Implementing Kaizen as a Strategic Priority in a Construction and Maintenance Company

Margarida de Pinto e Sá

Master's Dissertation

Supervisor at FEUP: Prof. António Carlos Corte-Real de Sousa
Supervisor at Company: Eng. Sérgio Reis

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"Sometimes I'll start a sentence and I don't even know where it's going.

I just hope I find it along the way"

Michael Scott

Abstract

This thesis focuses on the implementation of Kaizen as a strategic priority within Company X, a construction and maintenance company. The primary objective of this project was to integrate Kaizen principles into the company's strategic framework, aiming to improve operational efficiency and financial performance. The key objectives included restructuring technical teams, implementing a variable remuneration model, and enhancing employee versatility. Additionally, the long-term goal was to foster a culture of continuous improvement within the organization.

The methodology employed in Project Y involved a comprehensive analysis of the company's operations, utilizing the Value Stream Mapping methodology to identify inefficiencies and areas for improvement. Several projects were initiated, including Employee and Management Engagement in Continuous Improvement, a New Organizational Model for Technical Teams, Training Programs for Technicians, and the Implementation of a Variable Compensation Model.

While the initial initiatives did not immediately result in significant financial savings, they laid the foundation for ongoing improvement. These foundational efforts established a more agile and adaptable organizational structure, fostering talent retention and development, and standardizing critical processes. Moreover, they cultivated a culture of continuous improvement, empowering employees at all levels to contribute to the organization's growth and success.

To maximize the benefits of these initiatives, ongoing development is essential. Expanding the training program to additional teams, enhancing the Variable Pay Model, and standardizing the Construction Projects' Coordination process are recommended. These efforts will contribute to the company's sustained success and long-term growth.

In conclusion, this thesis outlines the implementation of Kaizen as a strategic priority within Company X, offering insights into its potential applications within the construction and maintenance sectors. The findings validate the effectiveness of Kaizen methodologies and provide evidence of their relevance in similar organizations where traditional management approaches fall short of meeting quality and cost requirements. This research contributes to the ongoing expansion of the Kaizen approach in comparable organizations, enhancing their competitiveness in a dynamic business environment.

Resumo

Implementação do Kaizen como Prioridade Estratégica numa Empresa de Construção e Manutenção

Esta tese foca-se na implementação do Kaizen como prioridade estratégica na Empresa X, uma empresa de construção e manutenção. O principal objetivo deste projeto foi integrar os princípios Kaizen no quadro estratégico da empresa, visando melhorar a eficiência operacional e os resultados financeiros. Os principais objetivos incluíram a reestruturação das equipes técnicas, a implementação de um modelo de remuneração variável e o aumentado da polivalência dos técnicos. Além disso, o objetivo a longo prazo era o de promover uma cultura de melhoria contínua dentro da organização.

O Projeto Y envolveu uma análise abrangente das operações da empresa, utilizando a metodologia de Value Stream Mapping para identificar ineficiências e áreas de melhoria. Vários projetos foram iniciados, incluindo o Envolvimento dos Trabalhadores para a Melhoria Contínua, um Novo Modelo Organizacional para as Equipas Técnicas, um Programa de Formação para Técnicos e a Implementação de um Modelo de Remuneração Variável.

Embora as iniciativas iniciais não tenham resultado de imediato em resultados financeiros significativos, estabeleceram as bases para a melhoria contínua. Esses esforços fundamentais estabeleceram uma estrutura organizacional mais ágil e flexível, promovendo a retenção e o desenvolvimento de talento e standardizando processos críticos. Além disso, cultivaram uma cultura de melhoria contínua, capacitando funcionários em todos os níveis a contribuir para o crescimento e sucesso da organização.

Para maximizar os benefícios destas iniciativas, o desenvolvimento contínuo é essencial. Recomenda-se a expansão do programa de formação para as equipas de Suporte, a melhoria do Modelo de Remuneração Variável e a standardização do processo de Coordenação de Projetos de Construção.

Em conclusão, esta tese descreve a implementação do Kaizen como prioridade estratégica na Empresa X, apresentando insights sobre as suas possíveis aplicações nos setores de construção e manutenção. As conclusões validam a eficácia da metodologia Kaizen e fornecem evidências de sua relevância em organizações semelhantes, onde modelos de gestão tradicionais não são capazes de responder aos requisitos cada vez mais exigentes de qualidade e custo. Esta dissertação contribui, assim, para a expansão contínua da abordagem Kaizen em organizações comparáveis, aprimorando a sua competitividade num ambiente de negócios dinâmico.

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It wouldn't feel right to write this dissertation and not use the Acknowledgments section as an excuse to put into writing the thoughts and feelings that have run through my mind as I come to finish this 5-year journey at FEUP. After all, I spent almost a quarter of my life preparing for this.

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Contents

Acronyms and Symbols

CI	Continuous Improvement
CRM	Customer Relationship Management
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization
EPC	Engineering, Procurement and Construction
EV	Electric Vehicle
FTE	Full-Time Equivalent
FTF	First-Time Fix
GQCDM	Growth, Quality, Cost, Delivery, Motivation
KBS	Kaizen Business Sytem
KI	Kaizen Institute
KPI	Key Performance Indicator
MCR	Mission Control Room
MOC	Major Oil Company
OPL	Operational Performance Levels
PMO	Project Management Officer
P&L	Profit & Loss
RPA	Robotic Process Automation
SLA	Service-Level Agreement
SO	Service Order
SW	Standard Work
TFM	Total Flow Management
TL	Team Leader
TPS	Toyota Production System
VSM	Value Stream Mapping

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Chapter 1

Introduction

This dissertation project reflects on the work conducted over a 5-month period at Kaizen Institute (KI), a global consulting firm. The dissertation project emerged within the context of an agreement between KI and one of its client companies for the implementation of "Project Y". Due to confidentiality reasons, the client company will be referred to as "Company X" throughout the document. All values regarding the company in the present document were scaled by a random numeric constant.

Company X provides services in the fuel retailing industry, such as the maintenance of fuel pumps, small installations, and the construction of complete fuel infrastructures, as well as the installation and maintenance of Electric Vehicle (EV) charging stations. It inserts itself in a sector in which operational excellence is a key factor for the competitiveness of businesses.

Project Y has a duration of 2 years and aims to improve the client's operational and financial performance, by increasing the efficiency of its teams and the quality of the services provided. The scope of this dissertation includes the first cycle of Project Y as its focal point.

1.1 Project's Context and Motivation

Globalization, the post-pandemic period, and the economic instability resulting from political conflicts in Europe have forced an increasingly fast-paced environment of change, where rapid reaction and adaptation are crucial for the survival of organizations. Alongside constant change, increased market competitiveness is also a present challenge for companies. The application of the Kaizen philosophy (*Kaizen* - a Japanese word meaning "change for the better" or "continuous improvement") and Kaizen Change Management presents itself as a strategy for improvement, growth and profitability. It allows companies not only to survive these challenges but to transform into "dantotsu" companies (*dantotsu* - a Japanese word used to refer to a company that stands out as the best). In this context, Company X also recognized the need to foster a culture within its organization where employees are receptive to change and actively engaged in continuous improvement. With its long-term strategy, the Kaizen methodology offers an effective approach to achieving Business Excellence in any organization, irrespective of its sector and size. Thus, KI

was challenged to initiate a two-year strategic program that consists of a plan coordinated by top management to create and maintain a culture of Continuous Improvement (CI) at all levels of the organization.

Project Y was initiated with an assessment of Company X's state, which revealed a set of inefficiencies throughout the organization like the lack of normalization of roles and processes, especially in leadership positions, insufficient access to relevant data, and an overall lack of employees' commitment to the growth and improvement of the company.

The first cycle of Project Y (the scope of this dissertation) places its primary focus on the management model of technical teams and on the work developed by the Operations departments, as these have the most significant impact on the company's operational performance and also present substantial opportunities for improvement. It serves as the foundation of the cultural transformation needed for the remaining initiatives that will take place in future cycles of this project. A further explanation of the company's organization, the initial state of each department, and what originated this project is presented in Chapter 3.

1.2 Kaizen Institute

Kaizen Institute is a global consulting firm specializing in continuous improvement methodologies, in particular the Kaizen philosophy. It was founded in 1985 by the Japanese thought leader Masaaki Imai. Masaaki was responsible for spreading the Kaizen philosophy around the globe, much due to the work done in his book, "KAIZEN: The Key to Japan's Competitive Success". KI currently operates in more than 45 sectors in over 60 countries; Figure 1.1 showcases KI's presence around the globe.

