Design and Implementation of Fleet Management Control and Performance Measurement System

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Abstract

Organizations are recognizing the importance of the supply chain in order to develop competitive advantages and establish sustainability. This is felt across multiple fields, and the health sector is no exception. In clinical diagnostics businesses, success is often translated in a global presence and the results of an effective supply chain can be observed by the agility, cost-efficiency and quality-control within the flow of materials, from suppliers to clients.

The company studied has a Mergers and Acquisitions strategy and has been in constant growth, gradually integrating the operations of new laboratories or care units. Since the Logistics Department is responsible for providing transportation services of samples from collection centers to the central laboratory for analysis, it is the one directly affected by the complexity of the market at stake and the one that directly reflects the results of success when it comes to added complexity points such as temperature control and traceability of transportation. A robust management framework and performance measurement system emerges as a crucial step in providing reasoned decision-making and enhancing the logistics management system as a whole.

In order to improve fleet management, the project developed resorted to the design of a new fleet management control system, through the application of theory based on fleet asset management principles and geographical expansion criteria. Furthermore, since the initial performance of the department was measured solely in cost related measures, the need for more appropriate metrics to monitor and control performance was explored. The control framework developed and performance measurement system feed data into a dashboard designed to give an overview of the fleet management's operations and enable the identification of improvement opportunities.

Resumo

As organizações estão cada vez mais a reconhecer a importância das cadeias de abastecimento como uma ferramenta para desenvolver vantagens competitivas e garantir a sustentabilidade dos processos. Este ponto é essencial em vários setores, sendo que o da saúde não é exceção. Nas empresas de diagnóstico clínico, o sucesso é refletido numa presença global e os resultados de uma cadeia de abastecimento eficaz podem ser visualizados pela agilidade, eficiência de custos e controlo de qualidade do fluxo de materiais, dos fornecedores aos clientes.

A empresa em estudo possui uma estratégia de fusões e aquisições e, por isso, está em constante crescimento, integrando gradualmente as operações de novos laboratórios ou unidades de atendimento. Como o departamento de logística é responsável por fornecer serviços de transporte de amostras dos centros de colheita para o laboratório central, é aquele diretamente afetado pela complexidade do mercado em questão e o que reflete diretamente os resultados do sucesso quando se trata de pontos de complexidade adicionados, como controlo de temperatura e rastreabilidade do transporte. Surge então a necessidade de ter uma ferramenta robusta de gestão e um sistema de medição de desempenho, de modo a fornecer informação para processos de tomada de decisão e a aperfeiçoar o sistema de gestão logística como um todo.

Para melhorar a gestão de frota, o projeto desenvolvido recorreu ao desenho e implementação de um novo sistema de controlo de gestão de frota, através da aplicação de princípios de gestão de ativos da frota e em critérios de expansão geográfica. Para além disto, uma vez que o desempenho do departamento, e da frota, era medido apenas com métricas de cariz financeiro, foi explorada a necessidade de métricas mais apropriadas para monitorizar e controlar a *performance*. Desta forma, através da implementação de um novo sistema de medição de desempenho e indicadores associados, o gestor de frota pode ter uma visão geral da funcionamento do departamento. A estrutura de controlo desenvolvida e conjunto de indicadores alimentam os dados de um *dashboard* de forma a fornecer uma visão geral das operações da gestão de frota e permitir a identificação de oportunidades de melhoria.

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Acronyms and Symbols

BSC	Balanced Scorecard
CAR	Capital Approval Request
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization
KPI	Key Performance Indicator
KRI	Key Result indicators
M&A	Mergers & Acquisitions
MTTR	Mean Time to Repair
PI	Performance Indicators
PM	Performance Measurement
PMS	Performance Measurement Systems
RI	Result Indicators
SCM	Supply Chain Management
SCOR	Supply Chain Operations Reference
SLA	Service Level Agreements
SMART	Strategic Measurement and Reporting Technique
SRM	Supplier Relationship Management
VBA	Visual Basic for Applications

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Chapter 1

Introduction

1.1 Project Context

This dissertation addresses the area of Logistics of a healthcare company specialized in clinical diagnosis. Logistics is an essential area for the enhancement of competitive advantage and differentiation over competitors. Taking this into account, the aim is to focus mainly on the development of a fleet management framework that enables the improvement of cost efficiency and its monitoring and control.

Unilabs focuses on providing adequate and reliable care to its customers, all whilst improving efficiency and performance. Over the past few years, Unilabs has kept a robust Mergers and Acquisitions (M&A) strategy and had, for the last three years, a compound annual growth rate of 24% both through the purchase of other clinical diagnostics companies in Portugal and through organic growth. Such growth has been accompanied by increasing challenges concerning operations complexity and therefore management, innovation and sustainability of practices.

This project emerges from the need of ensuring that the fleet management is in line with the Unilabs mission of becoming the leading diagnostics center in Portugal and providing quality services to clients. However, this is only possible if there is a cost management and control framework to analyse associated fleet operations. With this in mind, there are a range of opportunities for improvement of the fleet management model whilst maintaining service levels and quality.

1.2 Company Overview

1.2.1 History

The Unilabs Group was founded in 1987 in Switzerland with the merger of three diagnostics laboratories. As previously mentioned, since then, the Unilabs Group has grown rapidly, with a business model focused on M&A of other diagnostics laboratories all over Europe. In 2007, the Group merged with the Imaging Diagnostics giant *Capio*, that was active in Sweden, Norway, Finland, Denmark and the United Kingdom. This strategy enabled the Unilabs Group to become the European leader in diagnostics services.

Unilabs continues to expand, namely into the genetics and pathology sectors, offering its customers a wide range of diagnostics services. The company is also present in Latin America and the Middle East and currently has 12,000 employees, 1,300 of which are medical doctors, and 250 laboratories performing 195 million laboratory tests yearly.

The Unilabs Group entered the Portuguese health sector in 2006 with the acquisition of 85% of *Medicina Laboratorial Dr. Carlos Torres*. In 2017, Unilabs Portugal expanded its diagnostic services portfolio with the acquisition of *Base Holding* and now incorporates over 1000 care units offering services of clinical analyses, pathological anatomy, cardiology, gastroenterology, medical genetics, nuclear medicine and radiology. This national network makes Unilabs Portugal the national leader in clinical diagnosis.

1.2.2 Company Culture and Strategy

In 2017, Unilabs defined its mantra as **CARE BIG**, reminding every member of the Unilabs' team that their ultimate goal is to help find answers to improve the lives of clients. Furthermore, Unilabs' mission is focused on being at the center of decision making regarding the health of the Portuguese population, since it is estimated that 70-80% of all health care decisions involve pathology-based tests and investigations (NHS, 2009).

Unilabs is detained by private equity funds and its strategy focuses mainly on resource optimization, lead time reduction and cost reduction all whilst maintaining quality and service levels and increasing value for the customer. Along with this strategy, Unilabs has pursued continuous growth through the integration of other diagnostics centers with the ultimate goal of becoming market leaders in clinical diagnostics in Portugal. This methodology brings increased complexity throughout all management areas of the company yet it also allows for economies of scale and, by this means, increased negotiating capacity with suppliers and potentially increased EBITDA. The strategy is shown in more detail in Figure 1, considering all relevant areas involved in attaining this goal.

1.3 Project Objectives

Due to Unilabs' constant growth through M&A and organic growth, the Logistics Department is in continuous mutation regarding its fleet volume, cost structure and processes. It is the department's responsibility to integrate the fleet operations, acquired company's vehicles and cost centers and to create synergies between existing and absorbed operations. With this background in mind, the project emerges from the necessity of assuring not only the department's sustainability but also its scalability. This is done through the creation of tools aimed at making the decision making processes more data-driven.

The main objective of the project was to analyze the current state of the operations of the fleet management within the logistics department and to create systems that enhance the visibility of problems. Subsequently, the identification of improvement opportunities and development of a fleet management framework will allow for the achievement of cost efficiency and increased

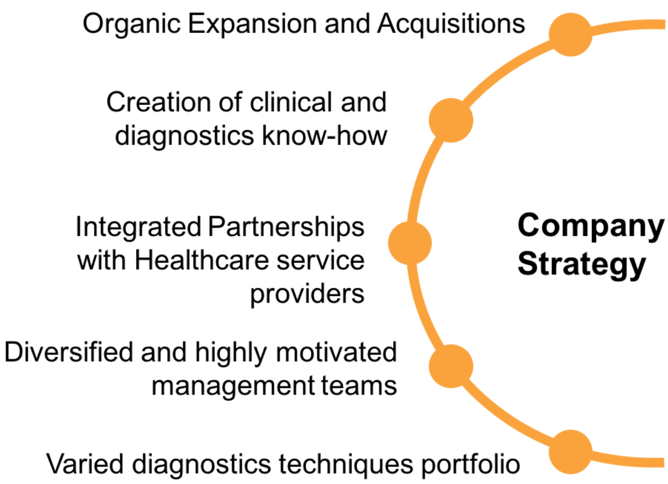


Figure 1: Unilabs Portugal Strategy. Adapted from institutional documents

service level. This management framework will work in various levels including data gathering and processing, daily fleet management and performance measurement.

Moreover, the identified improvement opportunities were weighted regarding their adaptability to different input conditions, sustainability and improvement potential in the long term, thus elevating the project from a tactical to a strategic point of view.

1.4 Methodology

This project was developed over 4 months in the Logistics Department at Unilabs Portugal. The project's progress followed the chronology observed in the Gantt chart in Figure 2.

#	Description	Weeks															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Process contextualization and range definition	■	■														
2	Definition and analysis of AS IS processes			■	■	■											
3	Workshops with logistics team						■	■	■								
4	Proposal and discussion of improvements									■	■	■	■				
5	Design and implementation of final													■	■	■	■

Figure 2: Project Plan

The methodology followed a top-down approach, being initiated by a global analysis of internal processes and how the logistics department fits in the overall Unilabs operations (#1). This reflection was followed by a deeper analysis of the AS-IS state of areas related to the main problem at stake, with a characterization of processes and cost analysis (#2). After identifying the scope of the project, workshops and meetings with the members of the Logistics Department were performed in order to understand their needs and evaluate possible improvement opportunities (#3). Later on, all the pertinent data for the design of the fleet management framework was collected and processed. The framework was then designed and presented to the management team for feedback and approval (#4). Finally, adequate adaptations were made to the framework to include the feedback received and the implementation was conducted (#5).

1.5 Thesis Outline

The present dissertation is divided into five chapters:

- Chapter 1 (Current) provides an overview of the company and its history followed by an overview of the problem in question and how it is aligned with the company's strategy and needs;
- Chapter 2 exposes the relevant information and theoretical background regarding concepts addressed and implemented throughout the project;
- Chapter 3 describes the Logistics Department's main operations and material/information flows followed by a focus on fleet management, detailed cost analysis and definition of framework fundamentals;
- Chapter 4 is comprised of a description of how the management framework was designed and the steps taken in its development. The subsequent implementation is also described as well as the constraints found during the process;
- Chapter 5 exposes and provides a detailed description of the visualization tool created and other improvements to the fleet management framework;
- Chapter 6 includes a critical analysis of the project and improvements developed with further insightful evaluation of possible future work.

Chapter 2

Literature Review

This chapter provides insights into the state-of-the-art and theoretical concepts that support this project. The structure of the chapter follows a top-down approach, starting with an outline of the definition of logistics, supply chain and its management, followed by a focus on fleet asset management and performance measurement tools since they are of special relevance for this project. The following section comprises an overview of the area of Supplier Reliability Management and its applicability to the project.

2.1 Logistics & Supply Chain Management

Supply Chains (SCs) are becoming increasingly refined due to globalization and digitization. The increased complexity of companies' strategies and fast changing environments contribute to higher risk SCs, resulting in exposure to unexpected disruptions (Munir et al., 2020).

Supply chain is defined by Ayers (2001) as "Life cycle processes comprising physical, information, financial, and knowledge flows whose purpose is to satisfy end-user requirements with products and services from multiple linked suppliers".

Furthermore, Supply Chain Management (SCM) includes the design, maintenance, and operation of supply chain processes required to satisfy final customer needs. Therefore, it is a systematic and strategic coordination of business functions within an organization. Just as supply chains are changing, their management changing too, and they are facing new challenges including trade-offs between labour, transportation and inventory to attain cost efficiency (Wilding, 1998).

Logistics is defined by Ayers (2001) as the "part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers' requirements". Since logistics is a very dynamic and diversified area and, in order to create a widely accepted definition, Rushton et al. (2010) outlines logistics as the following relationship: $Logistics = Materials\ Management + Distribution$. The Distribution component represents the storage and flows from the final production point to the final customer and Materials Management, represents the storage and flows into and through the production process.

Logistics has been a crucial feature of industrial and economic life throughout the years, being treated as sub-functions and sub-systems of distinct management operations. Nowadays, businesses evaluate these operations as being integrated in one system in order to take into account how they interact with one another. Due to this increased appreciation, the overall concept of logistics in the supply chain has been the object of growing scientific analysis aimed at continuous improvement. In both European and North American countries, logistics operations represent around 8 to 11% of gross domestic product. These numbers serve mainly to illustrate the relevance of logistics operations and the importance of keeping costs to a minimum (Rushton et al., 2010).

Logistics management and the decisions made in its scope are divided in a hierarchical order shown in Figure 3. The focus of this project is control management (highlighted), which assures the operations are run efficiently, whereas the planning area ensures the operations are set up to run properly. Additionally, the decision making levels affected by control management are solely tactical and operational. These decisions have a short to medium-term horizon and should not directly influence other logistics components (Rushton et al., 2010).

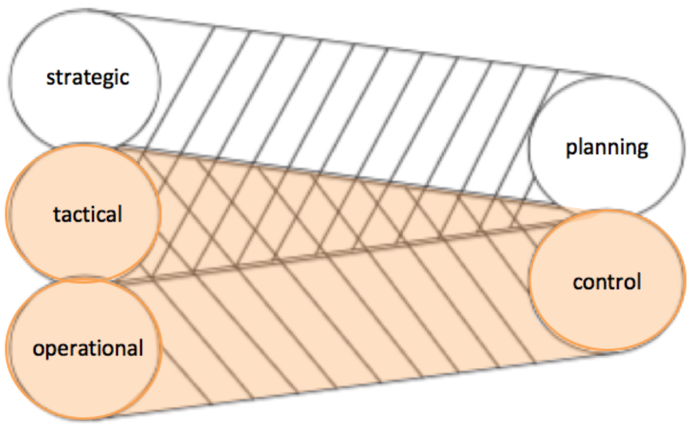


Figure 3: Logistics Management. Adapted from: Rushton et al. (2010)

Furthermore, and to attain effective logistics management, it is important to describe the flows throughout the chain. There is usually a misconception of limiting the logistics chain dimensions to physical flow, however, the dimensions of the logistics chain are defined as physical, information and financial flows. Last but not least, the fourth dimension is defined as knowledge inputs, or flows. This flow is also of extreme importance as it allows for future growth, product innovation and added value in the form of intellectual capital (Ayers, 2001).

