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DATA-DRIVEN OPTIMIZATION OF INVENTORY MANAGEMENT AND SALES STRATEGIES FOR AUTOMOTIVE COMPONENT SUPPLIERS

Bachelor's thesis

Information and Communication Technology, Bioeconomy

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Information and Communication Technology, Bioeconomy Abstract
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Retail businesses in Morocco have improved in a very rapid way after adopting new technologies. This thesis suggests various ways to make the sales and inventory of retail businesses more efficient by focusing on one of Sahillienne's stores in Morocco.

The goal of this thesis is to offer solutions in order to avoid inventory issues essentially related to overstocking and understocking and find the best timing for when and how much to restock inventory and improve sales.

The methods employed in this study involve gathering data from the Sahillienne store including store operations and customer feedback which can assist other retail businesses as well for better improvement. The methods found in the literature were applied in the theory and concluded reliable sources such as journal articles, books, blogs, etc.

The results of this study have found the store's inventory needs to essentially adopt a strategy that can be forecasting or just in time (JIT) or maybe a combination of both, taking care of customers and knowing their needs by offering good online services which will make them satisfied and increase sales of the store, it's also crucially important for a business to analyze their data before implementing any of these strategies by using ABC methods and key performance indicators (KPIs).

Thus, the results show that these data-driven strategies not only improve sales strategies and inventory levels but also make it easier for customers to get involved in the process. Ultimately, the study strongly supports the idea that data analytics can strictly change the way the product is managed and how sales are planned.

Keywords: Data analytics, sales analytics, inventory optimization, automotive components.

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1 Introduction

There is a lot of competition in the retail business, and customer needs change quickly. Technology is also getting better. It's very important for shops that sell in retail, like the Sahillienne company, to offer a wide range of goods and services to keep up with the times. But it's hard to keep track of stocks and make good sales plans in this field because there are so many parts, demand changes all the time, and there needs to be a lot of service. There should be just the right amount of stock on hand to meet customer needs without going over budget or running out of things. This is what inventory management in the retail business means. The old ways of managing supplies depend on guesses and data from past sales, which might not be enough to properly reflect current market trends or sudden changes in demand. The store might not be able to make money or keep customer satisfaction because of this, which could cause them to overstock, understock, or lose sales.

Information-driven optimization is a bright spot for shops that want to get through these rough seas. Along with the new skills of internet of things (IOT), logistics and big data analytics have come a long way. This is great news for shops. These technologies let them see what the customer is thinking by showing patterns in their actions, choices, and decisions that they didn't see before. Armed with this expertise, stores can first-rate-music their stock to reflect expected demand, adopt dynamic pricing techniques that mirror the real-time market situations, and engage clients on a more non-public level.

This thesis is not simply a testament to the transformative strength of data-driven strategies but also serves as a manual for Sahillienne employer and certainly any store trying to update their operations and income methods to keep up with the digital trends.

This study aims to focus on improving inventory management and sales performance thoroughly, by reducing holding, ordering, and shortage costs. This objective underscores the importance of achieving an optimal balance in stock levels to mitigate the financial risks associated with inventory mismanagement, including overstocking and understocking. Using data analytics for better understanding is a way to improve inventory buying and selling strategies and ways to lower inventory costs, which will make any Company sure that inventory levels are suitable and modified to meet sales requirements thus increasing sales potential and enhancing customer satisfaction.

2 Enhanced strategies for inventory and sales management optimization

Any business needs to know when and how they should purchase and restock their inventory, by having enough knowledge the business could avoid overstocking and understocking in their inventory. To answer the questions of when and how finding the perfect technique is a must. That is why business is required to understand their data before adopting any method. (Tilley, 2023).

In this chapter, it will go deeper by discovering strategies for inventory and sales management which will answer the question of when and how by giving those strategies and methods as tables they will explain more and know how to adapt them for good results.

2.1 Overview of inventory management and sales strategies in the automotive component

Businesses are worried about controlling their stock. The role of inventory management is to keep the right amount in their stock, and to control the inventory must be based on the client and type of product and process and from those three the product will be always available for the client and in the same time the company will be having a good amount of stock. The first role of inventory is to serve the client by the product will be always available in the stock. Businesses must be careful about forecasting their stock and their production even if they have calculated the right among what they will need, there might be an error or delay in the factory or delivery, and the technique that will be applied in the inventory must be compatible with the goal and demands of the inventory. If the businesses know how to forecast, that will be the best to keep the right amount in the inventory and keep the business a way of spending more money in the holding part. (Toomeu, 2000, pp. 4-8)

2.1.1 Inventory management in the automotive component sector

Inventory management is a process of ordering or selling. When it's placed correctly, it may help in identifying how much stock need to order and when Which can help simplify inventory to avoid overclocking and understocking. (Bachara, 2022).

Inventory management is important for different reasons, firstly improving ordering processes, reducing costs, optimizing resource allocation, improving service scheduling, increasing customer satisfaction, and better time management. By registering inventory

records businesses can have an overview of their stock enabling them to track historical trends for perfect restocking and order timing, what's makes it hard to lose sales due to stock shortages or misplaced items. Optimizing inventory levels also minimizes storage and labor costs. Effective inventory management ensures efficient use of space, capital, and resources, preventing excessive inventory that may tie up money that would be better spent on upgrading tools and equipment. Accurate records are the key to accurately scheduling services as they allow quick verification of parts availability and simplify the appointment making process. This reliability, tries to boost customer trust and satisfaction by ensuring quick responses to inquiries and meeting demand. Additionally, simplified inventory tracking allows employees to focus less on searching for replacement parts and more on activities that enhance business operations and profitability, such as organizing for efficiency, negotiating better order terms, and establishing supplier relationships in emergency situations. (Bachara, 2022).

As for the key practices and strategies, table 1 will explore those, this section explains how to enable companies to effectively enhance their automotive inventory management practices.

Table 1. Key practices and strategies for inventory management. (Tilley, 2023).

Practice and strategy	Description
Accurate inventory records	Maintaining accurate records of inventory levels, including on-hand, on-order, and sold items, is necessary for optimizing inventory levels and reducing the risk of stockouts.
Just-In-Time (JIT)	JIT aims to minimize inventory costs by ordering parts as they are needed, rather than maintaining large inventory levels.
Safety stock levels	Establishing safety stock levels is important for making sure that there is always enough inventory on stock to meet demand, while also considering the costs and benefits of holding safety stock.

Warehouse management	Streamlining warehouse operations across multiple locations is essential for reducing costs and delivering products on time.
Inventory forecasting	It's a technique for predicting inventory levels for the future period. It also helps in tracking demand and sales also helps better manage the purchase orders. basic calculations of forecasting: reorder point inventory (ROP) = (the average daily sales x lead time) + safety stock.

By implementing these best practices and strategies, automotive component stores can also improve their inventory management, improve their bottom line, and ensure customer satisfaction. (Tilley, 2023).

2.1.2 Sales strategies in the automotive component

In the dynamic world of retail, there is one primary goal shared by all retailers around the globe which is to increase the sales of their stores. The achievement of this goal lies not only in attracting and increasing visitors but also in maximizing the sales potential during those important interactions. Given the competitive landscape, simply increasing customer traffic is for sure not enough because the real challenge is to convert this traffic into an increase in sales growth which necessitates a multi-faceted approach that includes cross-selling, upselling, promotional activities, and unparalleled customer service, especially during peak business hours. (Gotter, A. 2024).

These strategies include a wide range of techniques starting from simplifying store operations and hiring strategic staff to improve loyalty programs and offering personalized services using social media platforms to increase sales. Additionally, each strategy must be carefully designed to address different aspects of retail management to effectively improve the overall purchasing experience and increase customer satisfaction while pushing sales growth. (Gotter, A. 2024).

Table 2 is proof that provides comprehensive details on eleven strategies designed not only to force but also to boost retail sales.

Table 2. Actionable strategies for propelling retail sales. (Gotter, A. 2024).

Actionable Strategy	Description
Optimizing store operations based on peak hours.	Setting and utilizing the maximum working hours is pivotal. Using sales data and customer traffic patterns allows for strategic scheduling and targeted promotions.
Strategic staffing with top-performing sales associates.	Deploying your most effective sales staff during peak periods can dramatically improve sales results.
Investing in robust sales training programs.	Equipping sales associates with the skills needed to cross-sell and sell effectively is the key. This includes deep product knowledge and customer engagement techniques.
Promoting local brand identity.	Focusing on the local brand values resonates with a significant portion of consumers, enhancing connection that can lead to increased sales.
Integrating loyalty programs into sales strategies.	Loyalty programs are a powerful tool to not only retain customers, but also encourage customers for a higher spending, leveraging the principle of rewarding repeat business.