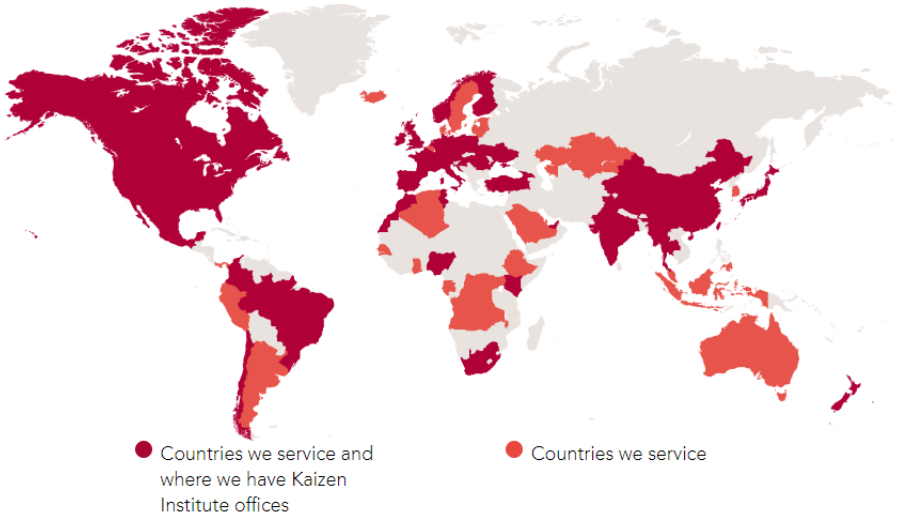

Figure 1.1: Presence of Kaizen Institute Worldwide. Source: Institute (2023b)

Kaizen Institute Portugal was founded in 1999, in Porto, and has since expanded to 2 other offices, in Coimbra and Lisbon. It has developed projects in a variety of companies and industries,

namely in the Production, Logistics, Retail, Public Administration, and Health sectors.

1.3 Company X

Company X is a Portuguese company primarily engaged in the Facility Management market, taking on the comprehensive technical aspects of buildings' infrastructure, equipment, and facilities. It specializes in the construction and maintenance of fuel stations. Company X belongs to a corporate group, hereby designated as "Group A", which comprises several private companies focused on the production, marketing, distribution, and technical support of equipment and management systems for the petroleum and convenience retail industries.

The first company of the group, "Company Y", was founded in Portugal, in the XIX century, and initiated its activity with technical assistance to petrol stations. After being granted the manufacture of fuel dispensers by the Portuguese Ministry of Industry, Company Y began expanding its business to the manufacturing sector. As business volume grew, it became necessary to separate the manufacturing business from the technical assistance one. Thus, Company X was created, about 40 years ago, focusing solely on providing facility management services to petrol stations. As an Iberian Leader, Group A currently operates in more than 84 countries through its organized network of representatives and more than 1000 employees, holding the position of a Global Player in the sector.

Company X develops its activity in the Iberian Peninsula, within Group A's "Engineering and Services" business area. It presents the following services:

- Engineering, Procurement and Construction (EPC):
  - EPC solutions for gas stations providing a detailed perspective on the construction project;
- Services:
  - Technical Assistance - providing preventive and curative maintenance services to service stations, both on-field and by remote access;
  - Repair Centre – providing repair and re-manufacture services for multi-brand electronic and mechanical equipment;
  - Electric Mobility – installation and maintenance services for electric vehicle charging stations.

1.4 Objectives

The main goal behind this project was to implement Kaizen as a strategic priority in Company X. To achieve this, several objectives were prioritized:

- Improve the organizational model of technical teams:

  - Implement a clear management model for technicians and leaders, aimed at structured problem-solving and increased levels of productivity and quality of service;
  - Standardize leadership roles and formalize them in a manual, with a focus on the new roles of Technical Support, Maintenance Coordinator, and Construction Coordinator.

- Improve employee retention and productivity:
  - Implement a variable remuneration model that promotes productivity, meritocracy, and satisfaction amongst employees.

- Achieve flexibility in the organization through increased versatility of employees:
  - Identify teams' competency gaps and create a plan to train employees, with respect to geographic distribution, type of intervention, and criticality of operations.

Besides, as a long-term goal, it is expected to develop a culture of continuous improvement in the company so that it can continue to improve its performance even after the project is finished. In order to better guide the evolution of this project, a set of main indicators was defined:

- Increase the achievement rate of Service Level Agreement (SLA) - agreed-upon levels of service quality (in terms of response time) with each customer;
- Increase First-Time Fix (FTF) - measures the percentage of times a technical issue is resolved during the first visit or interaction with the customer or equipment;
- Decrease voluntary employee turnover - the rate at which employees voluntarily leave the company and need to be replaced by new hires.

Overall, as an academic research project, this dissertation seeks to reflect on the implementation of Kaizen methodologies within construction and maintenance services providers, particularly for the fuel retail industry. It aims to analyze the findings obtained from Company X in order to gain insights into the practical application and effectiveness of Kaizen in this context and the possible applicability to similar business sectors.

1.5 Project Organization

The thesis project consists of four main phases, as shown in Figure 1.2.

In the initial phase, it was crucial to collect information and assess the company's initial situation in order to understand its context, including its business model, organizational structure, and operational processes. To achieve this, the Value Stream Mapping (VSM) methodology was employed, complemented by a Benchmarking analysis against Group A's performance.

Based on the diagnostic findings, a clear picture of the initial state and the envisioned future state was crafted. Solutions were then conceptualized for each identified improvement opportunity.

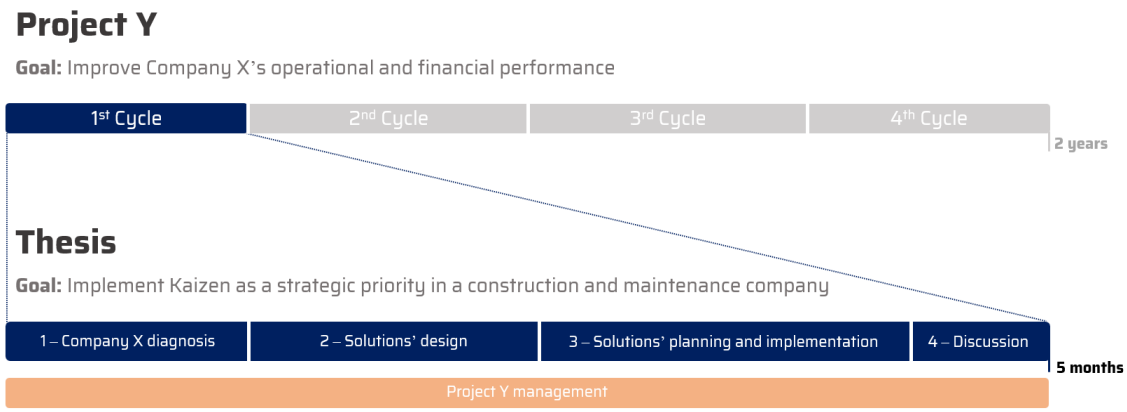

Figure 1.2: Project Organization. This thesis focuses on the 1st cycle of Project Y and is divided into 4 stages. The goal is to implement Kaizen as a strategic priority in Company X

In the third phase, the implementation of these solutions began, or they were planned for future stages, in close collaboration with the client.

Finally, the achieved results were evaluated and compared to the established objectives, and the next steps were recommended to facilitate the company's continued improvement of its performance. Alongside these developments, the thesis also sought to stimulate reflection on the application of diverse tools and best practices pertinent to the management of a two-year strategic project.

1.6 Structure

This dissertation is divided into six chapters:

- Chapter 1: Introduction to the project, outlining its objectives and the methodology employed to achieve those goals;
- Chapter 2: Theoretical foundation for the project, presenting relevant methodologies and concepts applied throughout the research, which supports the designed solutions, and evidence on the relevance of this thesis' subject;
- Chapter 3: Characterizing the initial situation of the company, identifying and describing the root causes of the problems that were encountered, as well as improvement opportunities;
- Chapter 4: Solutions to the identified problems are presented, along with a detailed vision for the future situation;
- Chapter 5: Outcomes of the solutions covered in the preceding chapter;
- Chapter 6: Summary of main conclusions drawn from the research, lessons learned throughout the project, and prospective initiatives that can help amplify the work developed.