2.1.1 Fleet Management

Fleet management is used to describe decision making in fleet vehicle operations. Along with other asset management practices, it is composed of activities ranging from identification of asset needs, procurement and acquisition, maintenance support systems and finally disposal or renewal of the asset. The idea is to perform these activities as effectively and efficiently as possible (Spüntrup and Imsland, 2018). A study by Mardiasmo et al. (2008) further highlights that fleet management requires consistent processes with regards to acquisition decisions, contractual arrangements, maintenance and disposal policies.

Still, asset performance is not only determined by management principles or policies but also through governance principles. These are described by Mardiasmo et al. (2008) as "a subset of organisational governance which specifies the policies and processes to acquire, utilise, maintain, and account for the assets of the organization". Their implementation has a material impact on the total organizational performance and administrative cost. Additionally, an insufficient focus on economic governance factors causes below-potential performance (Mardiasmo et al., 2008).

Spüntrup and Imsland (2018) highlight that there are three main groups of requirements that need to be taken in mind in order to achieve an effective and efficient fleet management. These include the integration of data into existing data systems and connectivity to other existing softwares, maintenance and optimization of assets in order to predict and prevent failures, technological components and features with eased access to information and utilization of dashboards for data visualization. The main goal is to evaluate the fleet utilizing a top-down approach, starting with an analysis of the entire fleet and then targeting single vehicles (Spüntrup and Imsland, 2018). Rushton et al. (2010) adds that an effective fleet management is aided by information systems developed to support and control vehicles and overall operations. The main functions of these information systems are maintenance scheduling, vehicle parts control, fleet administration, fleet costing and tachograph analysis.

Following Rushton et al. (2010), the project is classified as road fleet due to the physical nature of the product it transports, which has a low volume to weight ratio, high perishability and hazardous nature.

For large fleet volumes and by scaling up operations, a cost advantage is obtained through economies of scale. The procurement and maintenance of a larger number of vehicles can lead to a greater bargaining power with external suppliers. Furthermore, there is a decreased crew size since, normally, the workforce does not increase proportionally with the capacity of the fleet and because there is a greater knowledge of the workforce if vehicles of the same type are used (Spüntrup and Imsland, 2018).

2.1.2 Logistics Geographical Expansion

The overall trend of globalization has increased the tendency for businesses to geographically expand. This expansion is accompanied by an increase in logistics complexity since these operations support strategic market moves of companies as a whole (Abrahamsson et al., 2003). Logistics are required to expand, handle larger volumes, span over larger geographical areas whilst achieving cost efficiency and customer satisfaction (Sandberg, 2020).

Sandberg (2020) outlines four main logistics characteristics in order to support geographical expansion. The first is defined as a centralised logistics control, meaning that planning and strategic decisions are a centralised function in order to facilitate rapid knowledge exchange and increased flexibility to eventual changes. The second key point is a centralised logistics structure as highlighted by Abrahamsson et al. (2003), enabling a standardisation of working processes and consequently a better coordination and control of operations. Stank et al. (1994) further proves that centralized organizational structures are associated with a small percentage of net sales spent on logistics and a lower percentage of logistics costs spent on information systems. These are able to capitalize on the benefits of centralization whilst minimizing potential disadvantages such as decreased flexibility or response speed. Thirdly, the standardization of logistics operations is crucial since it goes hand in hand with control and performance monitoring. This point also enables the creation of economies of scale and therefore the possibility of achieving cost-efficient operations. Finally, the need for rapid learning and adaptation to new challenges brings out the continuous logistics learning and improvement. This final characteristic acts as a complement to the other three characteristics mentioned above (Sandberg, 2020).

A study by Alinejad et al. (2018) of Iranian companies further identifies that the main key success factors for logistics providers include management and leadership, relationships, business expansion and short-term flexibility. The points identified are all part of organization or management dimensions.

2.2 Performance Measurement

Performance measurement (PM) is used in order to monitor the execution of plans and provide insights to improve financial and operational performance. In supply chains, performance measurement is of extreme importance since it allows for a better understanding of systems and holds these value creating systems together, through unifying them in monitoring the implementation of an unique strategy (Stefanović and Stefanović, 2011).

It is imperative to monitor costs and performance since they automatically reflect on business objectives and operational requirements. These measures will support the planning and control of operations and enable the change or improvement of any operations that are not performing satisfactorily (Rushton et al., 2010). The overall objective is to provide accurate, reliable, timely and useful information on logistics cost and operational performance so that the contributions to the company as a whole can be determined. In turn, these will extend to knowledge creation and competitive power since they lead to improved decision making regarding value-added logistical processes (Fawcett and Cooper, 1998).

There are various approaches to performance measurement and control of logistics operations. Key Performance Indicators (KPI) and three Performance Measurement Systems (PMS) are addressed below.

2.2.1 KPIs

Parmenter (2015) divides performance measurement into 2 different groups: Result Indicators (RI) and Performance Indicators (PI).

RI are indicators that inform management how teams are working together to produce results. These summarize the activity of various teams. In turn, Key Result Indicators (KRI) are used to depict a clear picture of the progress of the organization's strategy. These RI are normally reviewed and monitored monthly or quarterly and are reported to the board or governing body. The main difference between RIs and KRIs is that KRIs represent a global vision of activities and present more important information.

Performance Indicators (PI) are non financial indicators that can be traced back to a team. These are not considered crucial to the business or its well being, however they help teams to align with the organization's strategy. On the other hand, Key Performance Indicators focus on the aspects of organizational performance that are crucial for the current and future success of the organization, and inform management on how the organization is performing by monitoring success factors. These success factors are usually already present in an organization but have not been recognized or utilized by management teams (Parmenter, 2015).

The main differences between KRIs and KPIs are the financial nature, frequency, reporting organ, specificity and responsibility. Firstly, KRIs can be financial or non-financial, whereas KPIs are defined as non-financial measures. Secondly, KRIs are performed in a monthly or quarterly manner and are reported to the board and KPIs are measured with higher frequency, such as daily or weekly and are reported to the CEO and/or management teams. Moreover, KRIs summarize progress in a particular area and KPIs tend to focus on a specific activity. Finally, KRIs as ultimately the CEO's responsibility but KPIs can be tracked down to a specific team or group of teams that work together (Parmenter, 2015).

Similar concepts were already covered by Kaplan and Norton when they developed the Balanced Scorecard (BSC). However, the approach given in that case utilizes the terms "lagging" and "leading". A lagging indicator, or outcome measures, are described as a generic metric whereas leading indicators, or performance drivers, are instantly measurable and specific to a given business unit (Kaplan and Norton, 1996).

2.2.2 Balanced Scorecard

The Balanced Scorecard was first introduced by David Norton and Robert S. Kaplan in 1992 and is now a widely used management tool for describing, communicating and implementing a company's strategy. This procedure adapts tangible objectives to the strategic mission of a business. These objectives are then translated into specific and measurable KPIs (Rushton et al., 2010). Kaplan and Norton divided this tool in four different perspectives: financial, customer, internal business process and learning and growth as shown in Figure 4. All of these are associated with specific objectives, measures, targets and initiatives. The BSC provides an overview of the company's performance, including financial measures, and complements them with operational measures on customer satisfaction, internal processes, and the organization's innovation and improvement activities. Kaplan also states that failed implementations are usually caused by a lack of support from management and executive leadership (Kaplan and Norton, 1996).

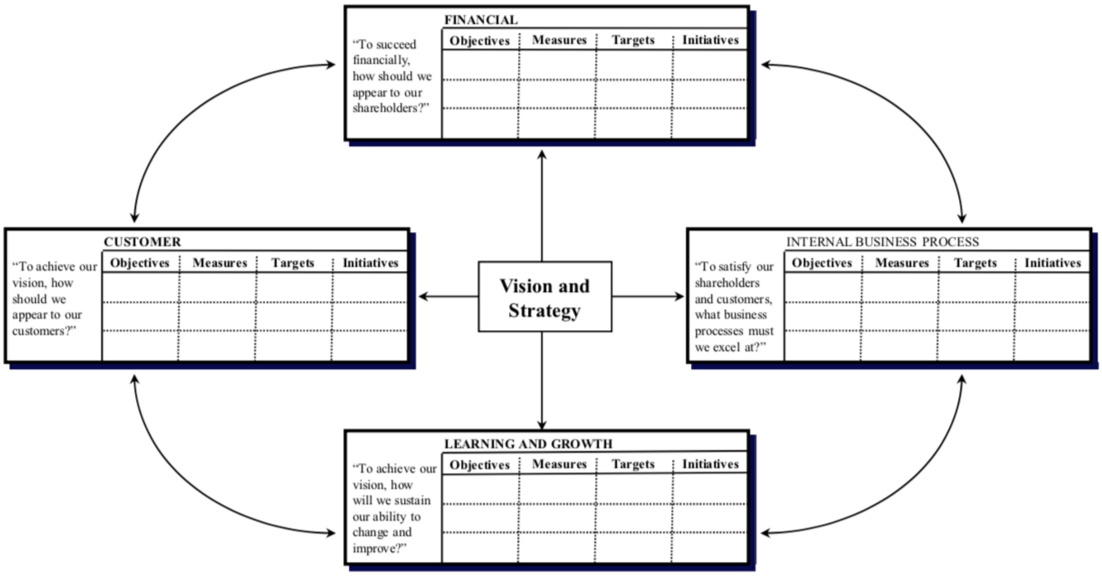


Figure 4: Four perspectives of the BSC. Source Kaplan and Norton (1996)

Healthcare is a sector characterized by a dynamic environment, which often leads to ignoring factors that are critically important for organizational success. The BSC captures this dynamic complexity in a management tool centralized in company strategy (Voelker et al., 2001).

2.2.3 SCOR model

The Supply Chain Operations Reference (SCOR) model is a hierarchical model created by the Supply Chain Council used to help SC managers understand the complexity of the supply chain. It comprises four main sections: Performance, which includes standard metrics to describe process performance and define strategic goals; Processes, the description of management processes and process relationships; Practices, the management practices that produce significant better process performance; People, standard definitions for skills required to perform supply chain processes.

The SCOR model is developed through 6 processes: Plan, Source, Make, Deliver, Return and Enable. These are then defined in increasing levels of detail, called process detail levels. There are various performance metrics defined for each level, ranging from delivery or cost to flexibility and assets (Supply Chain Council, 2012).

2.2.4 SMART Performance Pyramid

The Strategic Measurement and Reporting Technique Performance (SMART) Pyramid of Lynch and Cross (1991) comes from the idea that organizations work at different levels that require different focuses. It measures performance across nine dimensions - from a corporate vision to a more specific and objective focus, as show in Figure 5. Furthermore, this model also makes the distinction between internal and external parties.

There are three main functions that should be fulfilled through the performance measurement system: it should link operations to strategic goals, should take into consideration both financial and non-financial information and have the ability to focus on customer value (Lynch and Cross, 1991).

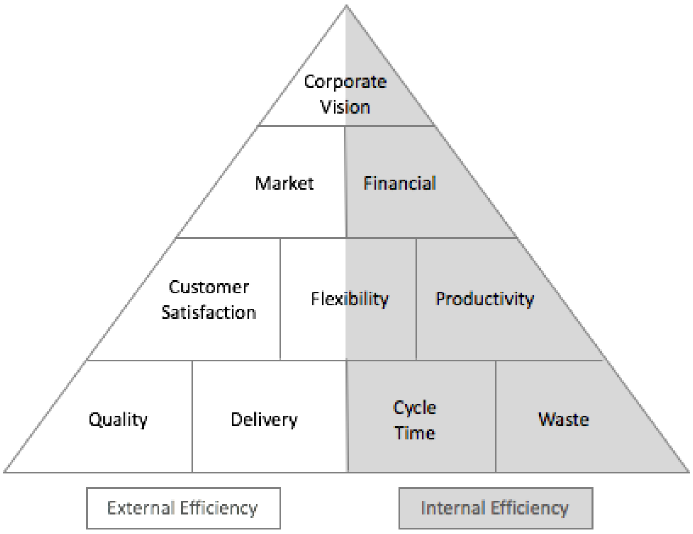


Figure 5: Performance Pyramid. Adapted from Lynch and Cross (1991)

2.3 Dashboard

Information is the key driver of most decisions. However, nowadays, the processes behind its processing and visualization techniques are complex and time consuming. Dashboards emerge from the need to facilitate data perception and ease discovery of insights. Data points are arranged into different views and information is displayed visually, allowing users to identify patterns, anomalies and relationships amongst variables (Vázquez-Ingelmo et al., 2020).

Dashboards are key to monitor business strategy and operations. These are used to aid decision making by exhibiting processed data, at the tactical and operational level, to capture short term operational performance (Person, 2009).

Ramly et al. (2011) identifies 5 criteria for dashboard construction:

1. Data visualization, showing only what is required;
2. Performance indicators, representation of previously selected PIs over a certain time interval;
3. Dashboard personalization, dashboard visualization and style catered to user;
4. Audit capability, visualization of historical data for comparison
5. Alert/Notification, thresholds or alerts triggered depending on specific rules.

2.4 Supplier Relationship Management

Companies are aware that, to create a competitive advantage, they ought to integrate and collaborate with their suppliers (PricewaterhouseCoopers, 2013). The supply chain is required to move from traditional cost reduction tactics to alternative approaches to supporting the business (Deloitte AG, 2015). This happens due to high dependence on suppliers and the importance they have in the well functioning of the supply chain (Tseng, 2014).

Supplier Relationship Management (SRM) is defined by PricewaterhouseCoopers (2013) as a "systematic approach for developing and managing partnerships". SRM focuses on the joint growth and value creation with key suppliers based on trust, communication and win-win solutions. Furthermore, the suppliers of an organization should also support its corporate mission, values and objectives (Tseng, 2014). According to Tseng (2014), supplier relationships can vary from purely transactional and price-based relationships to interdependent partnerships.

SRM main objectives are defined by PricewaterhouseCoopers (2013) as:

- Leveraging on supplier capabilities;
- Cost reduction;
- Improve security of supply;
- Increase innovative power;
- Increase supplier service.

The SRM process is defined by a set of complementary processes, shown in Figure 6.