Offering complimentary shipping to store as a value-added service.	This approach can reduce costs to the retailer while enhancing customer satisfaction through convenience.
Providing complementary and paid ancillary services.	Services that add value to the product offering can enhance the customer experience and generate good additional revenue.
Launching promotions that captivate consumer interest.	Compelling time-sensitive promotions can drive sales by creating a sense of urgency and exclusivity.
Delivering personalized customer service in-store.	Adapting customer interactions to individual preferences and history can dramatically enhance the shopping experience and foster loyalty of the customer.
Streamlining the purchasing process.	Implement mobile POS systems to reduce the waiting times also to improve overall customer service efficiency during peak shopping periods.
Leveraging social media for engagement and sales.	Social media platforms provide a rich way to connect with customers, showcase products, and increase online and in store sales through targeted content.

2.2 Revving up sales: overcoming challenges in automotive component supplier strategies

In the realm of the automotive component sector, businesses are navigating through a labyrinth of challenges related to supplier strategies. These challenges encompass the

volatility of demand, susceptibility to disruptions, and the imperative of fostering adaptability. Among the paramount concerns for these enterprises is the delicate equilibrium between averting surplus inventory and avoiding stock shortages. Jenkins, (2023).

2.2.1 Overstocking

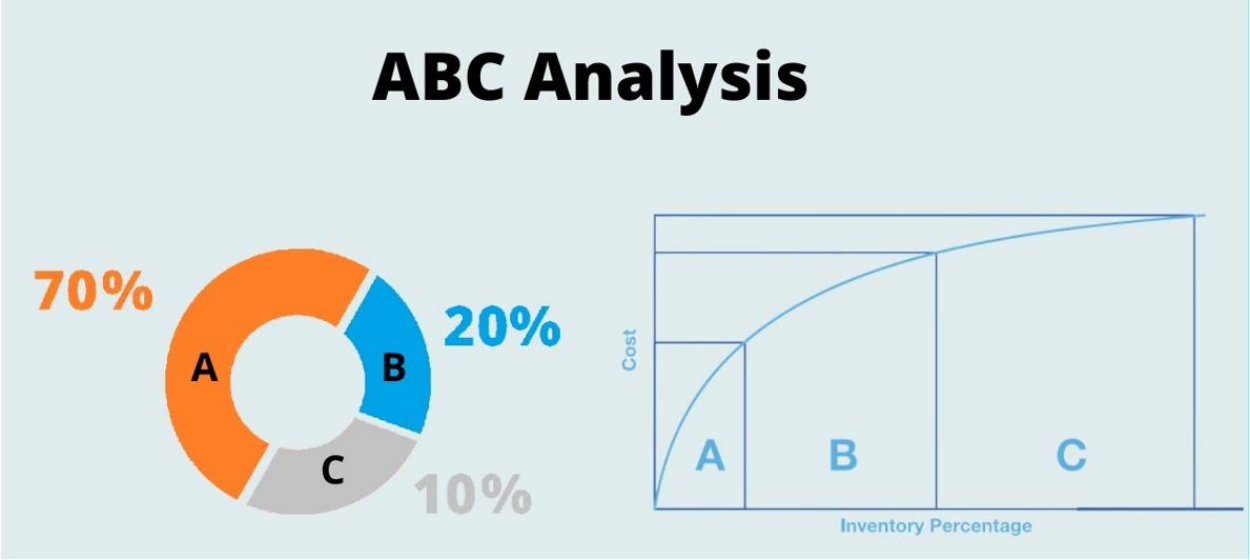
Aggressive restocking is the practice of purchasing the stock market in excess of the volume of sales. After the excess is obtained the interest rate decreases. Some of the causes include wrong estimates of demand from the buyers, fear of products going out of stock, poor organization of inventory, seasonal demands, supply-chain related problems, and challenges posed by the industry. Excess supply becomes a cost factor, especially if products are produced from scarce/ finite resources, and ends up hindering the effectiveness of the operation. Mitigation, in this case, would involve careful planning, number crunching, and inventory analysis. This is concerned with perishables and time-sensitive materials, where longevity becomes a threat since the products will age. The retailers will, therefore, sell them at very low prices just for clearance. In addition, sustained stocking levels cause the negative consequences that are not just the most obvious. It may require hiring new workers, and spending more time on managing inventory, shipping expenses, and quality control, which in turn affect the profit and hamper the operations by making them inefficient. Jenkins, (2023).

Managing your inventory will make you keep the necessary amount of supply and not excess of it. It is your fault if you conduct purchases without knowing what you already have in stock because you have a chance of getting the products in excess. Unlike large businesses that can afford the safety of overstocking, you will curb the harm that overstocking brings to your small business through point-of-sale (POS) data and information about your customer behavior to make accurate demand predictions. Unlike in the past where there was the usual 2 or 3 months stock turnaround for stores, real-time inventory analysis is now very much manual so customs need inventory management software. Some choices aren't too expensive and can give you useful information about how much inventory you need to avoid overstocking. Focusing on measures and key performance indicators will help you choose a system that fits your business goals and allows for growth that can be scaled up. It's important to check your point-of-sale (POS) system to make sure it's collecting the sales data you need to make smart buying choices. A good point-of-sale (POS) system lets you quickly access sales types, customer profiles, product categories, leftover stock, and reorder alerts. Systems like Shopify POS make it easier to keep track of goods and keep track of sales, which takes the guesswork out of buying things. Always Better Control (ABC) analysis helps stores sort their stock by how important it is, following the Pareto principle that says 20% of goods bring in 80% of the sales. High-priority, top-selling, and most profitable items are

represented by category A, crucial for focused selling and restocking efforts. Consistently well-selling items with a less frequent restocking schedule are included in category B. The lowest priority, category C, comprises items stocked in bulk to minimize reorder frequency. This strategic categorization enables retailers to optimize storage and streamline operations, concentrating on the most profitable category A items, thus enhancing business profitability. Jenkins, (2023).

Figure 1 displays the ABC analysis graphically. Identify industry inventories, list items by value, and count high, medium, and low-valued items. High-value inventories constitute 70%, medium 20%, and low 10% of total inventory. (Sukanta, 2022).

Figure 1. ABC method. (Sukanta, 2022).



2.2.2 Understocking

Understocking occurs when a company lacks enough products to meet customer demand, leading to stockouts and lost sales. This can result in customer dissatisfaction, damaged reputation, and increased competition. Frequent stockouts can deter new customers and negatively impact supplier relationships, making it challenging for businesses to conduct effectively. For people to be happy and for your business to look good, these results show how important it is to keep good track of supplies. (Wainwright, 2023).

Businesses should never be short on stock because they lose sales opportunities, make customers even less happy, and get a bad name. In this case, the customer has to go to a competitor to get the things they want because they can't find them. The business loses money because of this. Not having enough stock not only costs you money right away, but it

also makes customers mad because their needs aren't being met, which can make them less loyal or even leave for good. The effects spread to how people saw the company. When a company often runs out of stock, it can hurt its reputation, which can make it hard to get new customers and keep good relationships with providers. This kind of negative thinking makes it harder to run a business and can hurt its long-term growth and ability to stay open. These issues show how important it is to keep track of your products well. This will not only keep your customers happy and protect your good name in the market, but it will also help you avoid these problems. (Wainwright, 2023).

There are many things you can do to make sure you don't run out of stock correctly predicting demand, using modern inventory management tools, keeping a safe stock, and getting along well with your suppliers are just a few. Businesses can better guess what their customers will want by looking at past sales, market trends, and what their customers like. Then, they can change how much inventory they have to meet those goals. These days, inventory management tools help you keep an eye on both how much stock you have and how sales are going. This is done by automating the rearranging process so that the right amount of stock is always on hand. Not having enough inventory is less likely when there is safety stock on hand. This is because it can handle sudden rises in demand or delays in the supply chain. Having good relationships with suppliers is also important to make sure that goods get to companies on time and that they can get what they need. It helps them handle the issues that come up when demand changes and there is uncertainty in the supply line. All of these steps work together to lower the risk of understocking and the problems that come with it for business operations. (Wordsworth 2023).

2.3 Previous approaches to inventory optimization and sales strategies

Inventory optimization and sales strategies have been critical components of businesses across various industries for many years. Historically, several approaches have been used to manage inventory effectively and enhance sales performance. (Jenkins, 2023). Here's an introduction to some of the previous approaches to inventory optimization and sales strategies.