Chapter 2

Literature Review

This second chapter serves as a comprehensive exploration of the relevant literature supporting the developed project. It begins with a broader examination of the Kaizen philosophy and its progression into the Kaizen Business System. Subsequently, it presents the current state of the art on the application of Kaizen in various sectors, with a particular focus on the construction and maintenance sectors. Then, delves into a thorough investigation of successful Kaizen implementation strategies, and culminates with an explanation of some of the specific Kaizen tools and concepts applied in this project.

The search relied mostly on electronic databases (Scopus, Elsevier Science Direct, and IEEE Explorer) and was conducted using the set of primary keywords presented in Table 2.1. Fundamental books on Continuous Improvement were also consulted.

Table 2.1: Literature Review Scope

Topic	**Subtopics**
Kaizen Methodology	Toyota Production System Lean Kaizen Principles Kaizen Business System
Application of Kaizen	Variety of Cases and Results Construction and Maintenance
Sustainable Implementation	Primary Barriers Critical Success Factors
Kaizen Tools	Standard Work Process Mapping

2.1 Kaizen Methodology

Kaizen, from the Japanese *"Kai"* (change) and *"Zen"* (good), refers to continuous improvement, bringing awareness to everyone, everywhere, every day. The key to CI is in small innovations and creative ideas of employees in endless efforts to change (Janjić et al., 2020). The term was coined

in Japan's industrial setting of the '50s and has spread globally since then. To fully understand the development of Kaizen as a philosophy and a strategy, it's important to explore its contextual background.

After World War II ended (1945), Japan was in the process of rebuilding its economy. Companies faced challenges in terms of productivity, quality, and efficiency. At the time, the United States sent several quality control specialists, like Joseph Juran and Phil Crosby, to share their methodologies for improvement. Japanese employees started assimilating this knowledge and developing "quality circles" in which they discussed problems related to quality - the element that became Japan's priority (Coimbra, 2016). This evolution resulted in the Japanese movement of Total Quality Control (TQC) movement. Meanwhile, Toyota was one of the companies dealing with great financial difficulties in the post-war period. Faced with the challenge of improving Toyota's productivity levels without increasing manpower, Taiichi Ohno, an engineer and manager at Toyota Motor Corporation, started looking for ways to eliminate waste - activities that absorb resources but don"t create value (Basu and Wright, 2003). By reflecting on the complete process of production, Ohno concluded that the majority of time was spent on at least one out of seven sources of waste - *'Muda"*:

1. Overproduction (production ahead of demand);
2. Time on hand (people waiting for next production step);
3. Transportation (unnecessary movement of materials);
4. Inventory (materials not being processed);
5. Motion (unnecessary movement of people);
6. Over-processing;
7. Defects (inspecting and fixing).

By following this method, Ohno was able to greatly improve operating efficiency (reduced lead times, improved productivity, and increased quality). Based on the absolute elimination of waste, the Toyota Production System (TPS) was created (Ohno, 1988).

The two pillars of the TPS are Just-in-time (JIT) and *autonomation*. JIT is a system to get "the right parts needed in assembly reach the assembly line at the time they are needed and only in the amount needed" (Ohno, 1988), by implementing the concepts of continuous flow, takt time, and pull system. *Autonomation*, or automation with a human touch, uses machines that autonomously work while preventing errors (Toma and Naruo, 2017). Not only does that stop the production of defective products, but it also frees employees to attend to multiple machines and reflect on improvement measures for when the machine stops.

Lean, the adjective for *containing little or no fat*, is used in the management context to refer to a strategy in line with reducing or eliminating excess (*Muda*), thus focusing on value-added activities (Coimbra, 2016). Although the use of Lean was introduced more than 100 years ago, it has continued to evolve over time. Inspired by TPS, Jim Womack and his associates, MIT professors, described how Toyota drastically reduced its "fat" (stock) and surpassed competitors

in their ground-breaking book, *The Machine that Changed the World*, written in 1990. This was the big start of the *Lean* movement as known today.

While TPS gained consistency, the Japanese thought leader and founder of Kaizen Institute, Masaaki Imai, expanded the concept of Kaizen to the West by writing the book "*Kaizen: The Key to Japan's Competitive Success*" in 1986. Kaizen's methodology is based on five fundamental principles (Institute, 2023b):

1. **Create customer value**: Value is what the customer is willing to pay for. Use a *market-in* approach (instead of *product-out*) to identify customers' interests and enhance their experience;

2. **Create flow efficiency**: Everyone in the organization should aim to eliminate the three Ms - *Muda* (waste), *Mura* (variability), and *Muri* (overburden);

3. **Be Gemba-oriented**: Go to the *Gemba*, the actual place where things take place and where improvement can be made;

4. **Empower people**: Work in teams, develop them, set goals, and provide a system and tools to reach them;

5. **Be transparent**: Speak with real data. Performance and improvements should be tangible and visible. Visual management is a vital tool in Kaizen that highlights problems and allows for quicker response;

Although very similar and often mistakenly used as synonyms, Lean and Kaizen are slightly distinct concepts (Ortiz, 2010). Lean focuses on the result of eliminating waste, while Kaizen is the process to achieve it. The ultimate goal of Lean and Kaizen is Operational Excellence (OPEX) for Business Excellence and the philosophy to improve any process in any sector (Coimbra, 2016). Nonetheless, the literature review found in other sections will include research on both Kaizen and Lean methodologies as relatively similar concepts, in order to obtain a vast collection of studies on the application of Continuous Improvement practices.

2.1.1 Kaizen Business System

Kaizen Institute has developed its own management model - the *Kaizen Business System* (KBS).

KBS (see Figure 2.1) encompasses all aspects of a business and employs a holistic set of tools and techniques to enhance the entire organization, delivering long-term value to the company. Resembling a house, the foundations of this system are composed of three different models: Operations, Growth, and Change, which are applied by KI according to context. On top, lies the five metrics that guide any project: Growth, Quality, Cost, Delivery, and Respect for People (or Motivation) - GQCDM.

The Operations Model focuses on Quality, Cost, and Delivery metrics, applied to the management of flow, logistics, maintenance, service operations, and sourcing. Total Flow Management

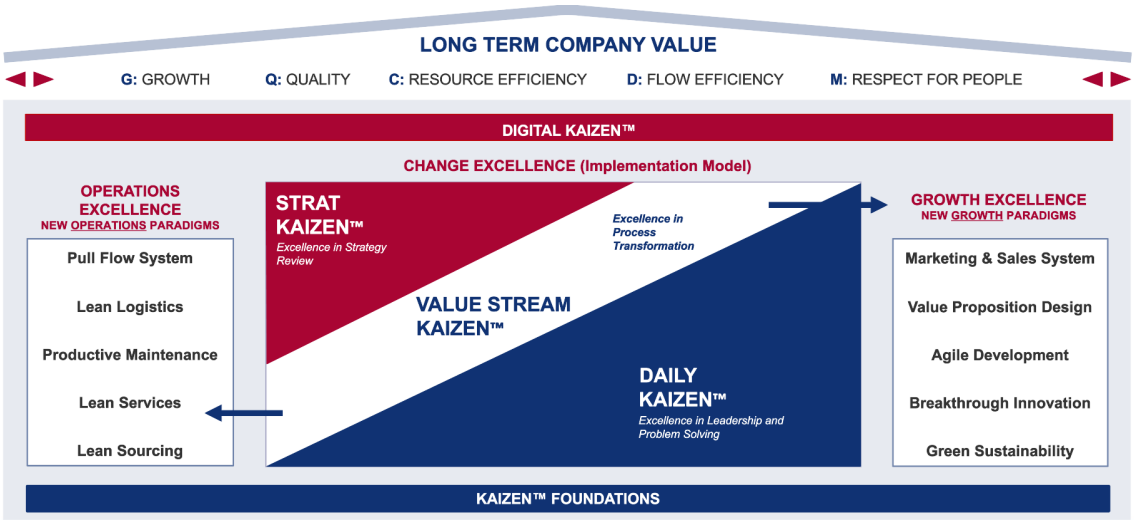

Figure 2.1: Kaizen Business System. Source: Institute (2023b)

(TFM), a management model for integrated logistics, is explained in this pillar. TFM uses pull-flow thinking, the core of the Toyota Production System. It requires coordinating the supply chain in order to obtain an optimal material flow and an optimal information flow (Coimbra, 2013).