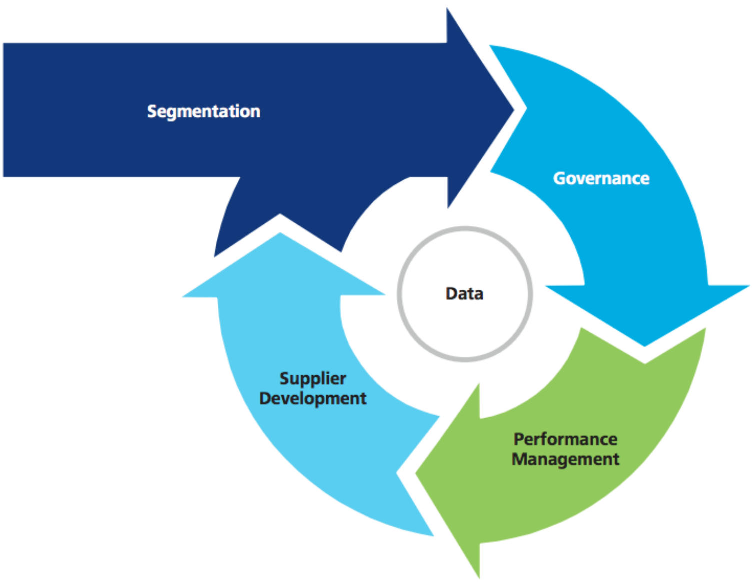


Figure 6: SRM Processes. From: Deloitte AG (2015)

The first process, Segmentation, consists of categorizing suppliers in order to identify the strategic suppliers with which to apply SRM. Non-strategic suppliers are targeted to traditional contract supplier management, focusing on costs and compliance. Subsequently, the Governance process aligns the organization's strategic objectives with those of the supplier. These objectives are crucial for the implementation of drivers in the Performance Management process. This next process involves the arrangement of continuous tracking of previously agreed upon operational measures which allow for a consolidated view of supplier performance. These metrics should be monitored frequently, with establishment of regular meetings for identification of possible problems or improvement opportunities. The last process, Supplier Development, consists in the creation of value through sharing plans between the two entities and creating innovation agendas.

Chapter 3

Problem Description

In order to fully comprehend the challenge at hand and its constraints, a description of the current state of the processes is given, starting with a brief introduction to the logistics department. An analysis of the different processes of the AS-IS fleet management and a contextualization as to how the management takes place is given in detail, as well as its implications cost-wise. Finally, an analysis of consumables and service suppliers is presented given that it is a key point of financial impact, having all the fundamental variables identified and emphasised in the last section.

3.1 Unilabs' Growth & Challenges

Over the past years, Unilabs has shown a great rate of growth, measured by an increasing a number of care units per year, as shown in Figure 7. This rapid growth was accompanied by a centralization of laboratories into a laboratory in Porto. The collection centers were kept as a contact with the customer and all samples are transported to the central lab through drivers.

This growth creates a great strain in the logistics operations that need to constantly adapt to new environments, integrate new companies and their operations, maintain standards and manage information flows. Changes are felt in all processes, from micro level such as sample transportation and through route management up to more macro-processes such as fleet asset management and cost control. These logistics operations are described in detail in the following section.

3.2 The Logistics Department

In 2008, when Unilabs entered Portugal, the logistics department was composed of two employees and several technicians. The technicians, after performing their job as sample collectors, would transport the samples to a central laboratory located in *Campo Alegre* street, Porto. The remaining samples would be transported to this laboratory by employees from other departments, such as the maintenance team. In September 2008, the Unilabs logistics department absorbed the operations of another laboratory: *Laboratório Dra. Isabel Vicente*. At this time, the team consisted of a

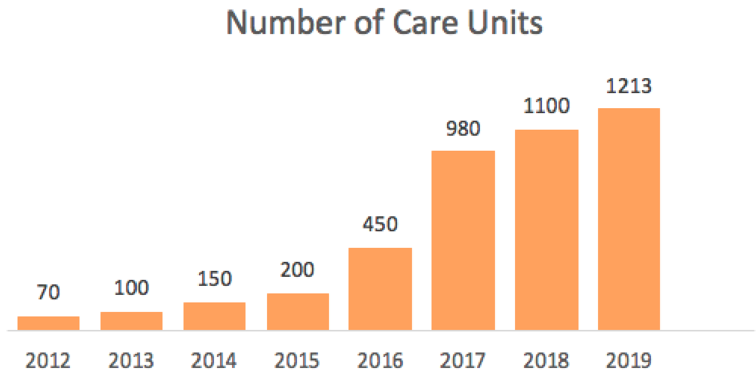


Figure 7: Number of Care Units (Year). Source: Unilabs' institutional documents

coordinator, five technicians and eight drivers. The transportation process was non-traceable, the people involved in the logistics department had no defined role and there were no defined routes.

Since then, the Logistics Department has worked in alignment with the strategy of the company through absorbing and managing the operations of different clinical diagnosis centers, laboratories and collection centers.

Currently, the department is comprised of one manager, two coordinators, four team leaders and fifty drivers. It has the responsibility of handling a fleet of 165 vehicles that are used for transportation of samples or other consumables, 100 of which are attributed to Unilabs' employees by the Human Resources Department. Simultaneously, the Logistics Department is required to manage three warehouses and twenty other multi-functional locations around Portugal. The department guarantees samples and consumables reach the right place at the right time and under the right conditions. In 2019, the logistics operations represented 3% of total costs at Unilabs Portugal.

There are different management areas in the logistics department including route management, fleet management, human resource management, urgent transportation requests, warehouse management, amongst others. This project will focus on the fleet management area of logistics operations.

3.3 Logistics Operations

The logistics operations are divided into two main sections: transportation and warehouse. Transportation operations are composed of all processes that involve transportation of samples from the collection centers to the central lab or peripheral labs, and consumables from the central warehouse to the collection centers whenever an order is placed. Warehouse operations comprise processing orders of consumables, preparing orders by picking, stock update through code-bar scanning and placement of completed orders in the right expedition rack with appropriate identification. In addition, all of these operations are supported by a logistics management team which is responsible for the control and optimization of all operations, fleet management, supplier management and maintaining service, cost and productivity levels. These management tasks are performed by the logistics director, who is at the top of the department's organizational structure, two regional coordinators, which regulate the fleet at a regional level, and the fleet manager.

The logistics operations are directly linked to all other Unilabs operations and directly influence them since the information and physical flows are part of every one of these areas. As shown in Figure 8, the logistics operations link together all Unilabs activities.

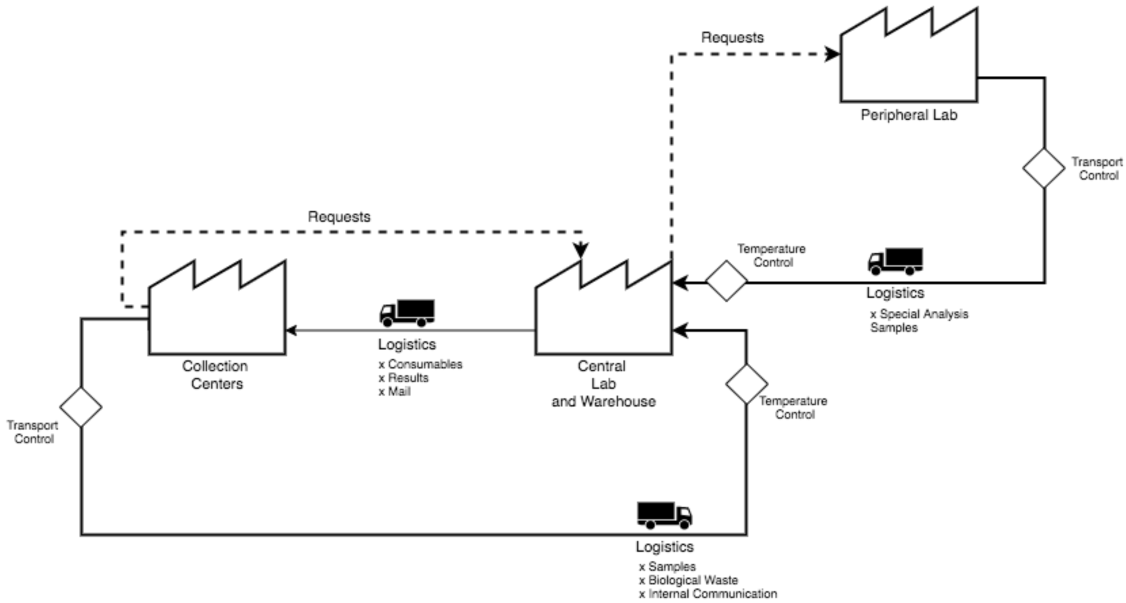


Figure 8: Logistics Operations Flow

Samples need to be properly delivered and its delivery needs to be controlled since a sample can not be lost or transported under inappropriate conditions, at the risk of not being able to collect them again. There are two control types: transport control and temperature control. The transport control ensures full traceability of the sample throughout the delivery flow. Samples are bar-code scanned before initiating transport and put inside a container designated for its transport. Then, a driver picks it up and starts the transport. Arriving at the lab, the samples are transferred from the transportation container to a lab tray where they will be subsequently sorted to different analysis sections. The temperature control used to verify transported samples before entering the central lab for analysis allows for data on the handling of samples and is a further indicator of driver rule compliance.

Fleet operations are executed by two types of workers: drivers and technicians. Drivers are members of the logistics department who have the responsibility of performing their predefined driver route, gathering samples from a maximum of thirteen collection centers each. Several synergies are harnessed through technicians. Some technicians work in collection centers during the morning, as receptionists, lab technicians or assistants and then go work in the central lab during the afternoon. The trip from the collection center to the central lab is therefore optimized as a round trip and a technician route is defined. These technician routes are shorter than a normal driver route, gathering a maximum of three collection centers, and are specific to the region in which that technician works. In total there are six technicians that bring samples from collection centers, in a daily route, to the central lab.

There are currently forty-nine routes covering three different regions in the north of Portugal, two regions in the area of Lisbon and two regions in the south of Portugal, each region containing a lab to where samples are delivered (Appendix A).

3.3.1 Fleet Management

At Unilabs, fleet management operations can be subdivided into four main elements, in accordance with the scheme in Figure 9, defined as a lifetime process from need to disposal. These elements are: capacity management (1), in which the need for a new vehicle is identified and critically analyzed to serve a specific objective followed by procurement operations that satisfy the need for a specific asset or service (2), leading to operational management (3) to ensure that short term objectives are met and that last-minute issues are resolved. This set of operations is concluded with the need to substitute a given asset and thus the procedure to dispose of it and remove it from the fleet operations (4).

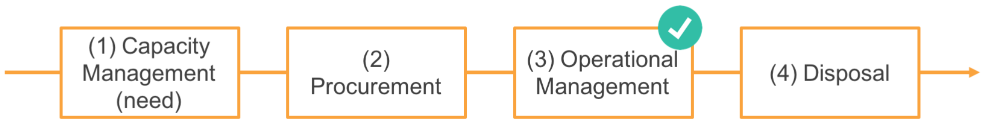


Figure 9: AS IS Fleet Management Operations

Element (1) - Capacity Management - identifies the need for a vehicle. The main criteria for the identification of this need presently are high mileage and high maintenance costs of current vehicles. These are coincident with the criteria used for vehicle disposal, explained below in this section. Another circumstance where the need may be identified is when Unilabs acquires, or partners with, a new diagnosis center or care unit center and their logistics operations are subsequently absorbed by the department. The need is evaluated if the current routes cannot support the collection centers' needs. In brief, the definition of the need of a vehicle is performed ad-hoc, with no specified criteria, no required information prior to decision-making and with no critical analysis of external entities' needs.

After identifying the need for a vehicle, Procurement operations (2) are conducted. These are defined in Figure 10. The process begins with the development of an internal form called Capital Approval Request (CAR) in which all specifications of the vehicle to be acquired are described, the supplier and the reason for that choice is identified, as well as the total cost of acquisition or lease. After the approval of CAR by the board, the proposal is passed on to the Purchasing Department to perform the purchase with the selected supplier. The specifications for the post-sale protocol of the vehicle are also sent to the Purchasing Department in order to ensure services such as substitution vehicle whenever needed and maintenance contract specifications. It is noticeable that this operation is performed by multiple people, translating in a high fluctuation in acquisition costs of vehicles as well as a fleet with a large number of different types of vehicles.

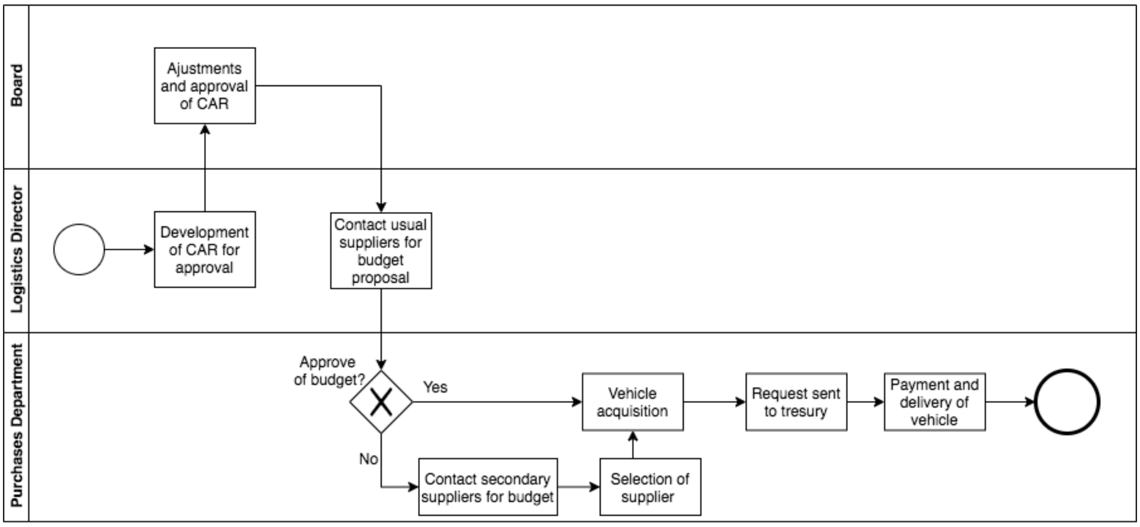


Figure 10: Swimlane Process (2) - Procurement

The third component of operational management (3) is the responsibility of the fleet manager. It is the only element which is completely developed and defined, relying on one sole element of the logistics team. This worker ensures that the day-to-day of the fleet runs smoothly and has the responsibility of solving unpredictable issues such as vehicle breakdowns, or negotiation with maintenance suppliers. This management is essentially reactive, with no consideration of how the decisions made are influencing the department's performance or cost. Some of the tasks are described below:

- **Management of fuel cards and toll devices** - Emission, cancellation and alteration of details of fuel cards and toll devices when required;
- **Management of breakdowns** - Contact external suppliers for maintenance of vehicles when required. Analysis of budgets and adjudication of service to a specific workshop;
- **Approval of invoices** - Invoices related to logistics operations, such as maintenance issues or vehicle disposal, require approval from the logistics department once these reach the accounting department. The fleet manager is required to compare invoice values with initial budgeted values and question suppliers if need be.

