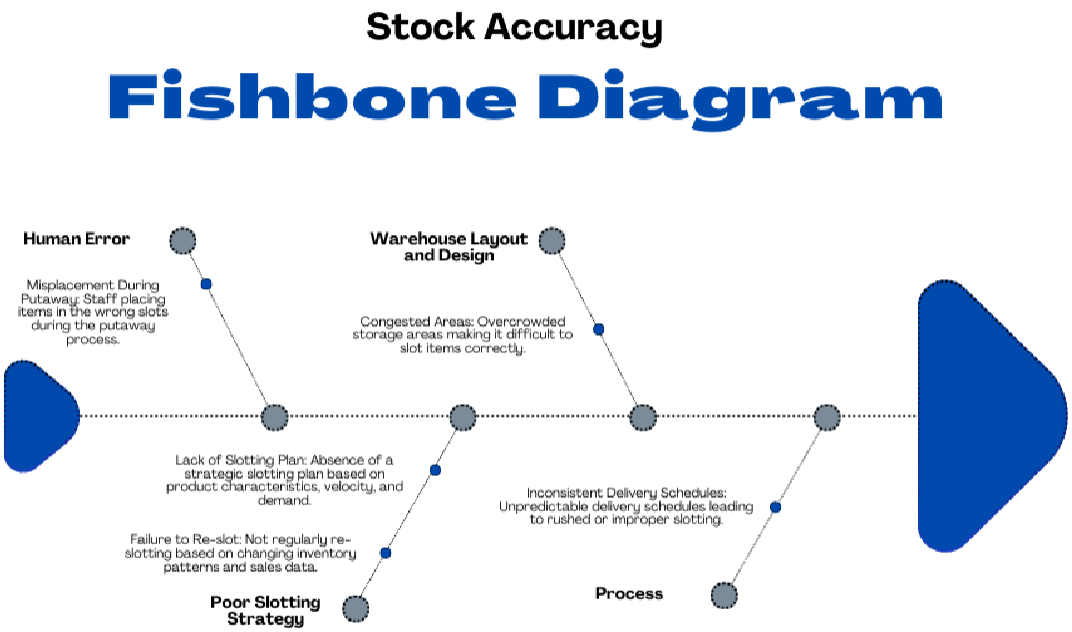
Source: made by the students

Figure 20: Ishikawa Diagram -Dock to Stock-



Source: made by the students

Figure 21: Ishikawa Diagram - Stock Accuracy-



Source: made by the students

3.3.6 Recommendations:

Once the root causes of each problem are identified, it is possible to propose targeted improvements in the form of recommendations. These recommendations come from interviews conducted with UPS's warehouse staff, as well as our personal reflections reinforced during our internship journey. Here is a summary of each proposal with an explanation:

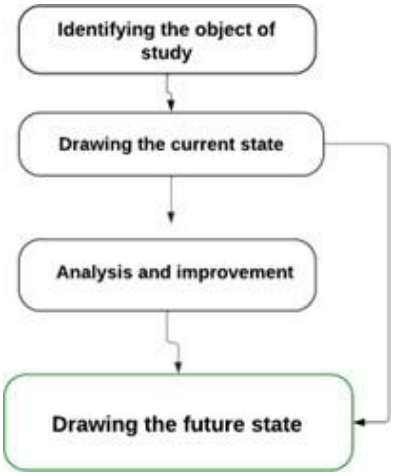
Table 6: Recommendations

Recommendation	Description
Establishing a forecast schedule for upcoming receipts and shipments with the supplier DELL.	By creating a forecast schedule based on client information, the company can better plan resources, optimise storage, improve efficiency, and meet deadlines for higher customer satisfaction.
Adjust the staffing levels to align human resources with the actual needs of the warehouse.	Staffing adjustments involve aligning the number of personal with the operational requirements of the warehouse.
Disseminate information in a smooth and efficient manner.	Effective communication between different warehouse teams is essential to ensure coordination of activities.
Implement a system for tracking logistics performance.	Implement a performance tracking system to regularly measure KPIs and identify improvement opportunities through dashboards, maintaining a strategy of continuous improvement in warehouse management.
Making changes to the company's organizational chart	Separating the 3PL warehouse from the cargo service. This will allow employees to better focus on managing 3PL operations, ensuring mastery of these operations, which will lead to the elimination of delays and slotting errors.
Establishing a strategic plan for slotting	This involves planning the placement of received products in the warehouse according to their size, weight, and demand. Regularly updating this plan based on sales data and inventory turnover can further enhance efficiency.
Hiring experienced and reliable customs brokers.	Building a competent Transit team will reduce the waste in transit time associated with customs clearance processes.