2.3.1 Previous approaches to inventory management

In the context of large-scale inventory optimization, two primary models have been developed to address multi-echelon (or multi-stage) inventory optimization problems, stochastic-service (SS) models and guaranteed-service (GS) models. The distinction between these models lies in their approach to the replenishment mechanism between

stages. SS models are predicated on the assumption that delivery or service time can fluctuate based on the availability of materials at the supply stage. Conversely, GS models operate under the premise that each stage can commit to a delivery or service time that is always achievable. This foundational difference in replenishment mechanisms underscores the varied applicability and effectiveness of SS and GS models in addressing inventory optimization challenges. (Wang & Hong, 2022, pp. 2-4).

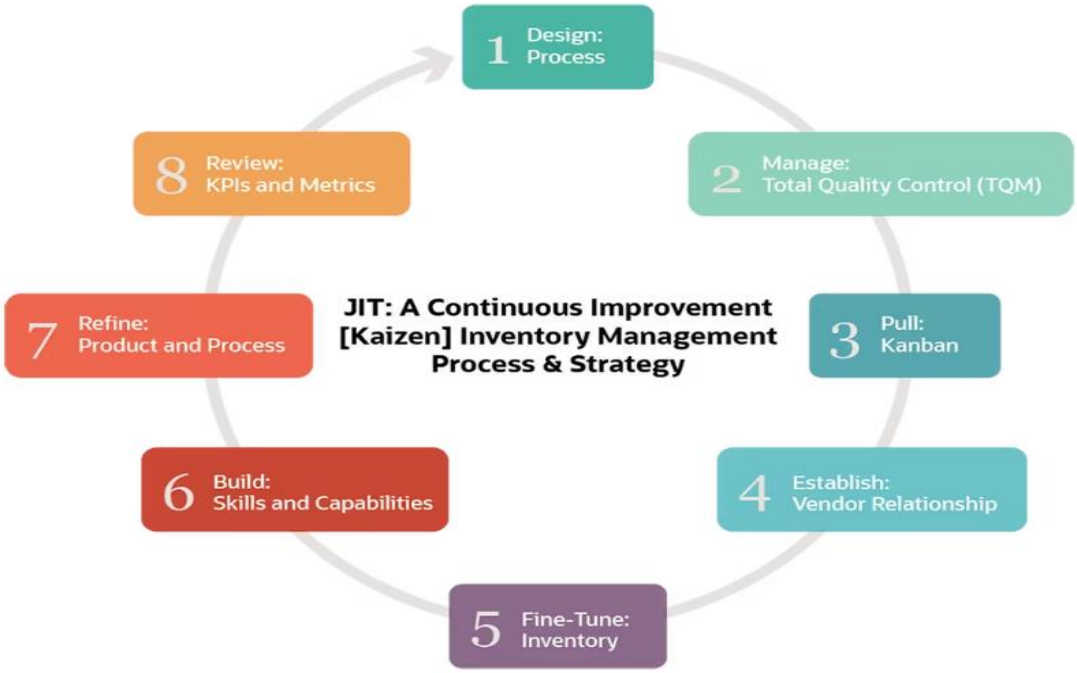
SS models have been applied primarily to serial and assembly systems, with an emphasis on environments where variation in service times can significantly affect inventory levels and operational efficiency. This approach, although important, is generally not suited to the large-scale problems on which this paper focuses, suggesting a need for solutions that can accommodate the complexity and scale of modern inventory systems. On the other hand, GS models, introduced by Simpson in 1958, have evolved through contributions such as Graves and Willems' dynamic programming algorithm for supply chains modeled as spanning trees and the development of efficient heuristics for solving NP-hard problems in general noncyclic networks. Despite their progress, GS models rely on the ability to establish deterministic upper bounds on stochastic orders, a difficult assumption for large-scale applications, which can lead to uncontrolled fill rates or high inventory costs. (Wang & Hong, 2022, pp. 2-4).

Notwithstanding these challenges, GS models offer a notable advantage in their tendency to concentrate inventory at a limited number of strategic nodes within the bill of materials (BOM). This characteristic significantly simplifies inventory management for large-scale problems by reducing the complexity associated with managing inventories across numerous nodes. The preference for holding inventory at strategic points rather than uniformly across all nodes aligns with the need for efficient and manageable inventory optimization strategies in complex production systems. (Wang & Hong, 2022, pp. 2-4).

Just-In-Time (JIT) inventory management aims to simplify production and minimize waste by ensuring materials and products are only ordered and received when it is needed. This approach reduces overstocking focusing on efficiency and quality over cost. Based on the Japanese philosophy of Kaizen JIT involves continuous improvement and involves every employee, from the CEO to the assembly line workers. It emphasizes long-term relationships with suppliers, flexible systems to eliminate disruptions, and quality management. The simple JIT process reduces costs, enhances productivity, and improves customer satisfaction by ensuring that products are manufactured in a timely manner to meet demand, thus improving operations and reducing unnecessary inventory. (Jenkins, 2023).

Figure 2 shows the JIT process diagram and its steps. Just-In-Time (JIT) is a management approach in which all aspects of production or services including people, are interconnected, aiming to reduce waste and improve quality. (Jenkins, 2023).

Figure 2. JIT process diagram and steps. (Jenkins, 2023).



Each company might have a different way of applying (JIT) method, but the main steps are the same. Figure 2 show how the circle of JIT works in inventory management for more understanding it needs to be explained step by step:

Design: this first step of the process of JIT starts with reviewing the basic building blocks of manufacturing example process design, product design, team planning, and manufacturing. Then, plans are made to design and build a flexible system. (Jenkins, 2023).

Manage: management review it works to define workers' roles and responsibilities define capacity and stabilize schedules also levels, it is called Total Quality Management (TQM). (Jenkins, 2023).

Pull: in this step, the team needs to learn the production and withdrawal methods using Signaling methods like Kanban also called JIT manufacturing. (Jenkins, 2023).

Establish: having a good relationship with the dealers it can improve the process of JIT by knowing and negotiating the lead time, and delivery forecast. (Jenkins, 2023).

Fine-tune: understanding the inventory and how it works and the data that come from sales to know when and what type of product needs to be purchased for less spending on the inventory. (Jenkins, 2023).

Build: for better results, you need to invest in your team by doing sessions where they will learn about the skills needed to complete their work perfectly. (Jenkins, 2023).

Refine: aims to make the number of steps and parts less through improvement and review of the entire process. (Jenkins, 2023).

Review: trying to identify and understand things in an easy way to find the problem and analyze it to find out the real reason. (Jenkins, 2023).

2.3.2 Sales plans used to work in a different way

Since technology and customer habits have changed over time, it's important to look at how sales strategies have changed over time. This is especially true in the auto parts business. Older methods that rely on real stores and direct sales have made it possible for more advanced methods to be used. Digital marketing, e-commerce platforms, and data analytics are used in these modern strategies to better reach and connect customers. This evolution reflects a broader trend in retail and distribution, underscoring the importance of adaptability and innovation in staying competitive and meeting the dynamic needs of today's consumers. (Gotter, 2023).

Greeting customers with a simple "Hi is this your first time shopping here?" can boost sales by 16%. This approach not only creates a welcoming environment but also opens up the opportunity for personalized engagement. For new customers, it's a chance to understand their needs through further questions. For returning shoppers, utilizing purchase history from the retail point of sale system can guide recommendations, enhancing the shopping experience by suggesting products that align with their preferences and past purchases. (Gotter, 2023).

Timing is crucial in cross-selling, ideally occurring after a rapport is established and a primary purchase decision is made. For instance, suggesting accessories to complement a dress for a casual event is effective cross-selling. However, immediate cross-selling upon product

selection or to customers with strict budgets or limited shopping time is advised against, as it could detract from the customer experience. Understanding customer needs and timing can significantly enhance cross-selling success, making it a strategic tool in sales. In upselling, the key is to offer value rather than just aiming for a higher sale. For example, when a customer considers a $300 set of wheels but is shown a superior set, originally $700, now on sale for $450, it presents an opportunity rather than just a sale. Highlighting the quality and savings makes the offer more appealing, framing it as an incredible opportunity for the customer. This approach emphasizes value and savings, making upselling more effective and customer-friendly. (Gotter, 2023).

Demonstrating products through direct experience is a powerful sales strategy. Similar to how, automotive stores can implement interactive displays for car components. For example, a car parts retailer could set up demo stations where customers can interact with electronic components, like infotainment systems, or witness the effectiveness of car care products firsthand. This hands-on approach not only educates the customer about the product's features and benefits but also enhances engagement and increases the likelihood of a sale by allowing customers to experience the quality and performance of car components directly. (Gotter, 2023).

Offering too many choices can lead to "choice overload," deterring customers from making a purchase. A Columbia University study found that shoppers were less likely to buy when presented with 24 jam options compared to just six, with sales five times higher in the latter scenario. Reducing options simplifies decision-making, increasing the likelihood of purchase and customer satisfaction. This principle suggests that a more curated selection can enhance the shopping experience and lead to better sales outcomes. (Gotter, 2023).