The Growth Model emphasizes revenue growth through five areas: marketing and sales effectiveness, value proposition, fast development, breakthrough innovation, and environmental impact.

The Kaizen Change Model is an integrated three-pillar system which enables organizations to create a culture of Continuous Improvement (CI). It is based on three capabilities that organisations need to develop to build competitive advantage (Institute, 2023a):

- Daily Kaizen: Includes Visual Management, Standardization, and Problem-Solving. The goal is to develop people and instill daily Kaizen behaviors in all teams to improve the way the business is run;
- Value Stream Kaizen: Improves business processes by following cycles of *Kaizen events* to solve bigger problems that cannot be solved in Daily Kaizen;
- Strat Kaizen: Finds strategic breakthrough initiatives to transform the business.

A *Kaizen Event* refers to a concentrated and well-organized improvement initiative that involves a dedicated cross-functional team working towards enhancing a specific area of operation, with clearly defined goals, within a short timeframe, typically lasting 3 to 5 days (Glover et al., 2014). The implementation of Kaizen Events at multiple points in time (as done in Project Y), fosters cycles of performance improvement (Doolen et al., 2008), and introduces techniques that help develop an organizational culture that sustains long-term commitment to CI (Glover et al., 2011).

Kaizen Institute's flag, which is incorporated in the visual representation of KBS, and is detailed in Figure 2.2, demonstrates the desired distribution of time for Innovating, Improving, and Performing Standard Work at each level of management.

Figure 2.2: Kaizen Institute Flag. Innovation (red), Improving (white), and Standard Work (blue) are CI areas that leaders should implement according to their level in the organization. Source: Institute (2023a)

2.2 Implementation of Kaizen

The publication of the first journal article on TPS has inspired the creation and evolution of various "models of excellence". Dinis-Carvalho and Macedo (2021) refers to excellence models as detailed descriptions of strategies to attain a competitive advantage in the market. The authors are inclined to conclude that the Kaizen Model, amongst the Toyota Way and the Shingo Model, is one of the most comprehensive excellence models.

Over the past decades, several Continuous Improvement strategies have gained growing prominence as performance improvement methodologies, extending their application beyond the manufacturing sector to various industries (Stone, 2012). Although the Lean philosophy originated with Toyota within the automotive industry, it has expanded far beyond the production sector and found significant application in other sectors, like services. Moreover, Coimbra (2016) states that the Kaizen methodology can be applied to any organization, independently of its sector or size. Table 2.2 presents some of the literature found on the application of Kaizen in various areas.

Despite being the focus of numerous studies and having been applied in companies for several decades, the popularity of Kaizen shows no signs of diminishing (Janjić et al., 2020). Lean principles, exemplified by the Toyota Production System, continue to interest significantly the Operations field (Staats et al., 2011).

A sizeable portion of the literature dwells on the benefits of implementing CI methodologies like Kaizen and Lean manufacturing. Several studies on the benefits of Kaizen implementation in companies from different sectors and geographies stated that Kaizen increases job enrichment, employee motivation, company performance and profit, and customer loyalty. (Cheser, 1998)(Titu et al., 2010)(Quesada-Pineda and Madrigal, 2013) (Desta, 2012) (Doolen et al., 2008).

Table 2.2: Literature on Kaizen implementation, tools used, and achieved benefits

Author	Area	Tools	Main benefits
Abdulmouti (2018)	Manufacturing	TPS; 5S; 7 MUDA; JIT; Kanban	Increased efficiency; Reduced manpower by 27%; Increased annual output by 13%
Feinman et al. (2022)	Healthcare	Value stream mapping	Reduced wait time by 60%; Increased capacity by 20%
Rifqi and Souda (2020)	Facility Management	Standard work; Visual management; 5S; Root-cause analysis	100% availability of spare parts; Reduction of time spent in motion by 85%; MTTR reduction of 50%
Radnor (2010)	Public sector	Workload balancing; Visual management; 5S; Workplace audit	Employee empowerment and development; Improvement of performance; Errors detection and prevention

2.2.1 Kaizen in Construction and Maintenance

Company X, part of the services sector of Group A, is a company that primarily operates in the Field Services market. It takes on the operational and technical responsibilities for the buildings' infrastructure and equipment in the fuel-retail market.

As previously mentioned, there is a vast collection of literature in regard to the application of Kaizen methodologies in the manufacturing sector and its application to achieve similar aims in other sectors has been proposed (See Table 2.2). Nonetheless, to date, the application of Kaizen in the field services environment, namely in the construction and maintenance business, has received relatively little academic attention. Thus, this paper aims to validate the application of Kaizen methodologies in the construction and maintenance sectors. This can provide useful evidence for the continuing extension of the Kaizen approach in similar organizations where traditional management approaches are failing to deliver the necessary quality and cost requirements.

2.3 Applied Kaizen Tools and Concepts

The following sub-chapter introduces some of the specific Kaizen tools used in this project to provide readers with a better understanding of their application.

2.3.1 Leaders' Standard Work

"Where there is no standard, there can be no improvement". According to the famous words by Taiichi Ohno, the man who invented TPS and developed Standard Work (SW), this is one of the most fundamental tools for the Kaizen model. SW consists of a set of work procedures designed to determine the best methods and sequences for each process. This method does not imply handling all forms of work in the same way; it implies the consistency in performing one particular type of work, irrespective of the operator involved (Bragança and Costa, 2015). The reason behind these

limitations is related to the elimination of Mura, aiming to enhance quality, safety, efficiency, and planning (Arezes et al., 2010). It doesn't mean that a work routine can never be changed, as that contradicts the principle of continuous improvement; instead, it suggests the best way to perform a certain work as it is known up to date.

Bragança and Costa (2015) observes that in various implementations of Standard Work, operators do not initially embrace it because they perceive some loss of flexibility and autonomy. This is especially relevant in the case of leaders, who are accustomed to higher levels of independence. However, the concept of SW can also be applied to leaders at various levels of an organization - it is referred to as *Leader's Standard Work*. As explained when presenting the KBS model, leaders need to put more time into Kaizen, through standardization, innovation, and improvement, instead of solely focusing on daily management and "firefighting" (managing surprises, delays, and month-end pressures or solving recurring problems). Kaizen events on Standard Work analyze leaders' current work routines and help build a more value-added vision, thus enabling leadership skills.

Leaders' Standard Work can be challenging at first, but it subsequently eliminates firefighting from the agenda, enabling leaders to focus on strategic change and personnel growth. The tool is composed by five steps:

1. **Set the scope and targets:** Improvement goals must be SMART - specific, measurable, achievable, realistic, and timely;
2. **Study leader's agenda:** Register all tasks performed by the leader during a full week and its time; for each day, the leader uses a DILO - *Day In the Life Of* - form; all tasks are then grouped into main topics (daily management, improvement, operational, etc.);
3. **Improve leader's agenda:** Waste should be eliminated, minimized or concentrated in other entities; brainstorm solutions and check time savings;
4. **Normalize agenda:** Using visual management, design a standard agenda (tasks, time, location, and method) and create standards to monitor its accomplishment;
5. **Consolidate work:** Test and adjust the standard work in the Gemba and create a revision routine to keep the standards updated.

Ultimately, where there is no standard there is no Kaizen and even jobs that require more autonomy are subject to some level of standardization in order to guarantee there is room for continuous improvement.

2.3.2 Process Mapping

Process mapping is a visual tool that allows the study of a specific process within the value chain. It entails developing a map or model that relates activities, individuals, material or information involved in producing a specific outcome (Biazzo, 2002). When optimizing a process, Process Mapping is used to map the current situation of a process to make it transparent and put the entire team at the same level of knowledge. After, improvement opportunities (systematic errors,

rework, bottlenecks, exceptions, etc.) are identified and assessed. The design of the future state is the result of integrating the improvement opportunities with new solution ideas (which can be prioritized based on impact and effort). Mapping the future situation allows for the evaluation of whether all elements align cohesively and provides the team with a clear transformation goal.

A Swimlane Diagram is a type of process map that shows how different groups or individuals contribute to a process. It divides the process into lanes representing roles or departments and uses arrows to display the flow and interactions between them. It's especially helpful when establishing work instructions and training for a new process as it makes each participant's role explicit.