3.4 Section 03: Results and discussions

3.4.1 Future state VSM:

Figure 22: Drawing the future state VSM



Source: Made by the students

We will assume that the recommendations mentioned above are implemented in the UPS 3PL warehouse. This assumption will allow us to estimate the potential gain and impact on warehouse performance, in order to assess whether improvements have been achieved. To do this, we will develop the future state VSM, taking these solutions into account.

Given that this assumption is hypothetical, we will estimate the resulting data from the implementation of these methods and represent them in the final VSM. This will allow us to visually analyse value flows, cycle times, waiting times, and other key indicators, before and after the implementation of the solutions.

To achieve this, we follow the same methodology used to construct the initial VSM, starting with the analysis of process flow, then proceeding to draw the value stream mapping.

Here is a series of figures illustrating the flow analysis for each estimated process after the implementation of the solutions, including the calculation of times, within the UPS company.

Figure 23: Future Process Flow Chart-Transit-

TRANSIT		VALUE STREAM MAPPING VSM2							
N	Phase	Transport	Storing	Operations	Control	Deadlines	Time (min/receiving)	Min	Max
1	Traveling from airport to customs desk	★					15	13	20
2	Wait for Unloading					★	7	5	30
3	Unloading		★				2	5	25
5	Customs Clearence				★		320	60	1j
6	Inbound Confirmation via customs			★			5	1	10
	Total	15	2	5	320	7	349		
	%	4.30%	0.57%	1.43%	91.69%	2.01%	100%		

Process efficasity = nb VA phases/nb VA phases+ NVA phases	20%	**VAT (min)**	5
Lead Time = VA +NVA	349	**NVA (min)**	349
Process efficience = Σ VA (min)/Lead time	0.014	**CT (min)**	325

Source: made by the students

Figure 24: Future Process Flow chart VSM-Inbound-

Inbound		VALUE STREAM MAPPING VSM2							
N	Phase	Transport	Storing	Operations	Control	Deadlines	Time (min/inbound)	Min	Max
2	Access to staging area	★					15	5	20
3	Dispatch	★					25	10	60
4	Conformity Control				★		25	10	60
5	Data entry via WMS			★			190	60	360
6	Establishing a slotting plan			★			110	60	360
	Total	40		300	25		365		
	%	10.96%	0.00%	82.19%	6.85%	0.00%	100%		

Process efficasity = nb VA phases/nb VA phases+ NVA phases	20%	VAT (min)	190
Lead Time = VA +NVA	365	NVA (min)	175
Process efficience = Σ VA (min)/Lead time	0.52	CT (min)	215

Source: made by the students

Figure 25: Future Process Flow chart VSM -Warehousing-

Warehousing		VALUE STREAM MAPPING VSM2							
N	Phase	Transport	Storing	Operations	Control	Deadlines	Time (min/product)	Min	Max
1	Product scan by Tundra			★			0.5	0.3	1
2	Put in stock following the slotting plan	★					7	5	10
	Total	7	0	0.5	0		7.5		
	%	93.33%	0.00%	6.67%	0.00%	0.00%	100%		

Process efficasity = nb VA phases/nb VA phases+ NVA phases	50%	VAT (min)	0.5
Lead Time = VA +NVA	7.5	NVA (min)	7
Process efficience = Σ VA (min)/Lead time	0.07	CT (min)	0.5

Source: made by the students

Figure 26: Future Process Flow chart VSM -Outbound-

Outbound		VALUE STREAM MAPPING VSM2							
N	Phase	Transport	Storing	Operations	Control	Deadlines	Time (min/order)	Min	Max
1	Order reception via Email			★			7	5	15
2	Wait for picking order					★	12	5	30
3	Picking	★					12	5	15
4	Packing	★					5	3	10
5	Outbound Scan			★			7	3	8
6	Traveling to expedition area		★				2	1	5
	Total	24	2	7	5	7	45		
	%	53.33%	4.44%	15.56%	11.11%	15.56%	100%		

Process efficasity = nb VA phases/nb VA phases+ NVA phases	33%	**VAT (min)**	14	
Lead Time = VA +NVA	45	**NVA (min)**	31	
Process efficience = Σ VA (min)/Lead time	0.16	**CT (min)**	14	

Source: made by the students

Once the estimated flow analysis is completed, we can now develop the future state VSM.
In this new value stream map, we clearly observe the improvements made. Specifically, we have successfully reduced the lead time for the processes of receiving, order preparation, and shipping through several implemented measures, including the establishment of a forecast schedule for inbound operations, the implementation of a slotting plan, and the reinforcement of staff for warehouse management. These measures have a direct impact on the time and lead time for moving goods from arrival to stock (dock to stock).
To summarize the results, we will create a comparative table between the current and future states of the warehouse using two KPIs: total lead time and dock to stock.