2.4 Utilizing data-driven insights to optimize sales strategies

Data-driven marketing uses customer data to create personalized campaigns, predicting needs and behaviors. This approach enhances engagement and conversion rates by focusing on specific customer groups. By creating detailed buyer personas, businesses can accurately identify their target audience and deliver highly personalized ads. Companies can get much better marketing results through targeted engagement by making ads that fit the needs and wants of each group, whether those needs and wants are related to price or a preference for high-end goods. (Mailchimp, n.d.)

To make a data-driven marketing strategy in five steps, you need to gather information about your audience from different sources, figure out which marketing channels work best for

them, and make ads that are specific to groups of customers based on detailed buyer personas. It also includes making a content strategy for multiple platforms to keep customers interested with both educational and promotional content. Tools like content calendars and email marketing software can be used to handle this. Finally, refining your brand based on insights gained from customer data ensures your offerings resonate with your target audience, enhancing brand loyalty and recognition. (Mailchimp, n.d.)

2.5 Importance of data driven and decision making in inventory management

Data-driven inventory management allows businesses to forecast demand and streamline stock levels, reducing risks of overstocking or understocking. This approach ensures real-time market demand alignment, customer satisfaction, and operational efficiency. (Cloud Solutions, 2023).

Advanced inventory management tools like Unleashed provide real-time visibility, enabling demand forecasting, inventory optimization, and cost reduction strategies. These systems enhance customer satisfaction, contribute to a sustainable business model, and enable businesses to navigate complexities with confidence, gaining a competitive edge. (Cloud Solutions, 2023).

2.6 Review of relevant theories and models in optimization

creating predictive models storing stuff better. It studies making pretend models, guessing how much people will want things using numbers, and putting together finding better ways. By looking at how much things will cost and how much can get, the study tries to make things work better and do better than others when managing stuff. (Bugrimov & Sarbaev, 2020, pp. 2-7).

Optimization algorithms are the integration of the search algorithm into inventory management model and it’s a direct application of optimization theory, which attempts to find the best solution from a range of possible solutions. In inventory management, optimization algorithms are used to define the amount of order quantity and reorder points based on several factors such as demand rate, ordering costs, holding costs, and stock out costs. This approach is consistent with the Economic Order Quantity (EOQ) model, and its variants, which are foundational theories in inventory management optimization. (Bugrimov & Sarbaev, 2020, pp. 2-7).

Cost-benefit systems. Continuous review systems involve it analysis The intention of a study is to investigate the effect of model parameters on parameter functions that reflect the principles of cost-benefit analysis. It examines trade-offs between different inventory strategies, considering inventory costs, ordering costs, penalty sales, demand satisfaction, time reduced utilization, etc. The goal is to find a balance that minimizes total costs while maximizing service levels and operational efficiency. (Bugrimov & Sarbaev, 2020, pp. 2-7).

Continuous review and periodic review systems is a methodology suggests elements of both continuous review monitoring stock levels in the real-time and periodic review planning horizon of 365 days inventory systems. Continuous review systems Include placing orders whenever inventory levels drop to a predetermined point, while periodic review systems involve reviewing inventory at fixed intervals and placing orders as needed. The study's approach of planning for supply orders based on the monitoring of stock levels and the establishment of minimum and maximum stock thresholds incorporates principles from both systems. (Bugrimov & Sarbaev, 2020, pp. 2-7).

2.7 Exploring data analytics software

Different Data software refers to software applications and tools that are used for sorting, cleaning, analyzing, and visualizing data. There are many data analysis software applications and tools available, including SAS, Jupyter Notebook, Knime, Qualtrics, Tableau, MySQL, Microsoft Excel, Python, R, Erwin DM, Microsoft Power BI, Qlik Sense, Looker, Klipfolio, Zoho Analytics, Domo, Sisense, Google Analytics, SAP Analytics Cloud, and Oracle. The best data analysis software for businesses will depend on their specific needs. To learn data analytics, one can take some special courses offered by universities or online platforms such as Coursera or Pluralsight. (Hiller, 2023).

2.7.1 Microsoft Excel

Excel is one of the best spreadsheet software that stands as a pivotal tool across various professional domains offering an unparalleled combination of calculation, graphing, and data analysis functionalities. It is Famous for its comprehensive suite of features like pivot tables and form creation tools Excel also simplifies data wrangling and reporting tasks and further enhances data manipulation through functions such as concatenate for merging text and numbers, and sumif for conditional summing, alongside a robust search feature for pinpointing precise data. Despite its prowess, Excel does face challenges with large datasets and number approximations, potentially leading to inaccuracies. However, its wide usage, coupled with an extensive array of functions and plug-ins, ensures that Excel remains a

critical and potent tool for data analysis, offering solutions to overcome its few limitations. (Hilller, 2023).

2.7.2 Python

Python is a programming language with a big range of users, It stands as an essential tool for any data analyst, distinguishing itself through its emphasis on readability and simplicity, unlike more complex programming languages. This accessibility, coupled with its widespread acceptance in the technology sector, ensures that many programmers come to the table with a familiarity with Python. Its versatility is further showcased by an extensive library ecosystem tailored to diverse data analytics needs. Libraries such as NumPy and pandas enhance computational efficiency and facilitate data manipulation, while Beautiful Soup and Scrapy are go-to options for web scraping. For data visualization and reporting, Matplotlib offers robust capabilities. Despite Python's notable memory usage and slower execution compared to some alternatives, these limitations are generally overshadowed by its advantages. Particularly for projects developed from the ground up, Python’s comprehensive benefits make it a standout choice in the arsenal of data analytics tools. (Hiller, 2023).

2.7.3 Power BI

Microsoft Power BI is a new tool entered to the field of data analysis tools, it has fast developed from Excel plug-in to a collective business analytics suite since its redevelopment in early 2010. it designed to meet a wide range of analytics needs, it's specialized to enable users to easily create craft visual reports and dashboards. Its standout feature is exceptional data connectivity, allowing for seamless integration not just with Microsoft Excel but also with a variety of data sources including text files, SQL servers, and cloud-based analytics from platforms like Google and Facebook. Despite its strengths in data visualization and accessibility, Power BI faces criticism for its somewhat cumbersome user interface, inflexible formulas, complexity of Data Analytics Expressions (DAX), and its proprietary language. However, it attempts to address a broad user base by offering multiple subscription tiers, including a free version which, despite its limitations such as a 2GB data cap, provides a valuable opportunity for users to familiarize themselves with the tool's capabilities. (Hilller, 2023).

2.7.4 Tableau

Tableau stands out as a leading business data analysis tool, It has the ability to create interactive visualizations and dashboards with less coding requirements, which makes it

easier to use. This tool differentiates itself by skillfully handling large data sets more efficiently than many other Business Intelligence (BI) tools while maintaining simplicity to use through its intuitive visual drag and drop interface. Although its amazing visualization capabilities, speed, interactivity, and mobile support, Tableau is not without limitations. It lacks a scripting layer to pre-process data and create complex calculations, which means users often need to pre-process data or perform scripting tasks in languages like Python or R before importing into Tableau. In addition, it even provides some data processing functions, but they are not as powerful as some users might need to use. However, Tableau outperforms in visualization, and easy to use interface still makes it a popular choice for data analysts, even considering the notable drawbacks, and its portable readiness adds a layer of convenience for professionals on the move. (Hilller, 2023).

2.7.5 Choosing the right data analysis software

Select the right data analysis software needed to go through an evaluation of several factors critical to meeting the unique needs. (Hilller, 2023).

Understanding primarily data integration requirements by determining the types of data to analyze and the sources from which this data is collected. Furthermore, data security and management are important necessarily for software that incorporates strong access control and permission mechanisms in order to protect sensitive information from outside threats. Consider the user base within the organization and determine whether the software needs to meet the needs of sophisticated data analysts, non-technical users or a combination of both, not to forget, the need to evaluate the software data modeling capabilities including whether it supports direct data modeling or it requires utilities such as SQL or DBT. Visualization capabilities are also of big importance so the software must offer visualization tools that align with the business needs. Other aspects like Financial aspects including price and licensing should be carefully evaluated because software options vary over s wide range from free to subscription based models. However, having technical support and an active user community can help with troubleshooting and skill development. Finally, scalability is of essence to the software chosen since it must not only meet current data analysis requirements but also accommodate future expansions in terms of data volume and complexity, all that with, ensuring that it remains a valuable asset as the organization is growing. (Hilller, 2023).

2.7.6 The steps of effective data analysis

Let's take a closer look and explore the nuances of conducting analysis by systematically working through these 17 points of critical techniques that are necessary for comprehensive understanding and effective implementation.