A study on process mapping applied for construction management (Anjard, 1998) states that process maps are excellent tools for evaluating continuous improvement potential for all teams and operations, including field services. By highlighting the step-by-step process, it's possible to identify inefficiencies and pinpoint areas where a change will have a significant impact.

2.4 Sustainable Continuous Improvement

Even though many companies initially experience improvements in operational performance by implementing commonly used and established Kaizen techniques, evidence shows that about 70% of organizational change processes fail to achieve sustainable results in the long run (Schipper and Swets, 2009). Other studies show that less than 10% of companies succeed at properly implementing Lean methods (Bhasin and Burcher, 2006). Oftentimes, acquiring knowledge of specific tools and techniques (5S, Six Sigma, etc.) is not a significant issue but eventually, most of these companies revert back to their traditional methods of conducting business (Costa et al., 2019). Without a full understanding of the Kaizen philosophy and a culture change, the application of isolated techniques leads to limited results that often are lost in the long run. Aoki (2008) points out that expanding the Kaizen philosophy to countries with diverse cultures from Japan (as is the case of Company X, which operates in Portugal) is feasible; however, companies must adhere to and persistently implement the fundamental principles of CI.

Different researchers emphasize that the results of transformation programs depend on several factors - barriers or promoters - which need to be identified and managed. Thus, the present subchapter dwells on the sustainable implementation of CI and what factors can lead to its failure or success.

Various studies have reviewed the critical success factors for a sustainable implementation of Kaizen (Bhasin and Burcher, 2006) (Janjić et al., 2020) (Hailu et al., 2017) (Jadhav et al., 2014) (Desta, 2012) (Oki, 2012) (Bwemelo and Gordian, 2014) (Costa et al., 2019) (Glover et al., 2011). The most relevant factors obtained across the literature are summarized as follows:

1. **Continuous improvement culture:** There should be a developed culture of continuous improvement that encourages change;

2. **Employee engagement:** Every member of the organization should be involved and committed to the long-term sustainability of the organization and to the CI process, such as regularly participating in goal setting, planning, and monitoring of performance;
3. **Top management commitment**: Effective leadership and top/senior management involvement (direct participation in CI programs) are crucial; Managers must be *Gemba-oriented*, transmitting motivation and support to employees by being physically present;
4. **National specifics**: National culture, work ethic, work environment, history, etc. can influence the sustainability of CI;
5. **Internal communication**: There needs to be a developed communication system between top management, heads, and employees; Employees should attend meetings where they can express their opinions and ideas freely;
6. **Organizational structure**: Too bureaucratic organizational structures tend to difficult CI;
7. **Planning:** Adequate planning and project sequencing is critical;
8. **Training**: There should be a training and education program for managers and employees; In most companies under review in the mentioned studies, it was found that workers do not have adequate preparation to understand the tools used in the implementation of Kaizen;
9. **Strategic orientation of employees**: Employees should be familiar with the strategic goals of the company; Employees should be pragmatically oriented to process and results;
10. **Guidance**: There must be clearly defined guidelines and procedures; Management should inform their employees whether they are working well or not; There is a need to have a program that evaluates the achievements and efforts of employees in Kaizen projects;
11. **Autonomy:** Employees must have decision-making skills and be given proper empowerment to implement the ideas defined in Kaizen events;
12. **Resources**: Management should provide resources (economic, physical space, time);
13. **Financial Rewards**: Monetary incentive rewards tied to improvements in operations through CI initiatives tend to foster active engagement from employees.;

Quesada-Pineda and Madrigal (2013) goes beyond and explores the factors affecting sustainable CI in organizations across different regions using exploratory factor analysis. This study also concluded that employee involvement, developing a CI culture, effective communication, and change management were crucial factors. Time itself had little effect on CI, as actions were found to be more relevant. Costa et al. (2019) found commonalities between most of the factors mentioned above, and defined three main categories of variables, described in Table 2.3:

One notable limitation of the existing literature is the inadequate focus on less successful Kaizen events. The literature predominantly highlights highly successful applications of Kaizen,

Table 2.3: Categories of Sustainable CI Variables

Category	Description	Factors included
Cultural	Behavioural aspects of each individual within the organization, encompassing their interactions with others and the organizational environment	1, 2, 3, 4
Organizational	Macro-organizational mechanisms and external aspects that influence the way CI processes are implemented and sustained	5, 6, 7
Managerial	Variables that act as management levers to encourage employee involvement, encompassing aspects related to work organization, coordination at the individual level, and employee empowerment	8, 9, 10, 11, 12, 13

overlooking the importance of understanding and learning from other cases. Farris et al. (2008) presents a case study from a less successful Kaizen event as an opportunity to identify and surpass the primary barriers of Kaizen implementation. By employing data triangulation on event input and process factors, three major factors were identified, which possibly played a significant role in the limited success of the Kaizen event. These were the lack of goal clarity (the method employed to communicate event goals to the team), inadequate selection of event team members (inclusion of members who are critical for the solution design and post-event implementation), and team autonomy (decision-making authority). These results are in line with the conclusions from the previously mentioned studies on the critical success factors for Kaizen implementation.

Chapter 3

Company X Analysis and Improvement Opportunities

By analyzing all areas of the company, a more comprehensive understanding of its situation was attained. Significant improvement opportunities were identified in the Operations and Support departments, as well as in the overall management of the company, that were prioritized for the first cycle. Hence, this chapter will be structured into the following sections, sequentially: an analysis of the company's activities, organization, and financial performance; identification of primary inefficiencies in the Operations and Support departments, and in the organization as a whole; and lastly, a summary of potential improvement opportunities.

3.1 Activity of Company X

Operating 365 days a year, 24 hours a day, Company X develops its primary business by providing continuous technical assistance for the maintenance and repair of multi-brand equipment. Additionally, they offer personalized management of architectural and engineering projects for refueling stations. Besides the Maintenance and Construction segments, the company offers complementary services in 2 other business units:

- Electric Mobility: Guarantees the installation, provision, operation, and maintenance services for all types of EV charging points;
- Repair Centre: Ensures the service of repairing and re-manufacturing multi-brand electronic or mechanical equipment.

The company is divided into 4 functional areas (units), represented in Figure 3.1.

Operations: Adds value to customers by providing them with technical services ("Engineering and Services") across 4 business units, also referred to as departments;

Support: Provides administrative support to the organization, by contacting customers, processing invoices, and planning the technicians' services;

Sales: Builds and maintains strong relationships with customers, negotiates conditions and, ultimately, generates sales and drives business growth;

Procurement: Responsible for purchases, developing budgets, and monitoring project expenses, as well as developing project plans in collaboration with other departments.

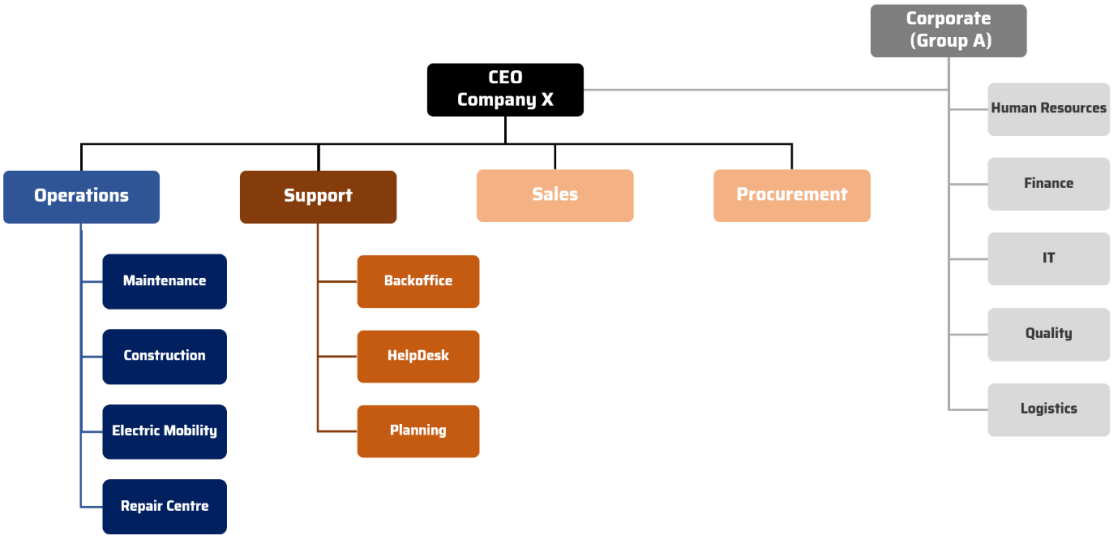

Figure 3.1: Company X's Organizational Chart. The company has 4 main units (Operations, Support, Sales, and Procurement) and is supported by 5 departments that belong to Group A

The company is also heavily influenced by the activity of 5 corporate departments - Human Resources, Finance, IT, Quality, and Logistics - which report to Group A's administration.