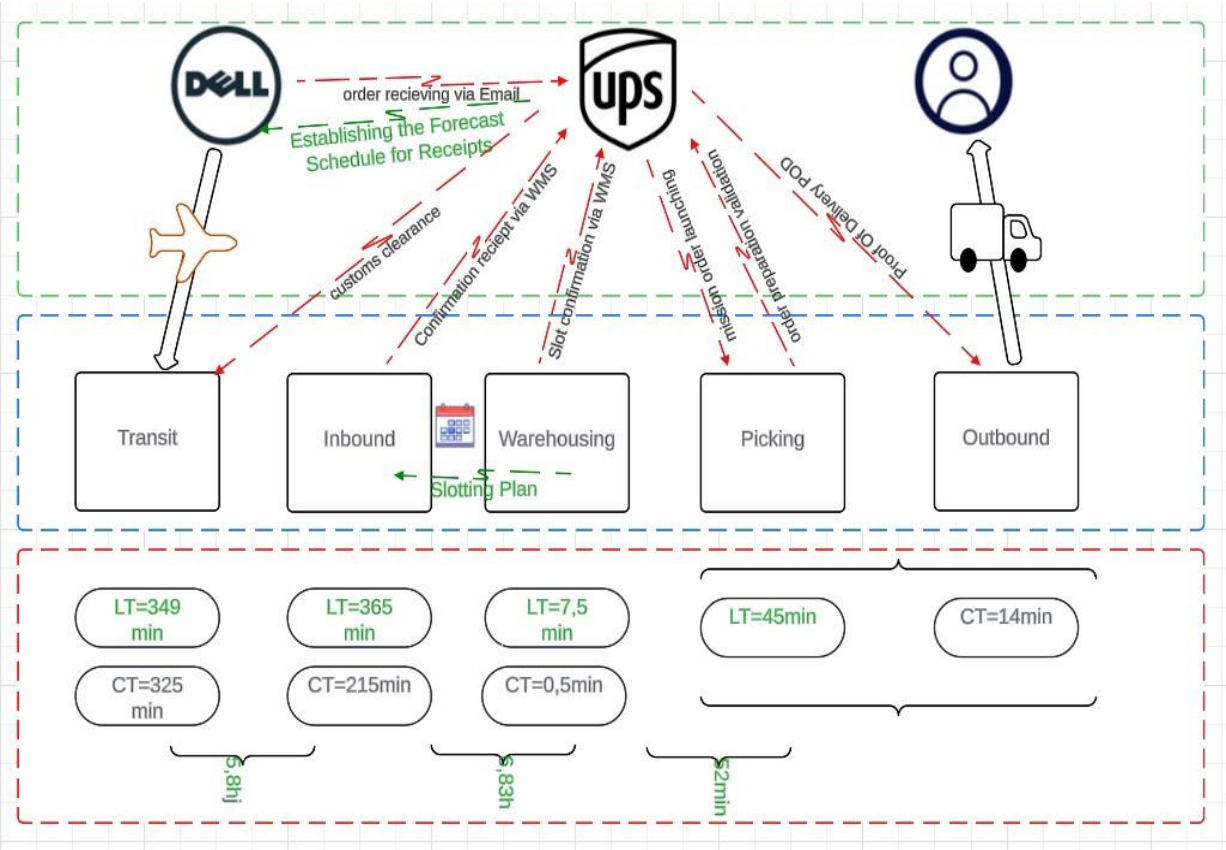
Table 7: Comparative table between current and future state using two KPI's

KPI	Current State	Future State	Improvement
Total Lead Time	163,4 h	12,8h	92% reduction
Dock to Stock Time	91%	48,4%	53% reduction

Source: made by the students

The estimation of the solutions has allowed us to compare the current and future states of the warehouse, as illustrated in the table, confirming that the improvement objective has been achieved. Once this solution is implemented, Conexlog UPS can proceed with a new evaluation to identify further opportunities for improvement and thus continuously enhance its performance.