The final phase of the disposal of vehicles is defined in Figure 11. Some processes are also not properly normalized. Firstly, there is no specified set of conditions that signal that a vehicle is to be disposed of. Currently, a vehicle is identified for disposal if it has caused excessive maintenance issues in the past and is expected to continue doing so thus having a high maintenance cost of repair or if the mileage is considered to be high. This generates a great deal of uncertainty as to if the decision to dispose of the vehicle was, in fact, the more cost-efficient one. Furthermore, the fleet manager contacts external maintenance service-suppliers in order to find out if there is any interested buyer. This implies that the external entity to which vehicles are sold when they are removed from the fleet is not uniform, resulting in a high fluctuation in sales values, even when vehicles in comparable conditions are sold to the same entity.

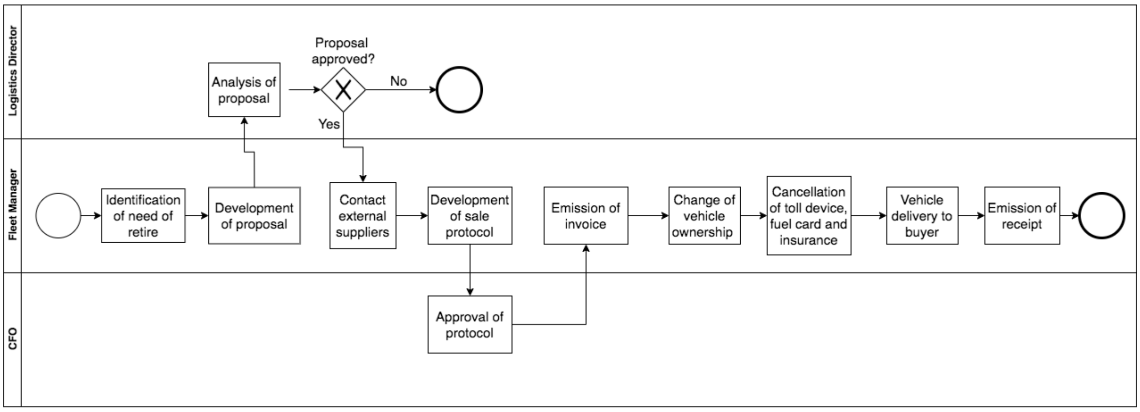


Figure 11: Swimlane Process (4) - Disposal

Another important aspect of fleet management are the suppliers. Every step in the *Need to Disposal* process requires external entities to supply products or services, such as vehicles, fuel, tolls, GPS vehicle tracking, rent-a-car, amongst others. These are described in more detail in the following sections.

The fleet management description identified in Chapter 2 is not congruent with the current fleet management. The fleet manager's responsibilities solely include operational management and all other responsibilities of capacity management, procurement and disposal are scattered across the department and in the hands of other members of the department, including the logistics director. Most decision-making processes are under the responsibility of the logistics director, meaning that, currently, the fleet manager does not have decision-making independence for most of these tasks. Furthermore, there are some elements relevant to the sustainability and cost-efficiency of the department that are lacking, such as performance measurement or strategic objectives. Presently, the performance is measured mainly in the scope of total expenditure, however with no visibility to which area these expenditures are allocated to or to which vehicles they are attributed to. Furthermore, the Logistics Department and fleet management specifically are lacking a strategic direction, implying that decisions taken have no strategic objectives in mind and that the short-term objectives in place may not be in line with the company's strategic objectives.

3.3.2 Data Management

Currently, fleet data is managed in two different worksheet files, henceforth denominated *Fleet data* and *Fleet costs*.

The *Fleet data* file is used to store all of the data of vehicles belonging to Unilabs. It is a database comprised of four main worksheets: "Global", which contains all information of vehicles, such as plate date, type of fuel, fuel card and toll device number, amongst other fields; "Disposal", which is simply an archive for all of the vehicles that are disposed of and withdrawn from the "Global" sheet; "Kms", which functions as an input worksheet for the mileage of each vehicle, registered with a quarterly frequency; "Rental" worksheet is comprised of all rented vehicles, the rental period and associated cost. These rented vehicles are usually required in periods when a Unilabs vehicle requires maintenance and there is no other available, or when a new employee is hired and requires a car immediately. This worksheet is consulted several times per day and is therefore required to be permanently updated only with relevant information, or else time spent in updating is considered as waste. Currently, the file is updated once or twice a week and there is no data cleaning, this is, no one is critically analysing if, in fact, the inserted data is correct and relevant for the day to day management of the fleet.

The *Fleet costs* database stores other information related to expenditures of logistics operations. This file includes three main worksheets: "Fuel" with fuel expenditures from all suppliers, "Via verde", containing costs associated with toll services and "Maintenance", which contains all invoices from maintenance and tire suppliers. The import of this data is manual and therefore time consuming and repetitive. It consists of a process of *copy and paste* of monthly extracts from all suppliers.

The Logistics Department generates a large volume of data through its processes. Most external suppliers provide monthly invoice statements with detailed information on how much was spent, in which date and by which specific vehicle, identified with a plate number. The remaining suppliers, that provide one-off services, work through the emission of individual invoices when their services are required.

After the reception of these documents from suppliers, they are simply archived in the Logistics Department's platform. No data processing nor treatment and analysis of the costs spent are performed. Furthermore, there is no guarantee of the integrity of the information archived or identification of any existent error in accounting. The current process is not permeable to the absorption of new operations of new mergers or acquisitions since it is not prepared for an alteration of fields or automatic addition of data. This creates an important improvement opportunity. The management of this department needs to be supported by a more robust framework in order to gather all this information into a standardized database and easily comprehensible visualization platform. Thus, the department can guarantee that employees are cost-conscious and can identify the necessary improvements and make informed decisions.

In order to create this robust framework, it becomes crucial to first find which information is relevant for monitoring and control. The cost related information issued by the department is examined in the following section.

3.3.3 Cost Analysis

Since Unilabs works through M&A, there are multiple companies that continue with vehicles and associated invoice statements under entities other than Unilabs. In fleet management, specifically, this translates in various challenges for data analysis:

- A large number of invoices associated with external services and numerous companies;
- Difficulty in gathering data from all Unilabs entities;
- Difficulty in linking workers to costs in logistics operations for which they have direct responsibility since no dynamic update is made of which driver is using which vehicle;
- Lack of analysis of relevant costs through available data.

At a first stage, tracking of the services was performed in order to identify the costs, which were subsequently divided into three main cost categories: fixed costs, variable costs and other costs, as can be observed in Table 1.

Table 1: Cost Item Categorization

Cost Category	Cost Item	Accountability	Periodicity
Fixed Costs	Renting	Logistics Director	Yearly
	Leasing	Logistics Director	Yearly
	Insurance	Fleet Manager	Yearly
Variable Costs	Fuel	Drivers	Quarterly
	FTEs	Logistics Director	Quarterly
	Maintenance	Fleet Manager	Quarterly
	Toll services	Drivers	Quarterly
	External Transportation	Logistics Director	Yearly
	Urgent Transportation	Logistics Director	Yearly
	Centrifuges	Logistics Director	Yearly
Other Costs	Parking	Fleet manager	Quarterly
	GPS services	Logistics Director	Yearly
	IUC	Fleet Manager	Yearly
	IPO	Fleet Manager	Yearly

The fixed cost category includes all costs directly attributable to a vehicle that do not change with operation volume. These are non-negotiable and contractualized costs such as renting, leasing monthly costs and mandatory vehicle insurance, monitored yearly.

In turn, variable costs are related to logistics operation volume. Fuel services, FTE (Full-Time Equivalent) driver salary, toll services and maintenance of vehicles, including repair of breakdowns and preventive maintenance, are directly attributable to a vehicle and are monitored quarterly. However, there are other costs which do not have a direct relation to vehicle operation. This is the case of external transportation, used extraordinarily for long-distance transportation where logistics operations are out of reach. Urgent transportation describes transportation performed exceptionally for urgent services, during non-working hours or during the night. Lastly, the centrifuges are standard analysis equipment transported by the logistics department whenever there is the need for either a centrifuge or when one is broken. The department is currently charged for the usage and maintenance costs of this equipment. This project is going to focus especially on variable costs items since these are the most susceptible to errors and prone to optimization through monitoring and control.

Other costs include items which are of reduced dimension. Namely, parking services, which are monitored quarterly, GPS services, IUC (*Imposto Único de Circulação*) which is a tax for vehicle circulation and IPO (*Inspeção Periódica Obrigatória*) which is the vehicle periodic inspection, all monitored yearly.

After cost categorization, there is still the need to find out which cost items are in fact relevant for monitoring and control. Hence, an ABC analysis was favoured. The ABC analysis aims to rationalize the defective control framework so that monitoring of costs can be targeted to relevant items and, in the long term, strategic management of the department can accurately assign their decisions. Furthermore, the level of resources that should be devoted to each cost category can be critically analysed.

For this purpose, the costs related to logistics operations of the year of 2019 were compiled and the graph in Figure 12 was constructed.

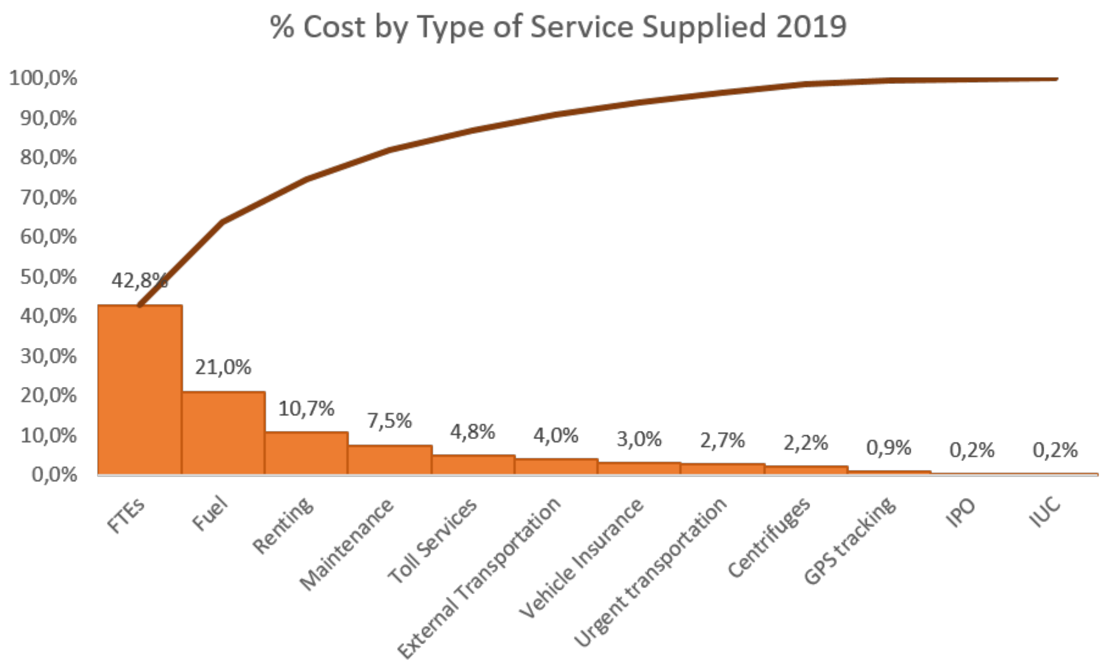


Figure 12: Expenditure in 2019

An initial comparison of the costs observed was made to a benchmark performed by the Unilabs Group internally, as shown in Table 2. This benchmark shows, on average, the percentage expenditure by cost item that is observed in Unilabs' logistics operations in other European countries. This primary analysis was performed in order to find out if Unilabs' fleet is in accordance to the Unilabs Group expected data and if the differences found are justifiable or not.

Table 2: Cost Item Benchmark. Adapted from Unilabs' internal research

Cost Item	Benchmark(%)	AS-IS(%)	Difference (%)
FTEs	47%	42,8%	-4,2%
Fuel	19%	21%	+2%
Renting & acquisition	13,2%	10,7%	-2,5%
Maintenance	4,3%	7,5%	+3,2%
Toll services	4,8%	4,8%	0%
External transportation	3,5%	4%	+0,5%
Vehicle insurance	4%	3%	-1%
Urgent transportation	2,8%	2,7%	-0,1%
Centrifuges	0%	2,2%	+2,2%
Gps tracking	1%	0,9%	-0,1%
IPO and IUC	0,2%	0,2%	0%

Costs observed in 2019 and the Unilabs benchmark are similar, with only some differences worth highlighting.

First of all, the leasing and acquisition costs have a -2.5% difference to what is observed in the Logistics Department. Since the acquisition and leasing cost of vehicles in Portugal is not substantially higher than in other European countries, it may be concluded that the department is using its renting ability to a lesser degree than what is expected, which means that there is a bad definition of capacity needs or that old vehicles are still running and should not be.

Secondly, the maintenance expenditure in 2019 is well above the benchmark in Table 2. This indicates that preventive maintenance is probably not being done correctly and/or that the fleet is old and in need of replacement of vehicles since, normally, old vehicles require more maintenance costs.

Furthermore, FTE expenditure observed in 2019 are below the European benchmark, probably due to lower salary rates in Portugal. The opposite happens with fuel, where a difference of +2% is observed, which may be justified by a higher tax rate for fuels in Portugal.

Lastly, the centrifuges are not present in the benchmark. These equipment maintenance costs are charged to the logistics department, although logistics operations do not, in any case, influence the processing, maintenance or usage of centrifuges.

The ABC analysis proceeds with an evaluation of A, B and C items. For the case at stake, A classification includes around 80% of all costs thus, these are represented by items FTEs, Fuel, Renting and Maintenance. The B classification represents 15.5% of costs and consists of items

Toll services, External transportation, Vehicle Insurance and Urgent Transportation. Finally, the C classification encompasses the items of centrifuges, GPS tracking, IPO and IUC.

Preliminary cost analysis done through Unilabs benchmark shows that maintenance and renting costs deviate substantially from the benchmark and the ABC analysis defines and classifies these items as A and B. Hence, these are relevant for further control and monitoring and require a more focal analysis. For this reason, a description of fleet operation suppliers (namely maintenance and renting) is included in the following section.

3.3.4 Fleet Operations Suppliers

The Logistics Department resorts to suppliers for various types of products or services. These suppliers are required since the logistics department is focused on the core business of transportation of samples, exams or documents and does not have an internal vehicle maintenance service or internal GPS tracking system, for example. Unilabs has decided to outsource these services to become specialized in the transportation service and to target the optimization of that service.

Suppliers can be divided into two main categories:

- Contracted Products/Services - Adjudicated to companies and duly contracted. The expenditures associated with these services are fixed and therefore are non-variable concerning the logistics activity or the billing volume. Some services included in this category are, for example, GPS services or renting services, in which expenditures have already been agreed upon. It is important to highlight that these should be subject to frequent tracking;
- Variable Products/Services - Related to external service suppliers which are highly dependant on fleet volume and activity and can be easily optimized. Thus, these are the preferred targets of cost control & cutting dynamic. These include all services which can be adjudicated to different suppliers. This is the case of maintenance and tire services, in which the fleet manager can decide to which supplier to resort to.