Company X owns two main facilities: one in the North (headquarters, its where most employees are from and and where services are predominant) and one in the "South" (covers the remaining services, in the central and southern regions of the country). X operates in Portugal's islands through subcontracting of technicians, thus offering services nationwide.

The company caters to two types of clients: "Private" (small companies that own one or a few fuel stations, typically operating as franchises of larger corporations) and Major Oil Companies (MOCs), which are prominent brand enterprises with an extensive network of stores distributed nationwide. It is critical to maintain a good relationship with both types of customers and to deliver a high-quality service since a well-constructed and maintained gas station has a significant public impact (so it can make or break existing and potential contracts). The commitment between clients and Company X is established through a contract, in which the type of service is described.

The construction department can be classified into two distinct service categories: equipment installations (which can include small-scale constructions), and large construction projects. Installation contracts are relatively straightforward, and characterized by standardized procedures. Conversely, drafting a construction contract is a multifaceted process that entails the assessment

and coordination of diverse factors. These contracts possess inherent complexity, as they necessitate evaluations conducted by multiple entities across various domains, including technical specifications, customer budgetary constraints, customer relationship, financing and payment terms, project geography, availability of technical teams, and timeline delineation. In this process, all departments within the organization assume critical roles, yet Coordinators bear the responsibility of overseeing the entirety of the undertaking. An effectively formulated contract assumes paramount importance, as it establishes the project's duration, identifies the requisite resources, allocates the budget for execution, and delineates the expected profit margin. By appropriately addressing these elements, construction contracts can be managed proficiently, facilitating the successful completion of projects within the prescribed terms and generating the desired financial outcomes. Any construction contract is unique and is signed every time there is a new project.

As for maintenance contracts, they imply a more long-term relationship. Customers can choose to have an "on-request" contract, in which they only pay for the requested services at the time they occur. Alternatively, customers can opt for an "all-included" contract, in which both preventive and corrective maintenance are included for a fixed annual price. In this case, the number of annual preventive maintenance actions per station is defined (but usually not the specific date on which they occur, allowing for flexibility in the Planning team to spread out preventive services throughout the year). As for corrective maintenance, contracts usually define the Service-Level in which Company X commits to completing specific standardized service orders within a certain time frame, as described in Equation 3.1.

$$\text{Service-Level Compliance } (\%) = \frac{\text{Number of Service Orders closed within the agreed time}}{\text{Total Number of Service Orders}} * 100 \tag{3.1}$$

There are three SLA levels based on the type of malfunction, and the repair time varies depending on the sales volume of the station and the day of the week. The existing levels are:

- Critical - Repair time limit between 3 to 10 hours;
- Urgent - Repair time limit between 5 to 30 hours;
- Normal - Repair time limit between 30 to 72 hours.

Figure 3.2 displays the monthly SLA compliance from 2019 to 2022 and the annual average. The graph shows a declining trend in compliance with Service Level Agreements over the past four years. Starting at 90% in 2019 and increasing slightly to 91% in 2020, the SLA dropped to 87% in 2021 and further decreased to 81% in 2022. The SLA serves as a lagging Key Performance Indicator (KPI), reflecting the company's difficulty in reacting quickly to clients' needs. Notably, there is a consistent pattern of higher SLA levels in the first semester compared to the second semester. Addressing this downward trend and understanding the seasonal variations will be crucial in improving overall performance to achieve the targeted SLA of 94% and improve customer satisfaction. Besides, non-compliance with service levels can lead to penalties charged

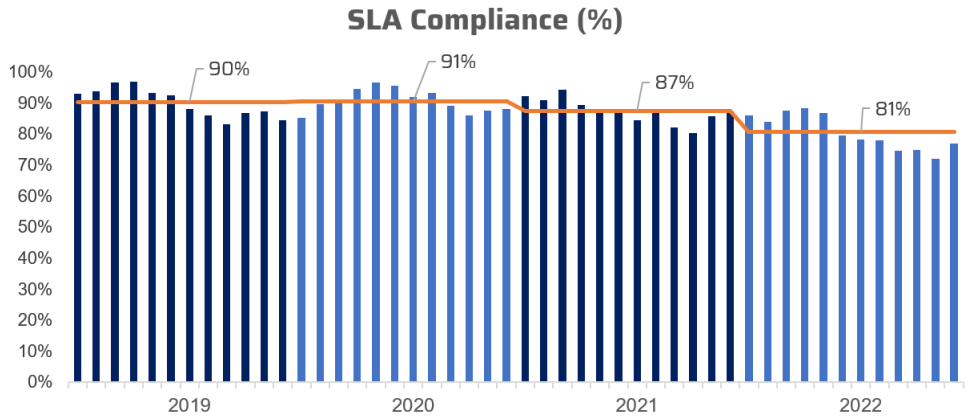

Figure 3.2: Monthly and Annual SLA Compliance (2019-2022)

by customers, reducing the company's profitability. Thus, meeting the established service times becomes essential in managing the company's operations, serving as one of the key indicators for evaluating the performance of the maintenance department.

3.2 Financial Performance

Measuring a company's financial performance is crucial for assessing its profitability, efficiency, and overall health in order to make informed business decisions. This is achieved by using metrics that provide valuable insights and benchmarks, enabling organizations to set baselines and goals.

EBITDA, which stands for *Earnings Before Interest, Taxes, Depreciation, and Amortization*, serves as a crucial financial metric that provides a clearer understanding of a company's operational performance and profitability. In the context of Project Y, the EBITDA of Company X is being closely monitored as the primary indicator for evaluating the project's success. The objective is to achieve an EBITDA of 7.3% by the conclusion of the two-year time frame. The EBITDA evolution measured at the end of each year, from 2019 to 2022, and in February 2023 (when Cycle 1 began), is displayed in 3.3.

It should be noted that some of the designed solutions discussed in this thesis will not yield immediate financial returns during this initial 5-month period, as their anticipated gains are projected to materialize at the conclusion of the two-year duration or further in time.

Benchmark Analysis: Group A

Another factor to consider is the positioning of Company X within Group A. For this purpose, a comparative analysis was conducted between Company X and two companies within the group operating in the same sector of the oil industry assistance, in Spain (ES) and the United Kingdom (UK), respectively. The results are summarized in the table 3.1

The main source of deviation lies in the operating costs, particularly in the category of "Specialized Labor" (8% PT, 2% ES, 3% UK). It is worth noting that the weight of fuel costs is higher in Portugal.

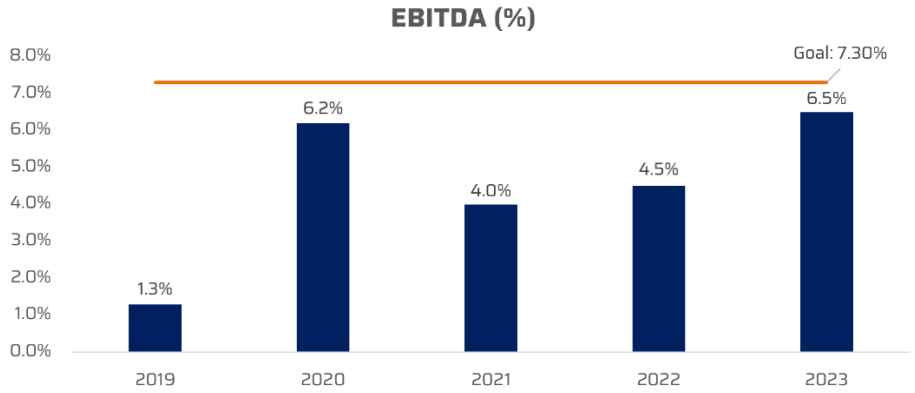

Figure 3.3: EBITDA of Company X. From 2019 to 2023, it has consistently fallen short of the 7.3% target

3.3 Operations Departments

Operations is the functional area in Company X that performs technical services and is composed of 4 departments (Maintenance, Construction, Repair Centre, and Electric Mobility). This section will begin by presenting the major characteristics of the Operations Organizational Model, outlining how each department is organized and interconnected. The following subsections will include an in-depth analysis of the Construction and Management departments, focusing on the identification and examination of the principal activities: Construction and Maintenance. The primary objective of this section is to offer a comprehensive overview of the company's operational framework while identifying opportunities for improvement.