Figure 27: Future State VSM



Source: made by the students

3.5 Conclusion:

In conclusion, the final chapter of our thesis aims to evaluate whether the improvement objectives have been achieved in the UPS warehouse.

After presenting the results of the various methods applied, such as the initial value stream mapping, the measurement of selected KPIs, Ishikawa diagrams, recommendations and solutions, and the future state VSM, we conducted a comparison between the initial and future states of the warehouse.

The comparative analysis confirmed the success of the improvement objectives set. Furthermore, this methodology highlighted the importance of continuous improvement to maintain and increase performance levels.

These results strongly encourage the company to consider the proposed recommendations and solutions and to actively pursue this continuous improvement approach in order to further optimize its operations and competitiveness.

By engaging in this process, UPS will be able to capitalize on the successes already achieved and continue to proactively develop to effectively and efficiently meet future challenges.

General conclusion:

The comprehensive study of logistics and supply chain management reveals a field that is both dynamic and indispensable to the success of contemporary businesses. The evolution from traditional logistics to integrated SCM reflects the increasing complexity and interdependence of global trade networks. This transformation has been driven by technological advancements, shifting consumer expectations, and the need for businesses to remain agile and responsive in a highly competitive environment.

The emergence of third-party logistics (3PL) providers has revolutionized the logistics landscape. By offering specialized services and leveraging economies of scale, 3PL providers enable companies to streamline operations, reduce costs, and enhance service delivery. This trend towards outsourcing logistics functions reflects a strategic shift that allows businesses to focus on their core competencies while benefiting from the expertise and infrastructure of 3PL providers.

Warehousing, as a critical component of SCM, has also evolved significantly. The adoption of advanced technologies such as warehouse management systems (WMS) and automated solutions has transformed warehousing operations, making them more efficient, accurate, and responsive to market demands. Lean warehousing practices further contribute to operational excellence by eliminating waste and optimizing processes.

Our specific focus on the optimization of the 3PL warehouse operations at UPS Algiers has highlighted the practical applications of these advancements. Through targeted improvements, we have optimized key performance indicators (KPIs) and enhanced the flow of warehouse operations. By identifying and eliminating non-value-adding activities, we have streamlined processes, reduced inefficiencies, and improved overall performance.

Despite the significant advancements in logistics and SCM, the industry faces numerous challenges, including supply chain disruptions, regulatory complexities, and the need for sustainable practices. Addressing these challenges requires continuous innovation, collaboration, and a commitment to adopting best practices.

This study underscores the essential role of logistics and SCM in driving economic growth and supporting global trade. The insights gained from our analysis and practical interventions at UPS Algiers provide a roadmap for optimizing logistics operations and enhancing supply chain

performance. As businesses continue to navigate the complexities of the global marketplace, the principles and strategies discussed in this study will serve as valuable tools for achieving operational excellence and sustaining competitive advantage.