- Collaborate on needs: Engage with all key stakeholders to clearly define your strategic goal or objectives. This foundational step ensures that your analysis aligns with organizational goals and identifies the insights needed to drive progress. (Bernardita, 2023).

- Identify questions: Develop specific questions that need to be answered to reach your goals. This crucial step frames your analysis focusing on your efforts to collect useful data that directly contributes to your success. (Bernardita, 2023).

- Data democratization: Aim for widespread access to data within your organization. This approach fosters collaboration and decision-making between departments, making sure that ideas are shared and used across different teams for overall growth. (Bernardita, 2023).

- Consider governance: prioritize data security and governance to protect sensitive information and comply with regulations. A robust governance strategy ensures data integrity, privacy, and trustworthiness, which are essential for reliable analysis. (Bernardita, 2023).

- Clean your data: dedicate efforts to purifying your data set from inaccuracies and redundancies. Cleaning data is fundamental for ensuring the reliability of your analysis, as it removes errors that could lead to incorrect conclusions. (Bernardita, 2023).

- Set KPIs: define clear, measurable indicators that match with the business objectives. KPIs serve as benchmarks for performance, guiding your analysis and helping quantify your progress towards achieving strategic goals. (Bernardita, 2023).

- Omit useless data: Filter out data that does not align with your analysis goals. This selective approach streamlines your analysis, focusing on the most relevant and impactful information and avoiding data overload. (Bernardita, 2023).

- Data management roadmap: craft a detailed plan for managing your data lifecycle. A well-structured roadmap facilitates efficient data handling, storage, and analysis, ensuring that your efforts are scalable and adaptable over time. (Bernardita, 2023).

- Integrate technology: adopt advanced analytical software and technologies. Integrating the right tools enhances your capability to gather, analyze, and visualize data, making insights more accessible and actionable. (Bernardita, 2023).

- Answer your questions: use your analysis to provide answers to the predefined questions. This step closes the loop, turning data into actionable insights that inform decision-making and strategic direction. (Bernardita, 2023).

- Visualize data: employ data visualization tools to represent your findings clearly. Effective visualization communicates complex data in an understandable way, enabling stakeholders to grasp insights quickly and make informed decisions. (Bernardita, 2023).

- Careful interpretation: approach data interpretation with diligence to avoid errors. Recognizing the nuances between correlation and causation, avoiding biases, and ensuring statistical significance is crucial for drawing accurate conclusions. (Bernardita, 2023).

- Build a narrative: craft compelling stories around your data. Data storytelling makes your findings more relatable and impactful, encouraging a data-driven culture and facilitating strategic conversations across the organization. (Bernardita, 2023).

- Autonomous technology: leverage the power of AI and ML for deeper insights. These technologies can uncover patterns and predictions not immediately apparent, offering a competitive edge in data analysis. (Bernardita, 2023).

- Share the load: promote a collaborative, data-informed environment. Encouraging everyone to engage with data democratizes insights and fosters a culture where informed decisions are the norm. (Bernardita, 2023).

- Data analysis tools: select the best tools for each analysis need. From BI platforms for dashboarding to statistical tools for deep dives, the right technology stack is crucial for effective data analysis and visualization. (Bernardita, 2023).

- Refine your process: continuously evaluate and improve your analysis process. Regular refinement based on outcomes and feedback ensures your data analysis methods remain effective and aligned with evolving business needs. (Bernardita, 2023).

2.8 The integration of IoT technologies in inventory management

The internet of things (IoT) is a network of interrelated devices connecting and exchanging data with other IoT devices and clouds typically embedded with technologies such as sensors and software including mechanical and digital machines and consumer objects. With IoT, data is transferable over a large network without human-to-human or human-to-computer interactions. (Gillis, 2023).

Figure 3 depicts an RFID, which is a system that comprises three components: tags, readers, and computers. RFID systems enable wireless data transmission between these components, facilitating efficient tracking, identification, and management of items. (Vaniotis, 2018).

Figure 3. RFID systems feature. (Vaniotis, 2018).

Today very competitive businesses constantly look for ways to boost productivity and reduce costs. IoT in inventory management is one area with much space for development. Inventory management may be automated and streamlined with the use of the IoT by enterprises. It

enables companies to get real-time information and insights that they can utilize to increase profitability and improve their inventory levels. (Vaniotis, 2018).

RFID systems utilize tags, antennas, and readers for efficient object tracking. Tags, attached to items, hold unique IDs and rely on reader-emitted energy to transmit data. Antennas bridge communication between tags and readers, which collect and send information, including location and time, to the cloud. This setup allows for seamless inventory and asset management by converting physical item details into accessible digital data. (Vaniotis, 2018).

The main function of IoT in inventory management is to provide users with an output that corresponds to the significant insights about inventory items' location, statuses, motions, etc. that are derived from the data that RFID readers retrieve. For instance, machine learning, a feature of an IoT-based inventory management solution architecture, may predict the number of raw materials required for the next production cycle based on data about the inventory quantity and location. An IoT system's output can take many different forms. For example, it might warn the user when a specific inventory item is missing, or when supplies need to be refilled. (Vaniotis, 2018).

3 Driving efficiency: methodological approaches to data-driven optimization of inventory and sales for Sahillienne's automotive components

This chapter delves into the strategic methodologies used by Sahillienne's automotive components to optimize inventory and sales through data-driven approaches. It explores techniques such as Just-in-Time inventory management, Economic Order Quantity analysis, ABC categorization, and demand forecasting. These methods are crucial for driving efficiency, reducing costs, meeting customer demand, and improving overall performance in the automotive components industry.

3.1 Research design

The goal of this study is to make any store of retail store work better. This means making sure there is a good balance between how much stock the company has and how much they are selling.

To use a set of optimal models for inventory management, just in time and forecasting will be used as mean solutions to apply, but before applying any of those it is necessary to adopt

ABC analysis, to divide inventory into three different categories (ABC) based on its importance. By applying this method using Excel to create a table where the products will be modified to classify them into different categories. At the same time, the use of the Economic Order Quantity (EOQ), Safety stock, and reorder point (ROP) to determine the right amount that matches the minimization of the inventory costs to reduce the risks of inventory of wrong forecasting, which allows it to maintain sufficient inventory items and uninterrupted inventory.

Furthermore, to measure the success of the optimization efforts defining and tracking key Performance Indicators (KPIs) is needed to be done. These KPIs will be used for monitoring customer satisfaction levels and sales growth. By incorporating key performance indicators into the project, it can ensure alignment with project objectives.

Implementation of those methods needs some calculations to get precise results, which will be shown in the following :

- Average Stock = (Initial Stock + final stock) ÷ 2. (Decarra, 2023).
- Minimum Inventory Level = average daily demand x average time to sell. (Kenyon, 2023).
- Safety stock = (maximum daily sales x maximum lead time) – (average daily sales x average lead time). (Thomas, 2023).
- Optimal stock = Optimal Order Quantity + minimum Stock + Safety Stock. (Decarra, 2023).
- ROP= (the average daily sales x lead time) + safety stock. (Tilley, 2023).
- EOQ = SQRT ((2 * demand rate * order or setup costs) / Holding or carrying costs). (Fernando, 2024).

Figure 4 presents the observation of the company storage area where they store their stock inventory, ensuring organized and efficient management of goods for streamlined operations and inventory control.

Figure 4. The storage of Sahillienne store.

The store has a storage capacity of 400 square meters where it can hold up to 30000 pieces. This study aims to help the store acquire new techniques to precisely determine the optimal number of items intended to be purchased and sold. This goal is to ensure full utilization of available storage space without overstocking, thus minimizing inventory costs, maximizing potential sales, reducing the risk of understocking, and making sure the customers are satisfied by ensuring the right products at the right time. In addition, calculating the right storage amount is critical to achieving these goals.

3.2 Data collection methods

To optimize inventory levels and sales performance at the store, a data collection strategy will be implemented. First, sales history and inventory levels will be extracted directly from the enterprise resource planning (ERP) system. This system offers real-time insights into stock movements, sales transactions, and customer orders.

Figure 5 presents data extracted from the company documents in PDF form, that contain their purchases from other companies. This data will simplify the operations between the store and companies to know how the inventory works.

Figure 5. Data from documents.