3.3.1 Organizational Model

In the Operational departments, each technician is part of a team that can be managed by up to 4 increasingly higher leadership levels (depending on the department):

1. **Team Leader (TL)**: As the first level of leadership, each TL oversees his team members. He coordinates their daily activity, ensuring tasks are completed efficiently, and providing guidance and support to the team, while also performing technical jobs like any technician;
2. **Coordinator**: Manages TLs and supervises work in his geographic zone (North or South);
3. **Department Leader**: In charge of setting a strategy for the department, manages teams, and reports to the Head of Operations;
4. **Head of Operations**: Ultimate responsible for the Operations division; reports to the CEO.

There is also the role of "Technical Support": an individual who helps technicians with any technical difficulty they encounter when performing a service. This role has only been implemented in the company recently and its responsibilities aren't yet formalized. There are two people with this role - one for Electric Mobility and the other for (Oil) Maintenance.

Table 3.1: Comparative Analysis of Company X with 2 companies from Group A (2022)

	Company X	Company ES	Company UK
Contribution Margin Ratio	45.5%	46.2%	54.5%
Cost of Sales	54.6%	53.8%	45.5%
Structure Costs	42.1%	37.1%	42.4%
Labor Costs	25.4%	24.5%	30.8%
Operating Costs	16.7%	12.6%	11.6%
EBITDA	**4.5%**	**8.7%**	**12.0%**

Figure 3.4 and the following paragraphs describe how each department is organized.

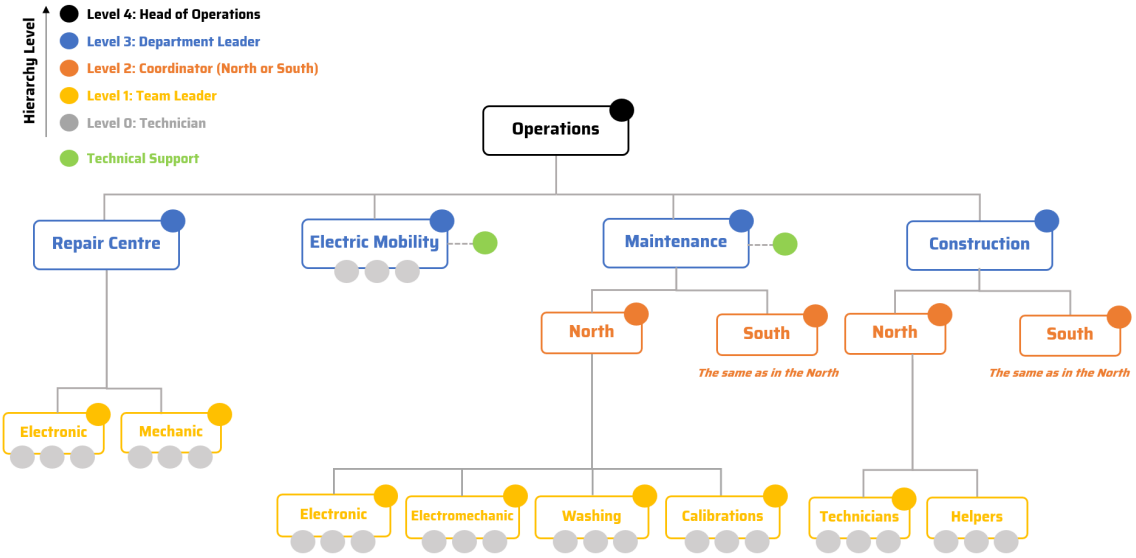

Figure 3.4: The Organizational Model for Operations comprises 4 leadership levels. The Maintenance and Construction departments are further divided into North and South. To simplify, the image doesn't depict the organizational structure of the South, as it mirrors that of the North

Repair Centre: There's one department leader managing two teams: the Electronic and the Mechanic repairs. Each team is composed of a TL and several technicians, specialized in that field of repair.

Electric Mobility: Since this is yet a small department in the organization, there is only one person in charge of 8 technicians. These technicians also do certain oil maintenance services when there's a high demand for them.

Maintenance and Construction: Unlike the last two departments, which are characterized by centralized teams overseen by a designated department leader, the Maintenance and Construction departments are geographically divided into two distinct zones (North and South), with each Coordinator assuming responsibility for the technicians operating within their respective zones. Maintenance is further segmented based on technical specializations (electronics, electromechanics, washing, and calibrations), with one team leader each. In each region, there is a Maintenance

Coordinator who manages TLs for that area. In the Construction department, there is also a Department Leader and (Construction) Coordinators for each geographic area, yet there are no technical specializations, just the division between technicians and helpers (junior technicians). The current organizational model within Company X is undergoing implementation, but it has not yet reached full fruition. Notably, the Construction Department is a recent addition to the organization. Until a short while ago, both maintenance and construction technicians were part of the same department, overseen by the current maintenance coordinators. As a result, the roles of construction coordinators and the construction department leader are relatively new and not entirely established. For instance, maintenance coordinators still retain some management responsibilities concerning construction technicians, such as approving their expenses and vacation requests. Additionally, the management of construction projects is currently divided into two levels of complexity: for simpler installations, maintenance coordinators oversee the work, while only for complex projects (previously designated as EPC solutions) does the Construction Coordinator's role come into play. In these instances, the Construction Coordinator oversees the project's entire progression, coordinates the daily tasks of assigned employees, and manages client relations.

The organizational and managerial framework of the technical teams reflects the absence of a unified model that encompasses the entirety of the Operations Department. This is exemplified by the contrasting approaches observed between the maintenance and construction departments. The former demonstrates a structured organization with clearly defined teams distributed across the country, whereas the latter is characterized by an *ad hoc* response to the company's momentaneous needs since teams are composed of technicians that are managed by two different coordinators according to the complexity of projects.

On the other hand, the division of maintenance teams into specialized repair areas, which is based on the classical management perspective focused on task optimization, may also be questioned. Each technician specializes in a limited set of tasks, implying that the selection of the technician to perform the service is crucial for its successful execution. The selection is based on the interaction between the client and the HelpDesk, and the accurate identification of the anomaly to be repaired. Since this identification is often misleading, it is common for a technician to travel to a gas station only to require a second intervention by a different employee because the anomaly did not correspond to the first technician's skills. This contributes to an increase in the First Time Fix (FTF) indicator, whose values can be seen in Figure 3.5.

Although the company's goal is to have an FTF of 95%, the monthly values from 2019-2022 indicate this goal is yet far from being achieved. In fact, the last months have seen a steep decrease, which should be a sign of alert for the company to act on it. Another factor that could be contributing to this decrease is the increased turnover of technical employees at Company X, leading to instability and lack of experience on the job. This topic will be further addressed in subsequent sections of this chapter.

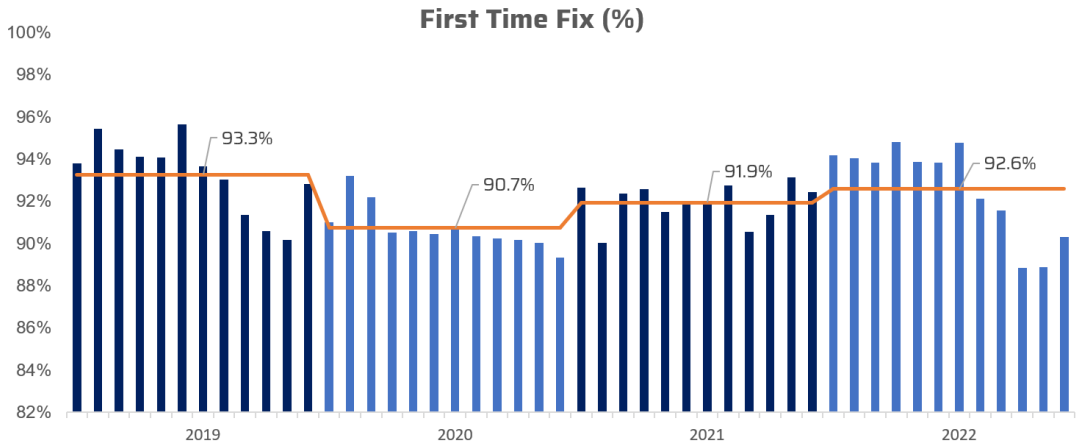

Figure 3.5: Yearly Average of First Time Fix (2019-2022)

Another important aspect of the Operations department of Company X is that many of the functions were assimilated by different members of the organization without a clear process of setting responsibilities per position and distinguishing roles among themselves. For example, there are several "grey areas" in the roles of Maintenance and Construction Coordinators, leading to gaps in which Company X isn't able to guarantee a consistent response.