Only variable products/service suppliers identified above are going to be further analysed since costs incurred with other suppliers have already been negotiated and contracted. It is crucial to control unitary prices and quantities utilized since these are variable and non-contractualized. In order to map the current state of these supplier associated costs, an ABC analysis was performed, shown in Figure 13 with 2019 costs for maintenance and tire suppliers of the Variable Suppliers category described above.

The ABC analysis clearly shows that maintenance suppliers cluster a higher amount of expenditures. An A classification is given to maintenance suppliers 1 to 12 and tire suppliers 1 and 2. All other maintenance/tire suppliers are given a B or C classification and are grouped under the category "Other". There is evidently a maintenance supplier that represents most of the costs and so requires a targeted study. A 35% share of costs being represented by a sole maintenance supplier might imply that higher costs are being practised. A high dependence on this supplier can translate into higher costs as well or that a higher volume can leverage better prices. Thus, this study suggests that these suppliers require additional control of costs and performance.

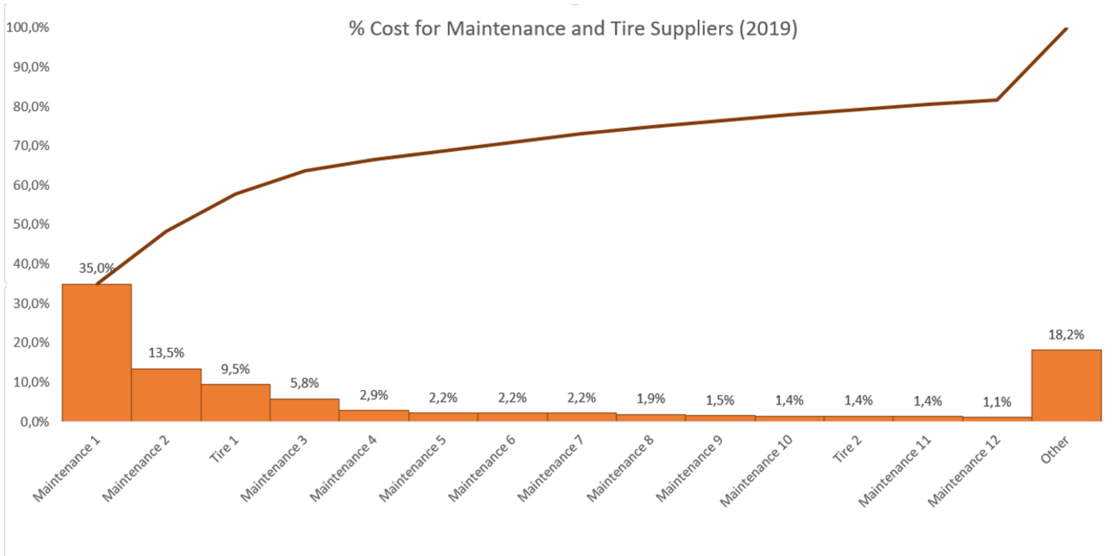


Figure 13: Maintenance and Tire Supplier Costs (2019)

Another issue with these providers is that there is no database for the storage of information related to contacts, availability, contracts, amongst others. The information of suppliers is not registered on any platform and therefore is non-accessible to other members of the department. This information is currently used by the fleet manager daily and is of natural knowledge. However, it is important to make it available for those who wish to use it and to standardize contacts and costs practised in relevant suppliers. In addition, the selection of these service providers and their evaluation is not quantified, which means that the costs incurred are not controlled and prices are not compared to other suppliers in the market.

3.4 Critical Analysis

The Logistics Department is under continuous change and its fleet management has suffered form it. The responsibilities and expected outputs of the fleet manager have not been properly defined.

Firstly, the department does not have a strategic direction or objectives. It is guided through the strategy of the company as a whole and with short-term cost reduction as its main purpose. It is critical to define a direction to which its operations and processes are working towards.

Secondly, the department is not a source of revenue, it is only considered as a source of cost. Even though its operations are crucial for the well functioning of the company, costs are perceived as negative towards EBITDA. Thus, the only metrics developed to measure the performance are once more cost-related and cost-reduction based. This is rather unappreciative of the department's work since not all costs are under its control. Fleet costs, for example, are extremely influenced by the cost of raw materials and of various products or services such as fuel, taxes or vehicle parts. If there is a fluctuation in these cost items, they may not be exclusively due to logistics internal performance, even though total fleet operation costs have to be controlled and considered for the strategic decisions of the company.

Moreover, assets are not dynamically monitored. For instance, if the vehicle database is not up to date then there is no control of who incurred which costs. If a driver cannot be traced to a vehicle involved in an incident, the responsibility cannot be properly imputed.

It is also important to note that although there is an enormous volume of data available regarding expenditures from various suppliers, there is no single database used to process this data. Since this data comes from various suppliers, the merger of these databases becomes difficult and maintaining it is a challenge.

The fleet management framework is underdeveloped. It consists of an *Excel* worksheet with vehicle information which is not updated regularly. Fleet management, as explored in Chapter 2, covers much more than just the recording of vehicle specifications. The existing processes are in need of improvement and responsibility attribution.

Cost analysis developed shows some cost categories that should not be imputed to the logistics department, such as centrifuges. Even though it is the logistics' responsibility to guarantee the delivery of this equipment, the actual costs of the equipment should not be incurred in logistics operations since it is a wrong practice and it is prejudicial for the Logistics Department as its operational costs are inflated.

Finally, suppliers are another variable in Unilabs' fleet management which are not controlled. The relationship with suppliers is not regulated and performance is not monitored. Also, the adjudication of service is not cost-efficient since decisions are not supported by information.

Chapter 4

Design and Implementation

This chapter addresses the process of implementing a fleet management framework, starting from the AS-IS state and the identification of problems with the fleet management and leading to a new fleet management framework proposal through the development of various tools for management support. The solution presented is based on theory and processes described in Chapter 2, adapted to the project and the fleet management itself. All of the tools implemented were based in optimized *Excel* worksheets so that human action could be reduced and data visualization eased, thereby increasing the productivity of the fleet manager within the performance assessment.

All of the suggested solutions were thoroughly discussed with the logistics management team and COO, through meetings and presentations for feedback and validation. Afterwards, these solutions were gradually implemented and adapted through relevant feedback received from the fleet manager.

4.1 Management Framework

Before the implementation of the solutions developed, it is crucial to see how they will fit the current situation. A new fleet management framework was designed, with characteristics considered essential for overall effectiveness. The new framework is shown in Figure 14 and is based on three levels: Vision, Mission and Strategic Objectives (1); Performance Measurement (2); Data processing (3). The grey arrow is an indication of information flow.

The top-level (Vision, Mission and Strategic Objectives) aims to define the department's approach, how it fits in the organization and its views on the future. The next level is comprised of a performance measurement system since the AS-IS state focuses only on cost performance. PM aims to utilize a PMS to enhance the department's productivity, cost-effectiveness and overall control of operations. The bottom level, data processing, is respective to all of the data gathering from internal and external sources, which are important for decision-making at upper levels of the pyramid.

Each of the levels previously mentioned is going to be respectively explored in the following sections.

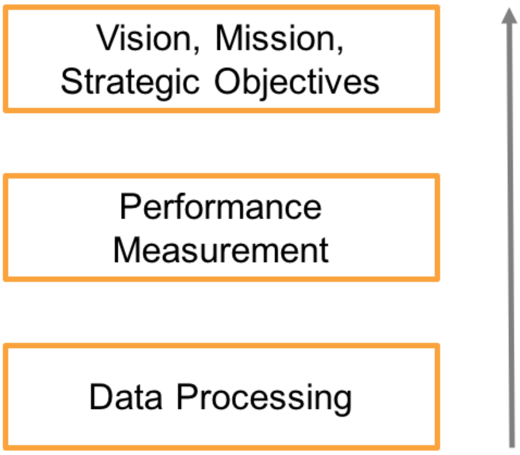


Figure 14: New Management Framework Scheme

The framework at hand aims to fulfil a set of objectives listed below.

- Provide strategic alignment with the department's vision, mission and objectives;
- Offer a clear communication tool to support the decision-making process;
- Provide historical data for comparison of performance;
- Facilitate utilization of monitoring and control tools through automation;
- Provide accurate data to model;
- Flexibility to the addition of new data and KPIs.

The first objective is defined in the next section. The following two objectives are addressed in Section 4.3 and the last three objectives are targeted in Section 4.4.

Before proceeding to the development of the framework in hand, it is important to emphasize that the framework is focused on optimizing processes of the responsibility of the fleet manager, outlined in Figure 9. All other tasks of the Logistics Department such as route definition and scheduling of delivery of samples are not going to be considered as in the scope of the project.

4.2 Vision, Mission and Strategic Objectives

To ensure the well-functioning of the department, the department is first required to have a direction and definition of the goals it aims to achieve. Hence, the definition of a vision, mission and strategic objectives of the logistics department are identified below.

Vision: Complement and enhance Unilabs' internal operations and help Unilabs create and maximize competitive advantages through the implementation of solutions and innovation.

Mission: Guarantee the efficient flow of materials and information throughout the Unilabs universe, ensuring high service level and reduced costs of operations.

Strategic Objectives:

- Guarantee Service Level Agreements (SLA);
- Support Unilabs in their geographical expansion strategy;
- Ensure financial accountability and predictability of the department;
- Improve lead time;
- Enhance control framework;
- Improve department productivity.

4.3 Performance Measurement

The performance measurement is a new level in the new management framework and will, therefore, be described in detail in the following sections. Its need arose from the unilateral performance measurement using only cost-related metrics, as mentioned in previous sections.

4.3.1 Analysis of Measurement Systems

Measuring performance aims to aid in fleet management through structured KPIs. However, before defining the metrics itself, it is important to define a proper performance measurement system to create a modelization platform for performance metrics identification and implementation.

From the three methods examined in Chapter 2, the SCOR model is identified as the weakest system for the problem at stake. This method is, as the name suggests, targeted to the whole supply chain and therefore becomes less flexible for adaptation to this fleet management project. Even though the model encompasses a performance measurement section, it also contains other sections such as processes, practices and people which will not be addressed. Due to flexibility and diversity in sections of management, this model is not appropriate for the project.

Similarly, even though the BSC provides a procedure for the creation of objectives to attain, this method is built top-down in an organization and not normally implemented in a department or department section individually. Its goal is to define the organization as a whole and subsequently identify leading and lagging indicators for the objectives. For this reason, the BSC surpasses the scope described for this project which is fleet management.

Finally, the SMART model, although restricted by nine dimensions, is the most adaptable and includes strategic vision and mission defined in Chapter 4.2. This model will be used for design and modelization of the performance metrics and will be used in aiding the implementation of these metrics.

4.3.2 SMART in Fleet Management

Even though there are various tools utilized in the logistics department for general operation management, the tools dedicated to fleet management are still missing. The implementation of the SMART PMS is going to aid the definition of performance metrics and the fleet management framework as a whole.

Due to the specificity of the fleet management framework, it becomes increasingly important to adapt the SMART system to the case. A new, adapted, SMART pyramid is shown in Figure 15.

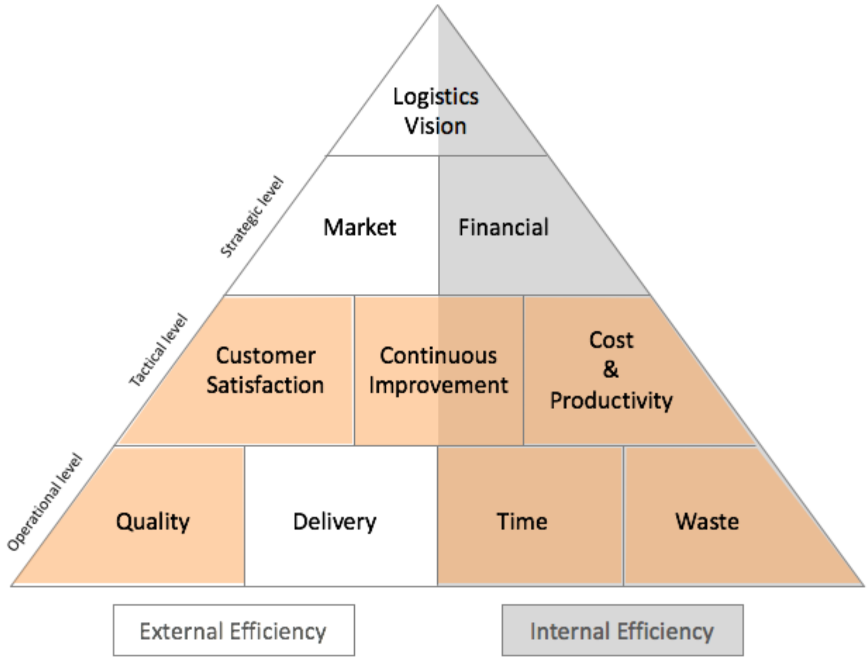


Figure 15: Fleet management SMART pyramid

Since the performance measurement system is applied to a section of the department and not to the whole organization, the scope of the pyramid shifts. The internal efficiency metrics relate to metrics of the logistics department, namely the fleet management, whereas external efficiency refers to metrics measuring the performance of areas external to the department but not necessarily external to the Unilabs organization itself.

The project will focus on KPIs at the operational and tactical level, highlighted in Figure 15, since it is where fleet management is inserted. However, the KPIs defined will always be linked to the logistics vision defined in Section 4.2 and have an impact at the strategic level.

4.3.3 KPIs

The KPIs introduced, together with the SMART structure, aim to build a reliable source of information with the minimal necessity of human interaction or input. Relevant information can rapidly reach decision makers and monitoring of relevant indicators is made easier.

All of the KPIs defined were approved by the fleet manager, logistics director and COO. This approval is crucial to guarantee sustainability of the proposal inside the company and continuity and monitoring of performance measurement.

In order to standardize the process of KPI definition, each KPI is shown in table form and is characterized by: Name, Definition, Formula, Units, Target value and Frequency. KPIs are delineated in the following sections and all KPIs are compiled in Appendix B.

Waste

Every vehicle is characterized by a metric of carbon dioxide emission which is related to the engine of the vehicle. Since Unilabs is becoming more environmentally conscious and bringing innovative ideas such as introducing electrical vehicles into fleet operations, it is essential to have an updated metric on how the fleet is performing. Therefore, the carbon dioxide emissions characteristics were collected for each vehicle (VE) and compiled into a KPI that is updated every time a vehicle is procured and purchased. The details for this metric are present in Table 3. The target value was identified as a percentage reduction in a period of 5 years.