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19/01/2022	61	00000347	SCAPIR F°2201514				**3.660,66**		**6.091,94**
19/01/2022	61	00000350	SCAPIR F°2201495				**1.077,83**		**7.169,77**
19/01/2022	61	00000353	CODISPAM F°220200714				**2.782,09**		**9.951,86**
20/01/2022	61	00000358	GPA F°90486				**2.601,96**		**12.553,82**
31/01/2022	61	00000415	AUTODISTRIBUTION F°2201-01761				**5.198,92**		**17.752,74**
03/02/2022	61	00000424	AUTOPLUS F°221008299				**1.511,20**		**19.263,94**
16/02/2022	61	00000421	SCAPIR F°2203477				**3.024,58**		**22.288,52**
16/02/2022	61	00001131	ELIGH NEGOCE F°00958				**8.676,26**		**30.964,78**
17/02/2022	61	00000427	AUTOPLUS F°221011762				**1.418,23**		**32.383,01**

To collect the necessary data, I contacted the company and asked them to send me the store data. They sent me customer purchases and inventory data via email, it was not recorded as Excel files but as PDF documents. For small businesses and company purchases, I had to contact the company's accountant as this data is only recorded in his office, this data was also received via email. The accountant couldn't send the data for 2023 because it had not yet been registered by him, so I had to work with the data for 2022.

It's important to collect all old data on sales and purchases which are often registered as papers, including useful PDF documents for distribution and presentation, and this type of format is not good for data analysis purposes. To facilitate the analysis these documents need to be converted from PDF documents into Excel because it offers more accessibility to use the data needed by making it easy to put in other advanced data analysis software and tools. By converting the sales and purchase data from PDF to Excel it becomes easier to read and filter the type of data that needs to appear in order to apply analytical techniques that facilitate the understanding and optimization of inventory levels and improve sales strategies.

To enhance the understanding of inventory, it's necessary to interview the manager responsible for inventory management. This direct meeting allows full collection of data in-depth on the views and the goals of the store operation. This interview was done online using Zoom where I asked the manager various questions, for example when the store restocks stock, what type of customer the store is, the number of suppliers the store collaborates with, how the storage system is organized and operated, and how the methodologies are applied. This conversation has provided valuable information that helps to understand the data shown in their inventory system.

To better understand what customers need, the feedback was collected directly from them. This was done through direct conversations, and store workers helped to collect this feedback. After that, they sent it to me via email for my research. Email surveys and feedback forms are available in-store and I used to encourage the customers to share their experiences and suggestions, thus aiming to collect valuable insights that can be useful for management strategies, product offerings, and overall customer service improvements.

3.3 Used tools for analyzing data

To analyze the data Excel, Power BI, and Python will be the best tools to use for this business because of their specific needs and those tools are more famous in the world of data analytics where finding information and tutorials are available online. Power BI and Python are going to be used for in depth analysis by visualizing directions, stock, sales, and patterns within the data. Power BI is the main platform for creating graphs and reports, thus offering a good insight into sales performance and inventory levels. Python and its libraries like Pandas and NumPy on the other hand, will be processing advanced data analysis including the use of forecasting analytics to predict future demand. Additionally, Just-In-Time (JIT) inventory management will be also used with an aim to lower inventory expenses by ordering the right parts only when they are required, thus reducing overstock.

4 Unlocking insights: presenting results from data-driven optimization of Sahillienne's automotive component procurement

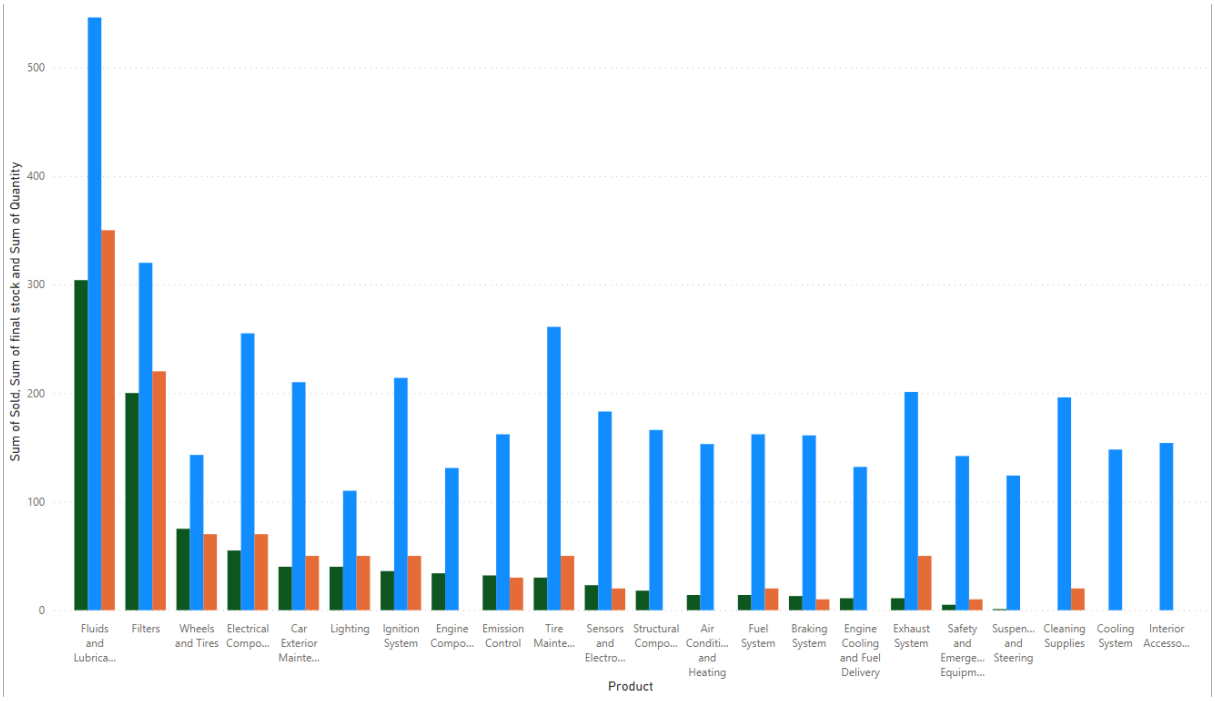
This chapter gets deep into the details of the data of the company Sahillienne, showing the results from the data given by the company containing sales and stock shown as graphs using Power BI, which leads to the understanding of how the inventory and purchases of the company work as well as understanding customer segments.

In the figures shown in this chapter, the ABC method will be applied to them which helps to know items are high valued and moderate valued products that bring in a lot of revenue and low valued items that impact revenue knowing which product Forecasting and JIT can be used in.

4.1 Results from the data

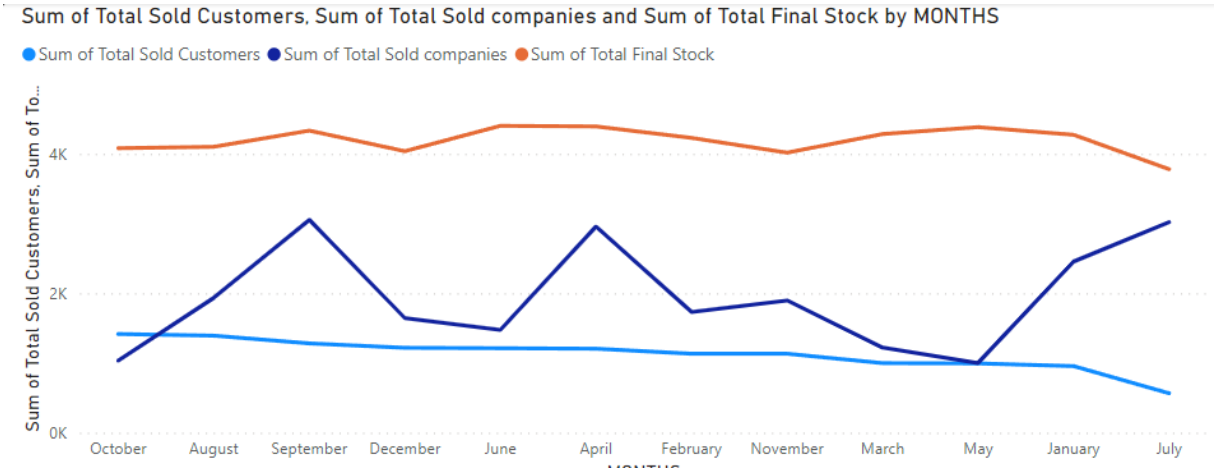
This part shows some of the results from the data provides key findings and the main ideas derived from the analysis which offers an overview of the results and implications of the research. Figures 6 and 7 will present data from the Sahillienne Automotive Component. Given a closer look, figure 6 displays sales and stock data for different car components that have been collected for all months of 2022.

Figure 6. Data from Sahillienne automotive component.



In figure 7, it will show the difference between the amounts that have been sold to customers and companies, while also displaying the final stock.

Figure 7. Sales and stock for all months of 2022.



The analysis includes data from recent months showcasing a full understanding of the company's operations and supplier relationships. This leads to the identification of several solutions and strategies that aim to optimize the store's inventory management with an aim to reduce the damage caused by overstocking and understocking also by increasing sales while minimizing inventory costs. These strategies are likely to succeed as well as to streamline operations and enhance the system on which the inventory operates In terms of cost it aligns with supply and demand in the store.