BIBLIOGRAPHY

References

1. Abby Jenkins, Product Marketing Manager, July 25, 2022.
1. Abby Jenkins, Product Marketing Manager, September 24, 2020.
2. Andrey Kazakevich, May 26, 2023.
3. Banzato, 2003; apud Ribeiro; Silva; Benvenuto, 2005, p. 8.
4. Bartholdi, J. J., & Hackman, S. T. (2011). Warehouse & Distribution Science. Georgia Institute of Technology, School of Industrial and Systems Engineering, The Supply Chain and Logistics Institute, August 22, 2011, latest release: version 0.95.
5. Bartholdi J.J and S. T. Hackman, Warehouse & Distribution Science. Georgia Institute of Technology, School of Industrial and Systems Engineering, The Supply Chain and Logistics Institute, August 22, 2011, latest release: version 0.95.
6. Bartholdi, J. J., & Hackman, S. T. (2011). Warehouse & Distribution Science. Georgia Tech.
7. Bartholdi, J. J., & Hackman, S. T. (2011). Warehouse & Distribution Science. Georgia Tech.
8. Bartholdi, J. J., & Hackman, S. T. (2011). Warehouse & Distribution Science. Georgia Tech.
9. Bartholdi, J. J., & Hackman, S. T. (2011). Warehouse & Distribution Science. Georgia Tech.
10. Boubakour, F., Professor in EHEC, SCM 01 course (2022).
11. Bowersox, D.J., Closs, D.J., & Cooper, M.B. (2013). Supply Chain Logistics Management. McGraw-Hill Education.
12. Carleton University, January 30, 2016 (Pages 333-337).
13. Carleton University, January 30, 2016 (Pages 337-341).
14. Council of Logistics Management (CLM), 1996.
15. Council of Logistics Management (CLM), 2009.
16. CSCMP (Council of Supply Chain Management Professionals) (2013). Supply Chain Management: Terms and Glossary.
17. David Garnier. "Value Stream Mapping: A Tool for Process Representation and Reflection for Lean Improvement Applied to the Pharmaceutical Industry". Doctoral Thesis, Joseph Fourier University, 2010.
18. Elia Oey et Maulana Nofrimurti. “Lean implementation in traditional distributor, warehouse - A case study in an FMCG company in Indonesia”. In: International Journal of Process Management and Benchmarking 8.1 (2018), p. 1-15.
19. Fabio Marques de Souza, Published in 2007.
20. Francielly Hedler Staudt et al. “Warehouse performance measurement: a literature.
21. Govindan, K., Soleimani, H., & Kannan, D. (2015). "Reverse logistics and closed-loop supply chain: A comprehensive review to explore the future". European Journal of Operational Research, 240(3), 603-626.
22. Hari, July 5, 2022. Maritime Law (Marine Insight).
23. Hari, July 5, 2022. Maritime Law (Marine Insight). (Marine Insight).
24. International Chamber of Commerce (ICC) website (iccwbo.org) offers resources and publications on trade finance, customs procedures, and global supply chain management.
25. Jan Karasek, 2013, The International Journal of Advances in Telecommunications, Electrotechnics, Signals and Systems, page 114. (An Overview of Warehouse Optimization)
26. Jociano Motta: Transit Time: Maximizing Efficiency In International Trade And Logistics, September 22, 2023 (Cheap2Ship).
27. Joseph M. Juran.
28. Juliet D'cruz, July 24, 2023.
29. Logistics and Warehousing Management, Page 98.
30. Logistics-International Features Certification.
31. Logistics-and-Warehousing-Management, P 99-100.
32. MONICA Logistics Innovators, September 23, 2023.
33. Operations, Logistics and Supply Chain Management, pp. 234–235.
34. RIBEIRO; SILVA; BENVENUTO, 2005.

35. Rogers, D. S., & Tibben-Lembke, R. S. (1998). "Going Backwards: Reverse Logistics Trends and Practices". University of Nevada, Reno, Center for Logistics Management.
36. Rother M., Shook J., 1999. Learning to see: value stream mapping to add value and eliminate MUDA. The Lean Enterprise Institute, Brookline, MA.
37. Rother M., Shook J., 1999. Learning to see: value stream mapping to add value and eliminate MUDA. The Lean Enterprise Institute, Brookline, MA.
38. Shannon Bambling, November 10, 2022.
39. Shannon Bambling, November 10, 2022.
40. SKPN Silva. “Applicability of value stream mapping (VSM) in the apparel industry, in Sri Lanka”. In: International journal of lean thinking 3.1 (2012), p. 36-41.
41. Snapl Solutions Inc., August 19, 2023.
42. Stock & Lambert, strategic logistics management, 2001.
43. Team Hopstack, December 29, 2023.
44. Team Laconav, April 18, 2022 (Loconav).
45. The Blume Global Team, July 12, 2019.
46. The Future of Warehouse Management: Trends and Innovations (bbmatrix.ai).
47. Tompkins, J. A., White, J. A., Bozer, Y. A., & Tanchoco, J. M. A. (2010). Facilities Planning. John Wiley & Sons.
48. Tompkins, J. A., White, J. A., Bozer, Y. A., & Tanchoco, J. M. A. (2010). Facilities Planning. John Wiley & Sons.
49. Tompkins, J. A., White, J. A., Bozer, Y. A., & Tanchoco, J. M. A. (2010). Facilities Planning. John Wiley & Sons.
50. Tompkins, J. A., White, J. A., Bozer, Y. A., & Tanchoco, J. M. A. (2010). Facilities Planning. John Wiley & Sons.
51. Underpinnings of social science theories relative to the role of 3PLs.
52. Waters, D. (2009). Global Logistics: New Directions in Supply Chain Management. Kogan Page Publishers.
53. Zach G. Zacharia. Journal of Business Logistics, Vol. 32, No. 1, 2011.
54. 3pl-logistics-solutions-guide-2023-.