Table 3: KPI CO_2 Emissions

Name	Definition	Formula	Units	Target Value	Frequency
CO_2 Emissions	Average CO_2 emissions of fleet	$(\frac{TotalVE}{Totalcars})$	g/km	-20% by 2025	Purchase moment

Waste of the fleet is also translated in a representation of the amount of time the fleet is unavailable to perform its processes. These unutilized resources are depicted in a KPI that will allow for the measurement of the on-demand time-availability. There are three circumstances in which a vehicle is immobilized: when it suffers an accident and is required to incur maintenance, when it requires preventive maintenance or when it suffers a breakdown. The total number of immobilized days (ID) for all vehicles are added and subsequently divided by the total number of required fleet service days (RD). The three types of vehicle immobilization started to be recorded in the middle of the month of May and so the data can not be considered reliable or fit to be presented. Still, the COO defined the target value for this metric as 98%. The attributes for this KPI are shown in Table 4.

Table 4: KPI Fleet Availability

Name	Definition	Formula	Units	Target Value	Frequency
Fleet Availability	Total time available to perform fleet operations	$1-(\frac{ID}{RD})$	%	98	Daily

Another metric that falls under this category is the waste in financial resources. There are two types of events which translate in a loss of funds: accidents (A) and tickets (T). A new registration method for these metrics was created in the *Fleet data Excel*. Since there was no previous registration of these metrics, there is no indication on what would be an acceptable amount of accidents or tickets per week. Once there is significant amount of entries, an average can be calculated and a adequate target value defined. The KPIs are defined in Table 5.

Table 5: KPI Fleet Availability

Name	Definition	Formula	Units	Target Value	Frequency
Accidents	Total number of accidents up to date	$\sum(A)$	-	-	Weekly
Tickets	Total number of tickets up to date	$\sum(T)$	-	-	Weekly

Time

Even though the time section of the SMART pyramid evidences cycle time or productivity, this section was adapted to fit the fleet management area. Therefore, the time KPIs are the average age of vehicles and average processing time (PT) for invoices, described in Table 6.

The first KPI is a measurement of the age of the fleet itself. Old fleets tend to produce more breakdowns and to require more costly maintenance and hence compromise the service provided by the fleet. The target value is not delineated since a threshold for average age is still to be defined. This threshold can be defined though a study of maintenance costs and where these equate the cost of the vehicles, so that a balance can be found between both costs. The frequency is also left blank since the calculation of this metric is dynamic and does not rely on user interaction. The KPI is calculated through the average sum of all ages of vehicles (A), which in turn are calculated by subtracting the current date by the license plate date.

The second KPI measures the time of the process of approval and handling of invoices specifically. The time for processing the invoices database is still in development and even though the metric is defined, it will not be included in the final data visualization platform.

Table 6: KPI Average Fleet Age and Average time for invoice processing

Name	Definition	Formula	Units	Target Value	Frequency
Time for processing	Time for processing of invoices	$\frac{\sum PT}{Total\,Number\,of\,Invoices}$	Mins.	-	-
Average fleet age	Age of fleet	$\frac{\sum_{n=1}^{n} An}{Total\,Number\,of\,cars}$	Years	-	-

Quality

The quality section is an external operational efficiency factor two metrics: 5S of vehicles and temperature control. These are associated with the quality of the fleet and management quality provided by the respective manager.

The 5S vehicles KPI gives an insight into the state of the vehicle and their compliance with company regulations. 5S refers to a continuous improvement tool that aims to improve productivity by five principles: Sort, Set in Order, Shine, Standardize and Sustain. The department has already defined ten 5S criteria (C), each with a weight of 10%. The registration of this metric is also already in place: each vehicle is evaluated and its score is registered weekly by team leaders and saved in a file archive. The 5S registration form is present in Appendix C. Even though the process for the registration of this metric is in place, it is not monitored and the information is not processed once it is collected. The purpose was to create a process that enabled the fleet manager to gain easy access to this crucial information. Team leaders now have to register the 5S score of every vehicle in a particular *Excel* worksheet so that this information can be imported to the fleet management file and dashboard. This metric is delineated in Table 7.

Table 7: KPI Vehicle 5S

Name	Definition	Formula	Units	Target Value	Frequency
Vehicle 5S	Quality of vehicle regulation compliance	$\sum_{n=1}^{n=10} Cn$	%	90	Weekly

The second quality KPI, shown in Table 8, refers to the temperature at which samples should be transported at. For compliance and certification matters, the temperature of the transported samples should be between 4ºC and 17ºC. The control is ensured by a data logger which is placed inside the container in which samples are transported. The data from the logger saved in the logger's software database. This software then emits an alert if the logger registers a reading above the specified temperatures. Previously the alert was merely informative and with no tracking of the cause of occurrence, translating in an underdeveloped analysis.

The main aim of the tracking of these alerts is to create a platform for the registration of actions taken to diminish these occurrences, the responsible for the occurrence and the history of occurrences for a specific logger. The KPI is updated daily and its target value is zero records out of temperature specification.

Table 8: KPI Temperature

Name	Definition	Formula	Units	Target Value	Frequency
Temperature	Sample temperature compliance	$\sum NAlerts$	-	0	Daily

Delivery

Performance indicators for the delivery section of the pyramid was not addressed since the delivery of the fleet services and its management is not under the scope of this project. The delivery section falls under the route management area which is, in fact, related to the fleet, but is considered as another section of the department.

Cost & Productivity

The tactical level of internal efficiency was modified to cost and productivity since in the fleet management environment these are directly linked. This level of the pyramid is associated to the levels below (waste and time cycle). A cost and productivity analysis is only possible if resources are available, under the right conditions and if all invoices from suppliers are delivered in time.

The first indicator is already used by the logistics department to measure performance, however this process is not automated nor standardized, meaning that different variables are accounted for in different calculation instances, resulting in incomparable data. The details for this metric are shown in Table 9. It was defined that the cost variables included in the formula were: variable costs (VC), fixed costs (FC), FTEs and other costs. The cost items associated to these variables were described in Chapter 4. Furthermore, the target value was defined in collaboration with the logistics director taking into account previous annual values for this metric and the ability of attaining economies of scale. Even though the aim is to closely monitor costs and performance, the costs from suppliers are only emitted monthly. This factor was assumed as a limitation and the frequency defined as monthly for all cost related metrics.

Costs analysed in Chapter 3 confirm that fuel and toll services are relevant items in the cost environment and are currently not being controlled. Apart from the foundational data gathering, no other control or monitoring is made to these items.

In order to grant the fleet manager an easier control of costs and allow for the allocation of costs to the respective user, an area that was not controlled before, a control tool was developed. It will also allow for transparency in the control of costs and in sharing of information. This control

Table 9: KPI Cost per Km

Name	Definition	Formula	Units	Target Value	Frequency
Cost/Km	Expenditures per kilometer travelled	$\frac{VC+FC+FTEs+Other}{Kms\,travelled}$	€/km	0,34	Monthly

tool uses information on costs per vehicle collected in a prime table and emits an automatic e-mail via *VBA module* to every user of every vehicle with fuel and toll service expenditures as well as percentage usage of annual *plafond*. An example of the standard e-mail as well as the *VBA* code is shown in Appendix D . This e-mail is to be sent at the beginning of every month, once monthly extracts are emitted by the suppliers. If a vehicle exceeds its predefined limit, an alert is issued to let the fleet manager know that there is a vehicle that requires attention. The fleet manager will then analyse if this circumstance is due to an error in data or if it is, indeed, due to excessive usage of fuel or toll services. The creation of the control and data gathering platform is described in more detail in following sections.

The next KPI defined takes into account the maintenance items. The goal is to measure all costs related to maintenance activities:

- Cost of tires (T) and their application;
- Cost of parts (P) related to maintenance procedures;
- Cost of other maintenance products such as oil, lubricant, cooling liquid, etc (O).

Despite the fact that fleet maintenance is greatly influenced by other factors such as fleet age or type of vehicles, a target value can be defined, taking into account historical values for this metric. The complete set information is shown in Table 10.

Table 10: KPI Maintenance cost per Km

Name	Definition	Formula	Units	Target Value	Frequency
Maintenance /Km	Maintenance expenditures per kilometer travelled	$\frac{T+P+O}{Kms\,travelled}$	€/km	0,11	Monthly

Customer Satisfaction

The tactical level of external efficiency is characterized by customer satisfaction. For this case the metric introduced aims to measure the quality of the fleet manager's service. The fleet manager, amongst other tasks, is required to book maintenance appointments when necessary, schedule vehicle inspections and deal with ticket and accident bureaucracy. The quality of this service is therefore measured through vehicle user satisfaction. Even though the metric is already defined, the registration procedure is not yet in place. However, the goal is to have a ticket method, where the fleet manager's service is requested. Then, a given amount of time is set for specific tasks and, for every late delivery, the fleet manger and his superior are notified. This KPI defined as a ratio of over-time tasks and on-time tasks. The characteristics of this metric are described in Table 11.

Table 11: KPI Driver Satisfaction

Name	Definition	Formula	Units	Target Value	Frequency
Driver Satisfaction	Driver satisfaction concerning fleet manager's service provided	$\frac{\sum on-time\ tasks}{total\ tasks}$	%	95	Quarterly

Continous Improvement

The flexibility section of the SMART pyramid is at a tactical level of evaluation and intends to characterize both internal and external efficiency. This section was adapted to fit a lacking element of this framework: continuous improvement.

This section requires, as a first step, the implementation of a continuous improvement management culture. This can be attained with the implementation of weekly meetings to define continuous improvement actions and to analyse the progress of defined KPIs. This analysis enables the identification of improvement points and corrective actions if required.

Once these meetings are regular and carried out with the purpose of identifying new actions and concluding actions defined, a KPI can be implemented. This KPI would be comprised of a ratio of the number of continuous improvement actions in place and the number of continuous improvement actions completed.

4.4 Data Processing

The data processing section supporting the management framework addresses the necessary processes for data gathering into an integrated database, that will be used for subsequent analysis and sustained decision making.

The database created and dashboard developed were integrated in the *Fleet costs* worksheet, since it was already in place and already familiar to the logistics department.

4.4.1 Database Creation

The database was created having the ABC analysis performed in Chapter 3 into consideration. Only five out of the twelve cost categories identified, representing 86,8% of total costs, will be included in the database, as they were considered most relevant for analysis and decision making.

The software used for this project was *Excel* mainly due to company preference, since it offers facilitated access and comprehension for all users.

The first challenge was creating a dynamic import to avoid the repetitive task of, every month, requesting the fleet manager to copy and paste each invoice statement to the file in question. Since Unilabs is composed of multiple individual organizations that were gradually absorbed, invoices are directed to multiple companies (24). This means that there would be, on average, 288 fleet invoices to copy and paste to the *Fleet costs Excel* per year, per service supplier. Some service suppliers, such as fuel, have all 24 companies integrated into a single invoice, however other, such as toll services, do not. In order to fix this problem, a dynamic import via *Power query* intelligence tool was used. A query was created for relevant suppliers in order to import the data directly from the files after downloading them from the respective websites or e-mail.

After creating the automatic importation of data, some treatment is still required in order to make data perceptive and both standard and practical to each individual database.

To facilitate the analysis of data and homogenize databases, there were a set of mandatory fields created for each of the different cost categories. These were: organization, vehicle license plate, date of operation, cost associated to operation.

In order to associate the expenditure to the volume of logistics operations, the need to calculate the kilometers travelled at the end of each month emerged. Since drivers are required to register mileage every time they refuel, the fuel database was the root for the creation of a secondary database, called "Kms". This was then created with the *Power Pivot* tool by gathering the higher registration of mileage for every month. The kilometers travelled were calculated through simple subtraction of the maximum kilometers of a given month by the previous month's record. As this process was made automated, the secondary database is updated whenever a new month is loaded into the fuel database.

All of these databases were firstly created with the purpose of saving time through automation and secondly to serve as input information for KPI update.

4.4.2 Interface Creation

After the creation of each database came the user interface. Each individual database originated a sheet in the *Fleet Costs* worksheet, simplifying the search for a specific record or group of records out of a cost category. To update the database, the user simply needs to refresh the worksheet and the data is automatically loaded into the different database. Figure 16 is a scheme that indicates how the worksheet was developed.

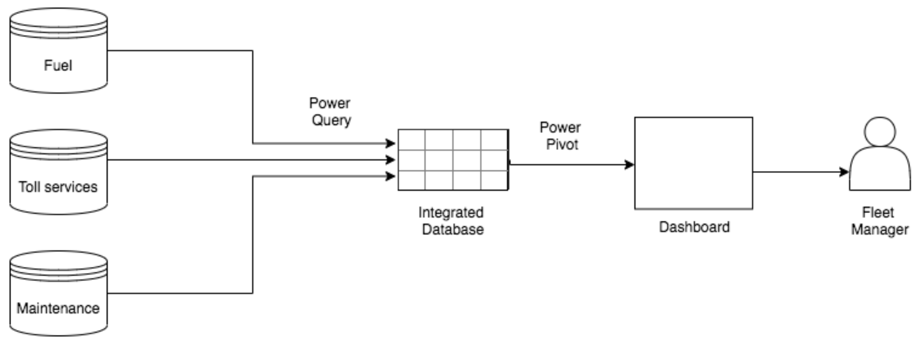


Figure 16: Database Development Scheme

The final step, of transformation of the integrated database into a data visualization dashboard is addressed in the following Chapter.

Chapter 5

Dashboard and Improvements

The ultimate goal of this fleet management framework was to create a tool to ease monitoring and control, thus making Unilabs a more data-driven company in its decision making. Another goal was to implement a dashboard where crucial information would be displayed in a clear way, as desired by the logistics director.

Together with the logistics director and fleet manager, it was defined that the dashboard would be divided in three: performance measurement, cost control and quality control (temperature). The performance measurement dashboard would be integrated into the *Fleet Data* worksheet and the cost control into the *Fleet Costs* worksheet. The usual operation of files was kept and visualization tools added, facilitating user usage and familiarity. A new registration and visualization platform was created for the quality control (temperature) metric since this information is required to be accessible for Logistics, Laboratory and Quality Departments.

5.1 Performance Measurement Dashboard

The final part of performance measurement is displaying the defined KPIs and information in a intuitive way, to foster an easy analysis of metrics and facilitated decision making.

For this project, data visualization aims to gather all of the KPIs defined into a single *Excel* sheet. The update shall be automated as a means to reduce the time spent by logistics collaborators in operational work and increase actual usage of these KPIs. This means that multiple databases were processed and connected, to create a coherent *Excel* platform, permeable to filters and data selection. The automation uses the *Power Query Excel* tool to import and clean data into the main *Excel* sheet. As such, every time a database is updated, so is the excel worksheet with compiled data. This worksheet is separated into tables, prepared for dashboard construction and update.

KPIs described in Chapter 4 are complied into a performance measurement dashboard. This section of the dashboard is shown in Figure 17.