From the data shown, it can be seen the inventory of the store working on keeping the stock in the same amount every month. The store's method involves restocking the products that have high sales in stable inventory levels like batteries, Filters, and wheels. Comparing this method to the others might lead to overstocking, and this may lead also to inefficient storage costs and the risk of inventory becoming obsolete. Due to the differences between the store clients.

with the manager helped to understand the store more, as he researched all the questions. The results were that the store has two types of customers, the first type is individual customers. The second type is small companies where their purchases are different from the first type. They don't have a fixed time or quantity of product to purchase, the store uses stock forecasting there, and it restocks once in the middle of every month. Still, if a second restocking is needed it will be done at the end of the month. For merchants, they have different suppliers around and out of the city their delivery time is around 1 to 4 days the other type of suppliers are outside of the country where they are located in France and Germany which makes their delivery time longer, up to 15 days.

The challenge the store is facing is mainly coming from small businesses because their purchases are randomly the store doesn't know when and how much they're buying which has been proved in the data each month that those small businesses purchase different amounts of products from the store due to the use JIT with Sahillienne where it's quite impossible to use forecasting with these small businesses.

The sales data analysis shows a strong performance which confirms the store's commitment to customer satisfaction. This dedication is particularly evidence of their responsiveness to specific customer needs, often trying to special-order items not regularly stocked or sold out. This practice not only meets individual customer needs but also impacts inventory management strategies. In case of the same demand for the item, the store proactively puts it into its regular inventory, thereby expanding its product offerings in response to consumer demand. Thus, placing great on keeping up with industry trends and introducing new products to their inventory annually. This strategy ensures the store stays competitive in the retail industry, continually attracting customers with the latest products.

In figure 8, the results of ABC methods will be displayed as the product will be classified into a different category.

Figure 8. Results of ABC methods.

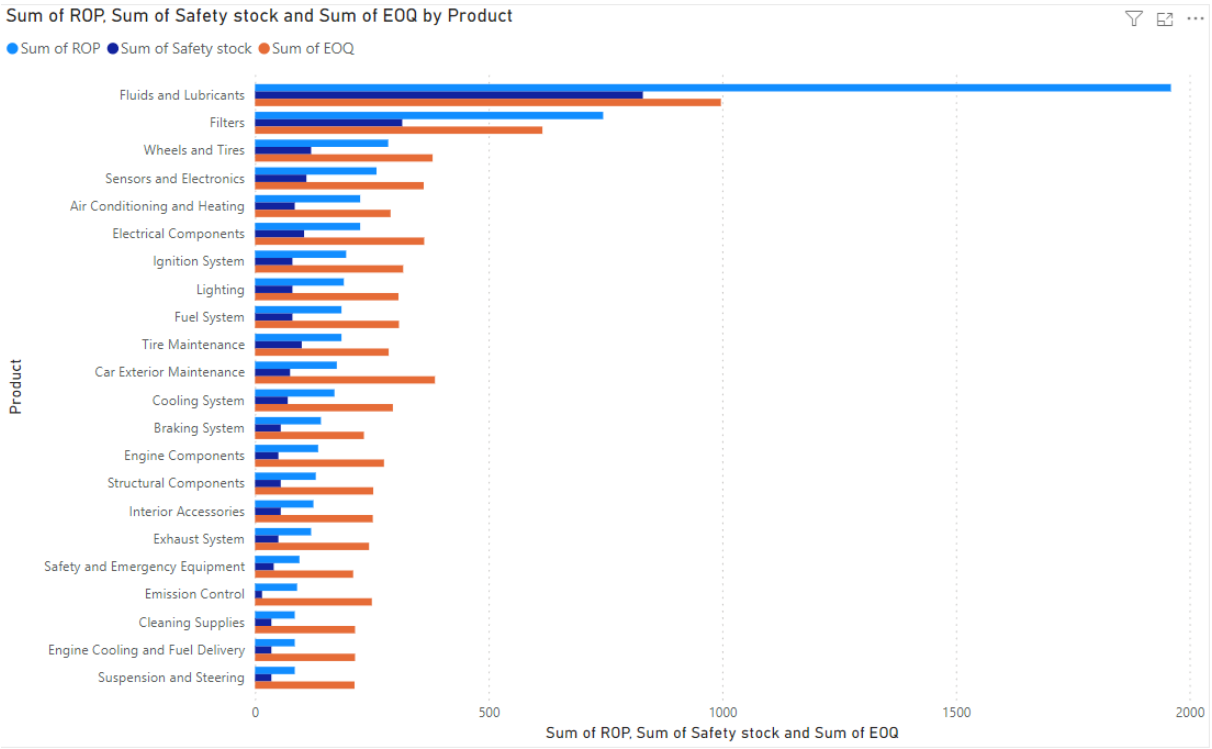
Product	Type of class	Rank	Sum of 12 months	Percentag	percentage value
Fluids and Lubricants	Class A	1	857134,7	19.61%	19.61%
Air Conditioning and Heating	Class A	2	833757,5	19.09%	38.70%
Ignition System	Class A	3	386031,3	8.83%	47.53%
Wheels and Tires	Class A	4	383485,2	8.77%	56.30%
Filters	Class A	5	327859,3	7.50%	63.80%
Exhaust System	Class A	6	296418,4	6.78%	70.58%
Cooling System	Class A	7	229472,8	5.25%	75.83%
Suspension and Steering	Class A	8	178655,1	4.09%	79.92%
Structural Components	Class B	9	152650,6	3.49%	83.41%
Sensors and Electronics	Class B	10	128723	2.947%	86.357%
Lighting	Class B	11	116977,9	2.68%	89.037%
Fuel System	Class B	12	98171,62	2.25%	91.287%
Engine Cooling and Fuel Delive	Class B	13	63975,45	1.46%	92.747%
Braking System	Class B	14	56046,03	1.28%	94.027%
Engine Components	Class B	15	54010,55	1.24%	95.267%
Tire Maintenance	Class C	16	50478,37	1.155%	96.422%
Emission Control	Class C	17	46649,29	1.07%	97.492%
Car Exterior Maintenance	Class C	18	33695,87	0.77%	98.262%
Electrical Components	Class C	19	26317,54	0.602%	98.864%
Interior Accessories	Class C	20	20645,25	0.47%	99.334%
Cleaning Supplies	Class C	21	17435,99	0.399%	99.733%
Safety and Emergency Equipme	Class C	22	9296,9	0.21%	100 %

This figure shows the result of ABC methods where the product has been classified into different categories, the first category is Category (A) all the products in this category present

high value stocks constitute 70% of the total inventory, the second category is class (B) which is highlighted in yellow color represents 20% of the total inventory, and the last category is class (C), marked in red, which represents 10% of the total inventory. From this analysis, the store can now focus and put more effort into managing Class A products, which have a significant impact on the store with fewer resources allocated to Class C products.

To avoid understocking, three things need to be calculated reorder point (ROP), safety stock, and EOQ. Figure 9 will show and explain more by using the calculated data from the store of Sahillienne company.