Webography

1. **Adam Henshall, January 19, 2023**. https://vww.process.st/muda/
2. **Inbound Logistics - Cross Docking, November 2023**: https://www.inboundlogistics.com/articles/cross-docking/
3. **Inbound Logistics - Logistics Management Challenges, October 2023** https://www.inboundlogistics.com/articles/logistics-management-challenges/
4. **KPMG - Top 10 Supply Chain Trends 2024**:Shawn Tay, Mehdi Ouici, association for supply chain management, top 10 supply chain trends,2024https://kpmg.com/xx/en/home/insights/2023/12/supply-chain-trends-2024.html
5. **Shipsy - Top Six Challenges Global Logistics Service Providers 2023**: https://shipsy.io/blogs/top-six-challenges-global-logistics-service-providers-2023/
6. **Snorable - Future of Warehouse Management Systems Predictions and Trends**: https://snorable.org/the-future-of-warehouse-management-systems-predictions-and-trends/
7. **BBMatrix - Future of Warehousing**: https://www.bbmatrix.ai/blog/future-of-warehousing
8. **ATECH Logistics - Improve Your Cross-Docking Processes**: https://www.atechlogistics.com/9-steps-to-improve-your-cross-docking-processes/

ANNEXES

List of Annexes:

Annex 120:

Interview guide

Introduction

As you know we are Benachour Samy and Dob Samy, currently students in the school of higher commercial studies (EHEC), we are internships in this company, we are preparing for our graduation thesis in the subject of "logistics optimisation of a 3PL warehouse"
Our questions aim to hit different aspects from the different programs, strategies and actions that help to track, and manage the stocks with a well performing way, we will focus on these which your company works with, their pros, and cons seen during the usage, you will be very helpful for responding to our questions which are the object of analysis and studies of the third chapter of our thesis in the goal of our practical study case.

1st AXIS: interviewed presentation

- Present yourself, and what position are you occupying, please?

2nd AXIS: Experience with DELL warehouse (3PL warehouse)

- when dell has subtracted their stocks management to conexlog, and why they have not externalised their work by themselves in your point of view?
- what are the ways you are using right know to manage the different transactions of DELL warehouse?
- how were these actions implemented in the warehouse?

3rd AXIS: pros observed

- have you seen any improvements of the stock accuracy, the speed of replenishment processes, error reduction when using these programs?
- what benefits have you observed since the adoption of these programs in inventory management?

4th AXIS: cons and difficulties

- Have there been issues with compatibility, staff training, or resistance to change?
- What challenges did you face during the implementation or use of these programs?
- How were these challenges overcome?

5th AXIS: impact on Work Processes

- How have these actions changed inventory management processes in the warehouse?
- What specific changes have you observed in daily activities related to inventory management?
- How have communication and collaboration between different stakeholders been influenced by these technologies?

6th AXIS: Recommendations

- Do you have any recommendations for improving the use of such programs in warehouse inventory management? Are there any additional features or potential improvements you would like to see implemented?

Conclusion:

- Thank you once again for your time and cooperation.
- Do you have any specific questions to ask or additional comments to make?

Annex 122:

Table: Calculation of KPIs, Transit operations

dock to stock	**76,76%**
transit time	8669-1400
inbound time	8669+800

transit time	**56,7min**
delivery time	7224
clearance time	1440
items received	102

Source: Made by the Students

Table: Calculation of KPIs, inbound operations

receiving efficiency	**64,63%**
items received	102
total hours	(800+8669)/60
waiting time for put away	**60%**
wait for putaway	480
total time for putaway	800
wait time for inspection	**3125%**
time for inspection	25
inbound time	800

Source: Made by the Students

Table: Calculation of KPIs, Warehousing operations

stock accuracy	**82,01%**
accurate inventory	2987
total number of inventory	3642
inventory visibility and control	**99,86%**
items tracked in real time	3637
number of items	3642
scrap rate	**4,25%**
scraped items	155
total inventory items	3642

Source: Made by the Students

Table: Calculation of KPIs, Outbound operations

order picking	**4,28min**
time to pick all orders	30
total number of picked orders	7
shipping accuracy	**91,55%**
correctly shipped orders	271
number of shipped orders	296

Source: Made by the Students

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