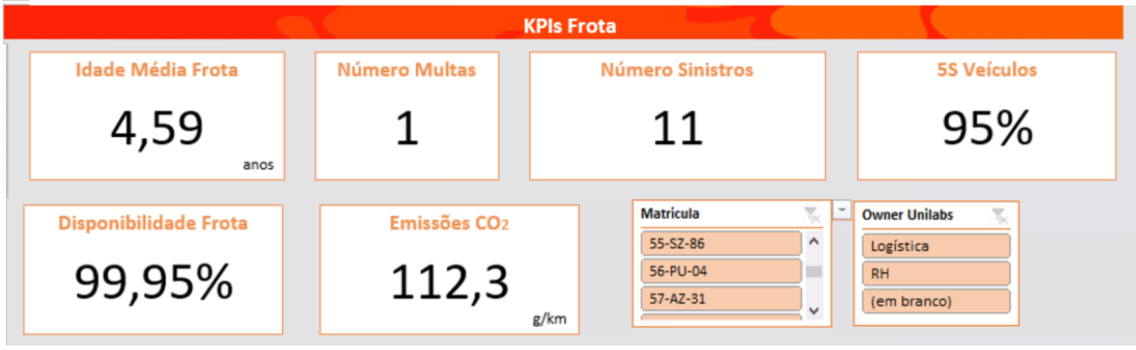


Figure 17: Performance Measurement Dashboard

After building and testing the dashboard to guarantee the output metrics were corresponded to the expected output, the fleet manager was consulted for input. His feedback resulted in the addition of several other elements to the dashboard, which would facilitate daily operations management. The changes added were:

- **Inspection list**: list with vehicles with pending inspections. Since inspections can be performed up to 3 months before inspection date, it is of extreme relevance to have an updated list of vehicles so that an inspection appointment can be scheduled;

- **Kilometers list**: list with vehicles with no mileage registered. All vehicle users in Unilabs' universe are required to register their mileage when they refuel. If mileage of the vehicle is not properly registered, the kilometers travelled can not be calculated and metrics influenced by this factor are going to be unrealistic;

- **% Use**: Pie chart with the allocation of vehicles, whether they are used by logistics fleet operations or allocated to human resources purposes;

- **Kilometers to date**: Graph showing the number of cars which have over a given amount of kilometers. This graph helps to quickly visualize the number of cars which have an alarming amount of kilometers.

These changes are shown in Figure 18.

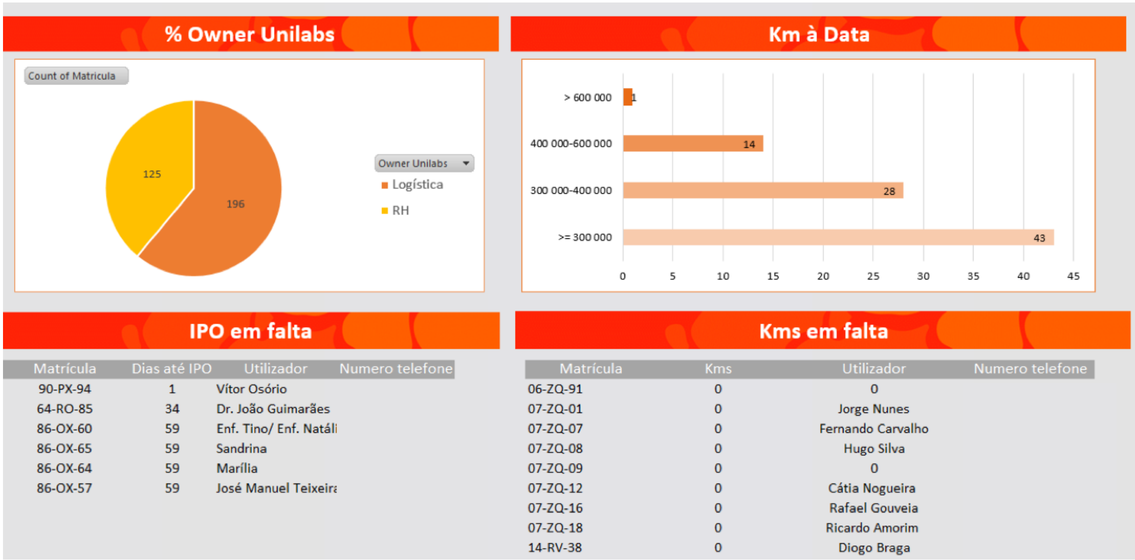


Figure 18: Additional Elements Performance Measurement Dashboard

5.2 Cost Control Dashboard

The cost control dashboard enables the user to have an overview of the expenditures of the logistics operations and creates a comprehensible interface with the user.

This dashboard is composed of three sections: control graphs, monthly expenditure and quarterly expenditure. The structure was developed in collaboration with the fleet manager to meet his needs, creating a dynamic tool, of simple perception, with relevant information.

The control graphs section, in Figure 19, allows for an easy grasp of the evolution of relevant cost categories throughout every month. The first figure shows the evolution of fuel costs and the second the toll service evolution. A third graph was developed, translating the "Kms" database into a graph to show fleet operations volume per month. The fleet operations volume can be easily compared to cost category expenditure. Furthermore, these figures can easily be filtered, allowing for an analysis of expenditures of individual vehicles.

Figure 19: Control Graphs - Cost Control Dashboard

The monthly expenditure section, shown in Figure 20 was developed so that the fleet manager could have a perception of how other expenditures, such as parking services, mandatory inspections costs or vehicle taxes, are evolving. Even though these were not considered as relevant in the ABC analysis, the fleet manager requested their presence in the dashboard created to have an overview of all costs could be created and to be able to track down cost fluctuations.

Unilabs

	2020	1	2
Custos Variáveis			
Combustível			
	Galp - Standard	3717,81	704,08
	Repsol - Standard	48493,72	49879,19
Via Verde		13128,27	13758,83
Manutenção		15522,46	21890,91
Pneus		4962,62	2929,49
Custos Fixos			
Seguros		5266,86	5266,86
Custos Aquisição			
	Leasings	59269,89	59269,89
	Rentings		
	Outros		
InoSat		0,00	208,78
MOD			
FTEs		38569,85	33539,03
Outros			
IPO			
IUC		579,23	579,23
Parques			
Total		189510,71	188026,28
KM percorridos		408.963,00	441.393,00
Custo/Km		0,463	0,426

Figure 20: Monthly Expenditure - Cost Control Dashboard

The quarterly expenditure, in Figure 21, was included since the logistics department has to present a quarterly report on logistics activities to the COO. This section is composed of all cost category items, separated by: variable costs, fixed costs, FTEs and others. Three groups of values are shown in this report's columns: the actual cost, the item percentage of total costs and the cost per km travelled. Still in this section, and to speed up the process of exportation of data, the export of the quarterly report was automated, through *VBA* program in *Excel*. The user is only required to click on a button, named "Report Emission", and a pdf document is automatically created and saved, ready to be sent to management teams.

Unilabs 1º TRIMESTRE

Custo/Km	€	0,418
Km Percorridos		1.248.902,00

Emitir Relatório

Custos	Valor		Custo/km	%
Variáveis			**0,19 €**	**45,3%**
Via Verde	38.124,42 €		0,03 €	7,3%
Combustível	137.430,01 €		0,11 €	26,3%
Manutenção	52.405,09 €		0,04 €	10,0%
Pneus	8.820,29 €		0,01 €	1,7%
Fixas		€	**0,15**	**34,8%**
InoSat	208,78 €	€	0,00	0,0%
Rendas	166.726,67 €	€	0,13	31,9%
Aluguer		€	-	0,0%
Seguros	14.816 €	€	0,01	2,8%
MOD			**0,08 €**	**19,6%**
FTEs	102.103,07 €	€	0,08	19,6%
Outros		€	**0,00**	**0,3%**
IUC	1.629,37 €	€	0,00	0,3%
IPO	- €	€	-	0,0%
Parques Estacionamento	- €	€	-	
Faturas a dinheiro		€	-	0,0%
Total	**522.263,43 €**	**€**	**0,42**	**100%**

Figure 21: Quarterly Expenditure - Cost Control Dashboard

The process of gathering data before this data processing step was introduced was extremely operationally demanding. The average time spent before and after the implementation of optimizations described above is shown in Table 12. These times were measured at the time of development of the first quarterly report for 2020. Even though the time for processing of first action is the same, the total time for data processing was reduced by around 74%.

Table 12: Process Time Optimization

Step	Time Spent Before Automation	Time Spent After Automation
Download of data from suppliers' platform	182 mins	182 mins
Copy and Paste of supplier extracts to *Excel* worksheet	13 mins	0 mins
Error identification and correction	138 mins	0 mins
Data gathering and filtration	124 mins	0 mins
Data visualization and graph construction	186 mins	0 mins
Report creation and pdf export	27 mins	0 mins

Apart from the optimization of processing time, the main benefit of this automation is to being able to have significant information for decision making. The fleet manager and logistics director can make decisions based on information and act in the most cost-efficient way.

5.3 Quality Control Dashboard

As mentioned before this dashboard was created separately in order to guarantee multi-departmental accessibility. The dashboard shown in Figure 22 is comprised of 3 graphs. The first one shows the number of occurrences per day as a way of showing historical data and determining the evolution of these occurrences. The second graph refers to the sector responsible for a given episode since it can be the Logistics Department to place the data logger in the wrong place or of the care unit network, which may not place enough ice accumulators inside the transport containers. The final graph shows a ratio of efficiency of corrective actions taken, if they produced positive results or not. This last metric is updated 2 weeks after the registration of the occurrence.

Figure 22: Quality Control Dashboard

5.4 Suppliers

In Chapter 3 some important suppliers were identified as being strategically relevant for implementation of focused control and negotiation.

During 2019, the Unilabs fleet had two different fuel suppliers. Since this item was classified as A in the ABC analysis, the need for negotiation of contracts and improvement of relationship with suppliers emerged. The negotiation was based on a migration of all vehicles of the fleet to a unique fuel supplier in exchange for adjusted discounts on the price of the fuel. The contract was adjudicated to a sole fuel supplier, translating in an average saving of 48k€ per year.

Similarly, the external transportation, which was classified as B, also demands an individual improvement. Given that Unilabs' strategy is to expand geographically, the external transportation becomes increasingly important since it functions as a support for fleet operations, increasing the reach of Unilabs' operations.

In the beginning of March, a new route was defined out of necessity, since a *drive thru* unit for SARS-CoV-2 diagnosis was established in Lisbon. External transportation is not suitable for this type of transportation due to the samples' hazardous nature. This route was defined so that it could absorb other routes that were being externalized. The absorption of these routes into internal logistics enabled an average yearly reduction of 33k€.

Chapter 6

Conclusion

Even though fleet asset management has continously proven to be a crucial element of not only the logistics department but of the Unilabs business as a whole, its monitoring was rather basic, including only invoice approval and minimal cost-analysis as key tasks. The expansion strategy of the company over the past years, through integrating numerous businesses, causes significant adversities particularly in the integration of the operations into Unilabs' and managing logistics capacity. Therefore, investing in the data integration and cost control of the operations became a priority. It was time for Unilabs to have a system up to the challenge of managing such an increasingly complex fleet asset management structure.

The scope of optimization started with the analysis of the AS-IS status of the department, through a description of the challenges faced and, subsequently, a detailed description of its operations. The current state of cost control was analysed, with the aid of ABC analysis to identify essential rubrics to monitor. Even though the analysis brought insights to which cost items were relevant, it was somewhat seconded, since the fleet manager's needs were prioritized at this first assimilation stage.

The main goal was then clearly defined: implementing a tool for fleet management in Unilabs' Logistics Department, adaptable to various levels. In short, data manipulation processes, which were still done manually, were eliminated and automatized, translating in significant time-saving improvements. Data visualization was enhanced, enabling an improved data-driven decision making. Furthermore, the performance of the logistics department started to be measured, using the SMART performance measurement system for modelization and KPIs for operationalization.

The implementation of this model was processed through the development of a sub-divided platform for data visualization as to facilitate the quick access to the relevant information and in an intuitive way. The dashboards created were tested and approved by the fleet manager and logistics director in order to improve functionality and usage in the future.

The approach used in this project was definitely a preventive future-forward one, allowing for a greater comfort aligned with the expected increased complexity of the fleet in coming years. To provide an example, the implemented cost control platform already allows for easy addition of new companies and volume of vehicles to the data set. Moreover, the fleet management performance system allows for a more comprehensive analysis of how the department is achieving its goals, allowing teams to adapt to new circumstances, act accordingly and in the most cost-efficient way. All of this makes Unilabs a more agile company, ready to deal with any arising challenges, a point worth reflecting upon. It was clear that although the methodology implemented substantially improved the fleet management at Unilabs, there are still some improvement points and despite having them already identified, it is important to notice that one of the keys to success is a continuous change management and thus the acknowledgement that not everything can be done at once.

Additionally, the SMART pyramid does not have a continuous improvement section. This is a weakness of the system chosen that was bypassed though the modelization and adaptation of the flexibility section of the pyramid and definition of KPIs to address it.

Finally, the implementation of the framework was well received by those involved, with motivation to adapt to this new way of working. Hence, in order to ensure the well functioning and sustainability of the framework, it would be essential to define follow-up meetings to further improve it and guarantee the correct utilization of the dashboard. Again, it is important to keep improving the system now with the involvement of more users of the interface to make sure it is also fitting their needs and preferences.

Future Work

Some actions that were not concluded, either due to time constraints or by strategic decision, still need to be followed-up.

The first point already mentioned was the implementation of the KPIs for the top level of the SMART pyramid - market and financial sections. This point is to be completed in the short-term, falling under the category of future work due to project time-constraints.

In the medium term, the KPIs and fleet management framework are to be expanded into the whole logistics department. The first step of this plan would be to develop KPIs and a subsequent visualization platform for the warehouse section of the department. This would be established in collaboration with the procurement team in order to have a more realistic and advantageous solution. The second action would be to develop the performance measurement system for the route operations, to control and monitor sample arrival to the central lab. The dashboards created would be accessible only for the coordinator responsible for a specific process, as we should also assure data regulation compliance. A parallel implementation process could also be put in place regarding the SRM process. Even though the segmentation step has already been achieved for the current suppliers, the governance, performance management and supplier development are still not in place. This would be of key importance, given that the correct integration of a SRM process can create competitive advantages, leverage on supplier capabilities and improve security of the supply.

Looking into the long-term, the goal would be to integrate all performance measurement platforms into a unique one, so that the logistics director could have an overview on the functioning of this department and improve the control. A suggestion would be to perform this integration in a more advanced tool such as *Power Bi* in order to improve visualization and data processing speed.

Bibliography

Abrahamsson, M., Aldin, N., and Stahre, F. (2003). Logistics platforms for improved strategic flexibility. *International Journal of Logistics Research and Applications*, 6(3):85–106.

Alinejad, E. A., Pishvaee, M. S., and Naeini, A. B. (2018). Key success factors for logistics provider enterprises: an empirical investigation in Iran. *Kybernetes*, 47(3):426–440.