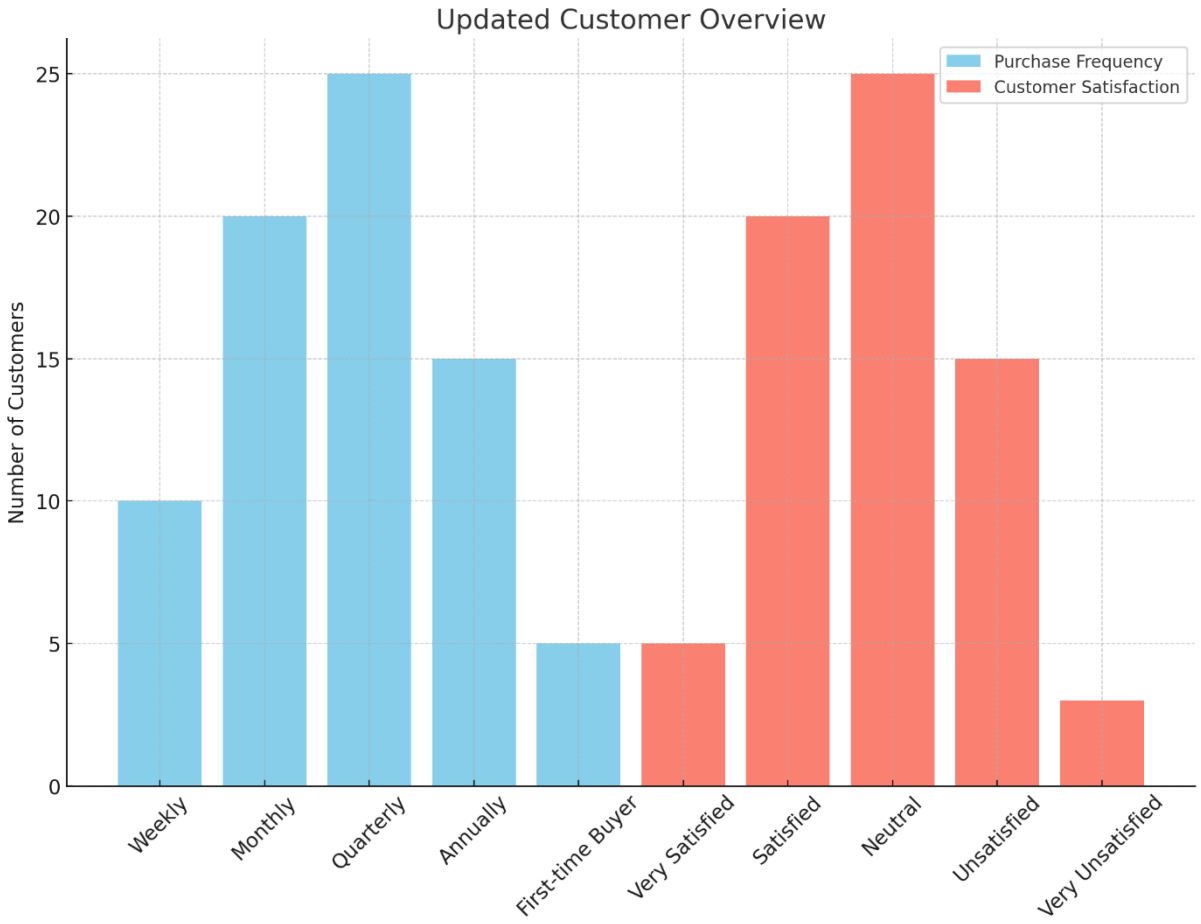
Figure 9. Graph of ROP, safety stock, and EOQ from the results.



This figure presents the results of ROP, safety stock, and EOQ, which are necessary to be known and calculated to improve inventory results. It has set all the types of products in the store inventory, the light blue graph presents the ROP which is an alert point for restocking inventory for example if the stock of Fluids and Lubricants goes below 1900 products the store needs to restock it. The dark blue graph as shown in the figure above presents the safety stock, which means the extra amount of stock the store needs to add to the expected amount that will be purchased to avoid understocking, for the orange colored graph represents EOQ, for instance taking the exact first product set in the figure, the store needs to order around 1000 units of that product to minimize the total costs associated with the order.

Figure 10 presents two graphs depicting customer feedback regarding the satisfaction levels of the company services. These graphs offer insights into how customers perceive and evaluate the quality of the services provided by Sahillienne.

Figure 10. Graph of customer feedback.



This graph shows the results of the data collected from both in-store and Google Sheets data of the customers. Analyzing this data shows that all very satisfied people are those who purchase weekly, and unsatisfied and very unsatisfied are the people who purchase between annually and quarterly. However, only two forms where I have received written feedback from unsatisfied customers, the reasons were timely service and difficulty in obtaining a refund for a particular product.

4.2 Solutions and recommendations

Based on the analysis, it's clear that the goal is to optimize inventory management by understanding the dynamics between local (national) and global suppliers, and the store's customer buying patterns. Here's a strategic solution that leverages forecasting and Just-In-Time (JIT) inventory management.

Forecasting for individual consumers: Given that individual consumers have a relatively stable purchasing pattern of 1 to 10 pieces, the business can use forecasting techniques to predict demand from this segment more accurately. Forecasting methods such as time series analysis, moving averages, or exponential smoothing can be applied based on historical sales data. This approach will enable the business to maintain an optimal inventory level for this customer group, minimizing the risk of overstocking or understocking.

How to use Just-In-Time (JIT) for small businesses: A Just-In-Time inventory management system would work better for small businesses whose order amounts change often and are hard to predict. Under JIT, companies only restock their inventory when they actually need it for production or sales, based on real orders from those companies instead of expecting them to do so. To use this method, you need to have good relationships with national and global suppliers to get supplies quickly. For national suppliers, it takes 1 to 4 days, and for global suppliers, it takes 5 to 15 days. Using just-in-time (JIT) cuts down on the costs of keeping goods and lowers the chance of having too much or not enough stock because demand is hard to predict.

To back up these plans, the company should also. Make better relationships with suppliers, and build stronger ties with both domestic and international providers to cut down on delivery times and make sure they can count on them. This could mean negotiating better terms, making it easier to talk to each other, and maybe finding more than one seller so that they are not so reliant on one.

Use technology to manage the inventory in real-time. Set up advanced inventory management tools that let you see stock levels, order statuses, and supplier lead times in real-time. These types of tools can help people make decisions faster and run both forecasting and just-in-time processes more efficiently.

The use of advanced inventory tracking in real-time using IoT will make the inventory easy to manage where there will be no need to require human-to-computer. The data will be always available on the computer, which will save time and know the available products. This technology would require the store to purchase some sensors, and that would be an investment. I recommend using RFID technology because it can be very useful. This RFID device will fit the store budget and will not cost much and is available in Morocco where it will be easy to obtain.

It would be very easy to keep an eye on stock amounts using this method so that there would be no out of stock and the store can see in real-time how many products are available in

stock and how far along an order is and when suppliers are planning to ship them while adding more advanced inventory management systems will surely help clients make better choices faster and with more information when they use these tools. Thus, making just-in-time (JIT) inventory management and forecasting much more useful.

For the sales part, I recommend opening and closing the store based on peak hours using sales data and customer traffic or using IoT technologies by installing sensors at the store's entrance. This will make it easier to know most peak hours, so I suggest closing the store at 8 pm instead of 6 pm to collect the data for those hours. Therefore, this can be done for a month to see then if the closing hours fit the store.

Launching promotions will also increase sales. I noticed that the store lacks promotions. To attract more customers the store can decrease the price of products that are about to expire or products that are not selling well and offer loyalty discounts to customers who spent 1000 dirhams which is about 90 EUR on their purchases or the store can offer them a free or discounted product.

The store can add to their techniques the ability of returning or exchanging product, so the customers will be able to buy what he wants with no overthinking if it is the right product for his car, the returning can be during 3 days, with the necessary of the receipt

The company can enhance the store's brand identity by creating a social media account or website where the availability of online shopping or searching for the product is easier for the customer. Additionally, putting up ads for the store is a smart way of getting more people to buy things, which leads to the conclusion, that when a business does its marketing right it makes it more visible and attracts a bigger range of customers. Thus, with more foot traffic and maybe even more sales especially when using different types of advertising, like social media, local newspapers, online platforms, and in-store promotions, the store can get the word out regarding its value offering, show off its selection of products and therefore draw attention to any deals or discounts. This will essentially increase sales and help the store grow overall.

5 Conclusion

This thesis is essentially about the Sahillienne company with a single goal of showing how data-driven optimization affects. A lot of research, data analysis, and different data-driven methods were implemented in this study in order to solve relevant problems that Sahillienne

was encountering. Additionally, it came up with ideas that will not only improve how things work but also make customers happy and increase sales.

As the first step in this study, taking a close look at the issues that are affecting supplies and sales, it was obvious that the business wasn't really able to run smoothly or make money because of issues like having too much or too little stock.

This study successfully integrated the data-driven strategies, including Just-In-Time (JIT) inventory management, forecasting techniques, and the results of ROP, safety stock, EOQ, and ABC method which lead to optimizing the inventory level from the risk of overstocking and understocking. These results can help the store know the best timing and amount of products to restock. By using data analytics, the store can improve its sales strategies to match better what the market needs and customers need by integrating some new technologies into the store.

These key findings of the study show how important it is for Sahillienne to make choices based on facts and figures. This method not only lets the business react quickly to changes in the market, but it also lets them take charge of their product management. That way, popular things would always be on hand, and sales would not be missed as often. The research also found that using personalized marketing strategies based on analyzing customer data can make customers much more loyal and interested, which in turn boosts sales.

Sahillienne may get a lot of good things from following the suggestions made in this study. Lower inventory costs, higher profits from always having goods in stock, and a huge rise in customer happiness are some of the benefits. A big step toward operational excellence and getting ahead in the crowded market for online car parts is switching to a system that is driven by data.

In the end, this thesis not only adds to the academic discussion about retail management and supply chain, but it also gives Sahillienne 24 jam lienne a plan for how to get around in today's complicated retail world. As the automotive component business changes, retailers will need to use data-driven strategies to ensure their long-term growth and success in a world that is moving more.

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