Ayers, J. B. (2001). *Handbook of Supply Chain Management*. St. Lucie Press.

Deloitte AG (2015). Supplier Relationship Management - Identifying and maximising the value of strategic supplier partnering. https://www2.deloitte.com/content/dam/Deloitte/ch/Documents/process-and-operations/ch-en-operations-supplier-relationship-management.pdf.

Fawcett, S. E. and Cooper, M. B. (1998). Logistics Performance Measurement and Customer Success. *Industrial Marketing Management*, 27(4):341–357.

Kaplan, R. S. and Norton, D. P. (1996). *The Balanced Scorecard: Translating Strategy Into Action*. Boston: Harvard Business School Press.

Lynch, R. L. and Cross, K. F. (1991). *Measure up! The Essential Guide to Measuring Business Performance*. Mandarin, London.

Mardiasmo, D., Tywoniak, S., Brown, K., and Burgess, K. (2008). Asset management and governance - An analysis of fleet management process issues in an asset-intensive organization. *2008 1st International Conference on Infrastructure Systems and Services: Building Networks for a Brighter Future, INFRA 2008*, pages 1–6.

Munir, M., Jajja, M. S. S., Chatha, K. A., and Farooq, S. (2020). Supply chain risk management and operational performance: The enabling role of supply chain integration. *International Journal of Production Economics*, 227:107667.

NHS (2009). Report of the Second Phase of the Review of NHS Pathology Services in England. http://microtrainees.bham.ac.uk/lib/exe/fetch.php?media=review_report_final_proof08.pdf.

Parmenter, D. (2015). *Key performance indicators : developing, implementing, and using winning KPIs*. John Wiley & Sons, Inc, 3 edition.

Person, R. (2009). *Balanced Scorecards & Operational Dashboards with Microsoft ® Excel ® Create Balanced Scorecards and operational dashboards that drive success Companion Web site*. Wiley Publishing, Inc.

PricewaterhouseCoopers (2013). Supplier Relationship Management - How key suppliers drive your company's competitive advantage. https://www.pwc.nl/nl/assets/documents/pwc-supplier-relationship-management.pdf.

Ramly, N. N., Ismail, A. Z., Aziz, M. H., and Ahmad, N. H. (2011). Operations dashboard: comparative study. *International Conference on Graphic and Image Processing (ICGIP 2011)*, 8285(Icgip):830–834.

Rushton, A., Croucher, P., and Baker, P. (2010). *The Handbook of Logistics and Distribution Management: Understanding the Supply Chain*. Kogan Page Limited, 4 edition.

Sandberg, L. H. &. E. (2020). Exploring key logistics characteristics supporting embeddedness in retailers' geographical expansion. *The International Review of Retail, Distribution and Consumer Research*, 30(1):1–26.

Spüntrup, F. S. and Imsland, L. (2018). Asset fleet management in the process industry - a conceptual model. *IFAC-PapersOnLine*, 51(18):281–286.

Stank, T. P., Daugherty, P. J., and Gustin, C. M. (1994). Organizational Structure: Influence on Logistics Integration, Costs, and Information System Performance. *International Journal of Logistics Management*, 5(2):41–52.

Stefanović, N. and Stefanović, D. (2011). Supply chain performance measurement system based on scorecards and web portals. *Computer Science and Information Systems*, 8(1):167–192.

Supply Chain Council (2012). Supply Chain Operations Reference Model. *Supply Chain Operations Management*, pages 1–976.

Tseng, S. M. (2014). The impact of knowledge management capabilities and supplier relationship management on corporate performance. *International Journal of Production Economics*, 154:39–47.

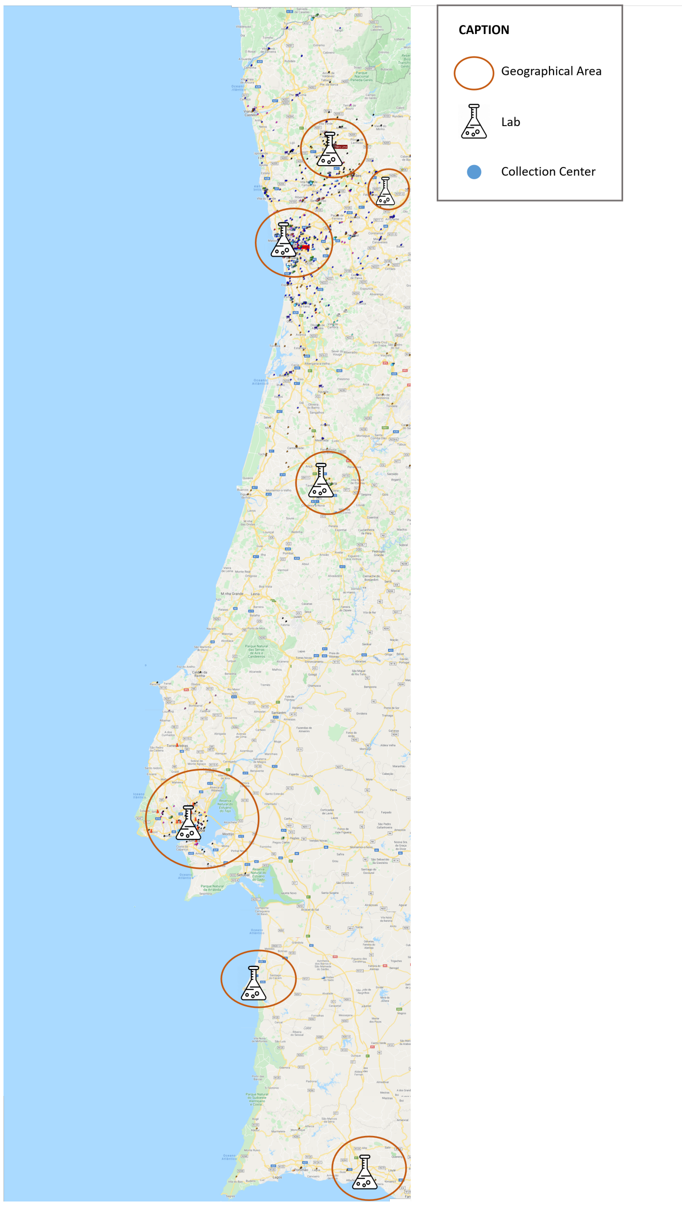
Vázquez-Ingelmo, A., García-Peñalvo, F. J., Therón, R., and Conde, M. Á. (2020). Representing data visualization goals and tasks through meta-modeling to tailor information dashboards. *Applied Sciences (Switzerland)*, 10(7):06–23.

Voelker, K. E., Rakich, J. S., and French, G. R. (2001). The balanced scorecard in healthcare organizations: A performance measurement and strategic planning methodology. *Hospital topics*, 79(3):13–24.

Wilding, R. (1998). The supply chain complexity triangle: Uncertainty generation in the supply chain. *International Journal of Physical Distribution & Logistics Management*, 28(8):599–616.

Appendix A

Map of Logistics Operations



Appendix B

KPI Description

Name	Definition	Formula	Units	Target Value	Frequency
CO_2 Emissions	Average CO_2 emissions of fleet	$(\frac{TotalVE}{Totalcars})$	g/km	-20% by 2025	Purchase moment
Fleet Availability	Total time available to perform fleet operations	$1-(\frac{ID}{RD})$	%	98	Daily
Accidents	Total number of accidents up to date	$\sum(A)$	-	-	Weekly
Tickets	Total number of tickets up to date	$\sum(T)$	-	-	Weekly
Time for processing	Time for processing of invoices	$\frac{\sum PT}{Total\,Number\,of\,Invoices}$	Mins.	-	-
Average fleet age	Age of fleet	$\frac{\sum_{n=1}^{n} An}{Total\,Number\,of\,cars}$	Years	-	-
Vehicle 5S	Quality of vehicle regulation compliance	$\sum_{n=1}^{n=10} Cn$	%	90	Weekly
Temperature	Sample temperature compliance	$\sum N\,Alerts$	-	0	Daily
Cost/Km	Expenditures per kilometer travelled	$\frac{VC+FC+FTEs+Other}{Kms\,travelled}$	€/km	0,34	Monthly
Maintenance /Km	Maintenance expenditures per kilometer travelled	$\frac{T+P+O}{Kms\,travelled}$	€/km	0,11	Monthly
Driver Satisfaction	Driver satisfaction concerning fleet manager's service provided	$\frac{\sum on-time\,tasks}{total\,tasks}$	%	95	Quarterly

Appendix C

5S Template

5s

1.SEIRI

Triar o que é necessário e o que não é necessário

2.SEITON

Organizar o necessário de forma simples e visual

3.SEISO

Limpar a área e repor as condições iniciais dos equipamentos

4.SEIKETSU

Normalizar para manter as novas condições

5.SHITSUKE

Sustentar para cumprir e melhorar

Método para **organizar os espaços** de trabalho e aumentar a **eficiência**

5S corresponde m a **5 passos** que começam todos com **S em japonês**

Auditoria 5s

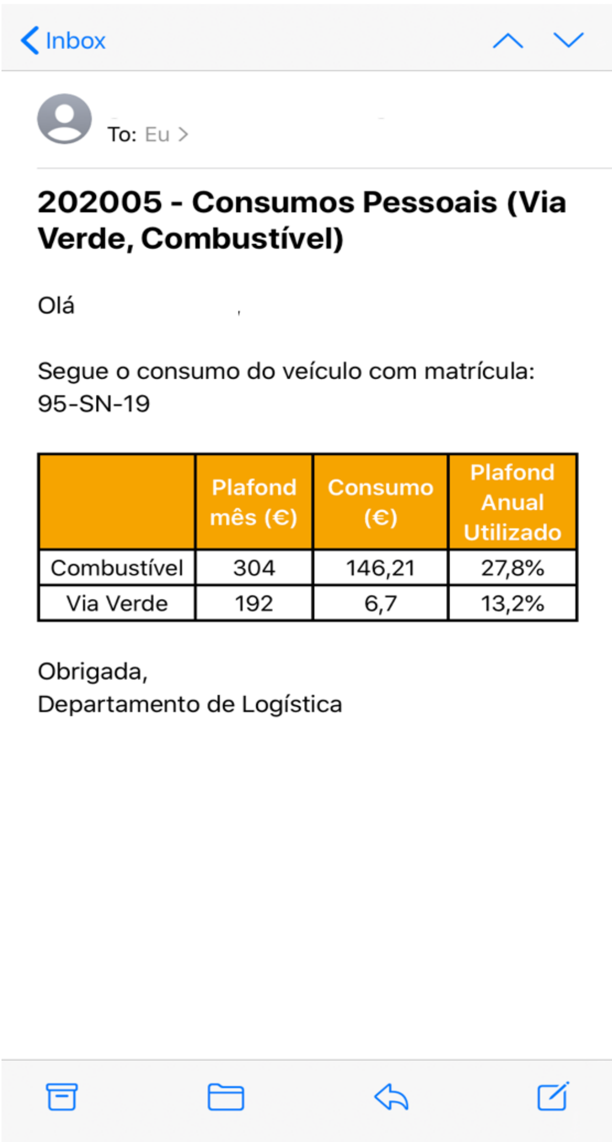
Data	
Viatura	

#	Tipo	Descrição	OK	NOK
1	**Fardamento**	O motorista encontra-se devidamente fardado e apresentado?		
2	**Malas**	As malas encontram-se limpas no seu interior e exterior e sem cheiros?		
3	**Viatura**	A viatura está lavada e não apresenta danos que não estejam identificados (B.I. do veículo)?		
4	**Viatura**	A mala da viatura e habitáculo encontram-se limpos e organizados, contendo apenas material necessário ao desempenho das funções?		
5	**Viatura**	Os pneus estão OK (pressão e estado)?		
6	**Viatura**	Há água no limpa pára-brisas?		
7	**Viatura**	Óleo do motor e água de refrigeração estão OK?		
8	**Viatura**	Loggers encontram-se devidamente acondicionados na respetiva mal?		
9	**Viatura**	Motorista tem consigo toda a documentação da viatura (carta verde, folha IPO e DUA)?		
10	**B.I. Veículo**	Inspeção e manutenções preventivas estão atualizadas no B.I.? Há alguma em atraso?		
TOTAL				

Appendix D

E-mail for Cost Control

D.1 E-mail Example


Inbox

To: Eu

202005 - Consumos Pessoais (Via Verde, Combustível)

Olá ,

Segue o consumo do veículo com matrícula: 95-SN-19

	Plafond mês (€)	Consumo (€)	Plafond Anual Utilizado
Combustível	304	146,21	27,8%
Via Verde	192	6,7	13,2%

Obrigada,
Departamento de Logística

D.2 E-mail VBA Code

```
Sub Send_Files()

    Dim C, x As Integer
    Dim OutApp As Object
    Dim OutMail As Object
    Dim sh As Worksheet
    Dim cell As Range
    Dim FileCell As Range
    Dim rng As Range
    Dim HtmlContent As String

    Set sh = Sheets("Resumo")
    C = 1
    While sh.Cells(8 + C, 6) <> ""
    C = C + 1
    Wend
    Set OutApp = New Outlook.Application
    Set OutApp = CreateObject("Outlook.Application")

    x = 0
    For x = 0 To C

        If Cells(x + 8, 5) Like "?*@?*.?*" Then
            Set OutMail = OutApp.CreateItem(0)
            MsgBox (Cells(x + 8, 5))
            With OutMail
                HtmlContent = "Olá " & Cells(8 + x, 2) & ",<br>
                <br> Segue o consumo do veículo com matrícula: " & Cells(8 + x, 6) & "<br>
                <br><style> td,th {border:2px black solid !important} table {border-collapse:collapse}</style>
                <table style=text-align:center>
                <thead style=background-color:#F6A500;color:white;border:2px solid black><tr>
                <th style=width:4cm></th><th style=width:4cm>Plafond mês (€)</th><th style=width:4cm>Consumo (€)</th>
                <th style=width:4cm> Plafond Anual Utilizado</th></tr></thead><tbody><tr><td>Combustível</td>
                <td>" & Cells(8 + x, 15) & "</td><td>" & Cells(8 + x, 14) & "</td>
                <td>" & Format(Cells(8 + x, 18), "0.0%") & "</td></tr><tr><td>Via Verde</td>
                <td>" & Cells(8 + x, 9) & "</td><td>" & Cells(8 + x, 8) & "</td>
                <td>" & Format(Cells(8 + x, 12), "0.0%") & "</td></tr></tbody></table>
                <br> Obrigada, <br> Departamento de Logística"
                .To = Cells(x + 8, 5).Value
                .Subject = Cells(4, 4) & " - Consumos Pessoais (Via Verde, Combustível)"
                .HTMLBody = HtmlContent
             .Send

            End With
            Set OutMail = Nothing
        End If
    Next
    Set OutApp = Nothing
    With Application
        .EnableEvents = True
        .ScreenUpdating = True
    End With
End Sub
```