In summary, the improvement opportunities in the Operations Organizational Model are:

- Implementing a more cohesive and integrated organizational model;
- Clarify and document the responsibilities and roles of leaders to ensure accountability and a more effective organizational structure;
- Enhance Collaboration between Coordinators and consider reassigning responsibilities for a unified structure and balanced roles;
- Standardize the role of "Technical Support" and better explore its potential to increase technicians' knowledge;
- Review the division of maintenance teams in technical specialties. The company can explore alternative approaches like training technicians to have a broader set of skills, thus addressing the FTF indicator.

3.3.2 Construction

The Construction department develops Engineering, Procurement, and Construction solutions that provide a detailed view of the project and optimize resource planning for efficient execution. EPC projects can vary in complexity, ranging from simple equipment assemblies to the installation of mechanical, electrical, and fire networks. Additionally, Company X specializes in planning and executing turnkey contracts, which involve handling the entire scope of the project, from design

and construction to commissioning of the service station. The next paragraphs will be focused on Construction projects of high complexity, which are (as previously explained) assigned to the Construction Coordinator of its geographic location - North or South.

Information Flow

A Construction project is divided into 4 main stages, detailed in Appendix A. In each stage, certain conditions must be met in order to proceed to the next one:

1. **Budget Request**: budget is drafted after technical and financial conditions are analyzed;
2. **Validation**: customer approves budget;
3. **Planning**: all conditions to begin construction (technical documentation; materials/equipment/fleet needed; teams and subcontractors; safety, quality, and any other legal requirements) are met and a start date is set;
4. **Execution**: technical documentation is approved and the invoice is sent to the customer.

The success of a project is generally defined by its completion on schedule and within budget; thus compliance with budgeted costs and planned time frames is an essential key factor. By assessing the present information flow in construction projects, it becomes possible to identify inefficiencies that must be addressed in order to achieve a successful project.

The execution of construction projects is inherently intricate due to the involvement of multiple entities within and outside a company, necessitating the dissemination of project details to all stakeholders. However, an apparent deficiency in communication persists within the organization, as individuals are not adequately updated, leading to an ineffective information flow. Moreover, the registration of project requests encounters ambiguity, as these requests often come from diverse channels instead of being channeled exclusively through the Sales department.

As owners of construction projects, Coordinators are entrusted with overseeing the execution carried out by both internal and subcontracted technical teams. Their primary responsibility encompasses ensuring project adherence to specified timelines and budgets. Regrettably, Coordinators lack the necessary tools to monitor project profitability, as access to such information is only available after project completion, rather than throughout its duration. This dearth of real-time profitability control limits their ability to promptly identify and address cost-related issues, impeding effective financial management during project execution.

Furthermore, the Procurement and Sales departments often construct commercial proposals based on previous projects without adequately considering the specific requirements of the current undertaking. Although Sales is responsible for gathering initial project conditions to facilitate accurate project assessments by the Coordinator, this process is frequently incomplete. Consequently, it is only during project execution that the Coordinator identifies the need for additional work or equipment, and the Planning team needs to revise the project timeline. Additionally, customers may reject budget updates if they were not appropriately negotiated within the contract, leading to unexpected costs. Data from projects concluded between 2020 and 2022 shows that the

sum of all costs was 14.3% higher than budgeted costs. Figure 3.6 shows the profitability of those projects (each project's profitability is associated with the month in which it was concluded).

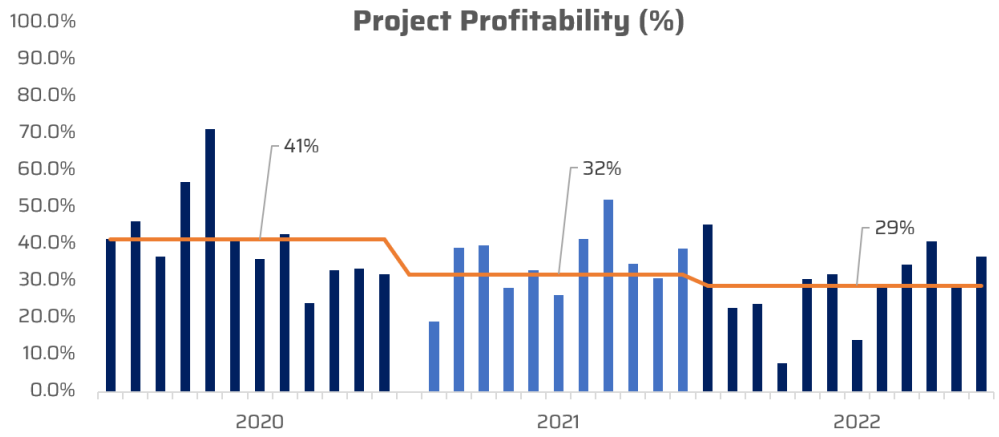

Figure 3.6: Yearly Average of Monthly Project Profitability (2020-2022)

The compliance rate of the weekly plans defined by the Planning Team is another important KPI. Projects taking place in 2022 show an average compliance of only 78.4%. Monthly values can be analyzed in Figure 3.7.

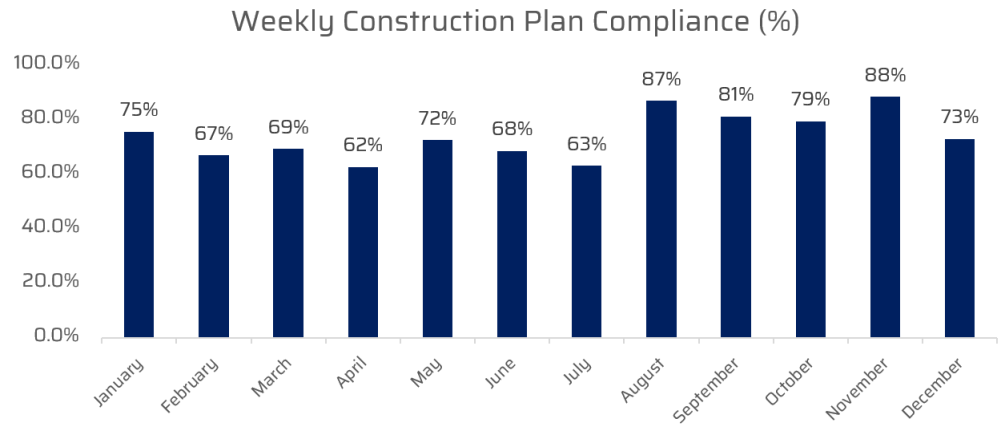

Figure 3.7: Monthly Average of Weekly Construction Plan Compliance Rate (2022)

In summary, the aforementioned challenges collectively impede the successful completion of projects within designated time frames and budgets. To address these issues, the main improvement opportunities are:

- Enhance Project Profitability Control: Provide coordinators with the necessary tools and access to information to monitor and control project profitability in real-time. This can involve implementing data visualization software or systems that enable tracking of costs, labor hours, and other relevant financial data;

- Improve Proposal and Contract Management: Enhance the collaboration between the Procurement, Sales, Planning, and Construction departments to ensure that commercial proposals and contracts are drafted with careful consideration of the project specifications, avoiding the need for significant modifications during the execution phase;
- Communication: Implement measures to enhance the company's communication flows;
- Streamline Request Registration: Establish a standardized process for registering project requests, ensuring that all requests go through the designated sales department.

3.3.3 Maintenance

Regarding the Maintenance sector, Company X provides on-site corrective and preventive maintenance services, in addition to remote assistance through collaboration with the HelpDesk department. Curative maintenance corresponds to the technical assistance of fuel stations after an issue has been reported by the customer and represents the company's majority of maintenance service orders. Technical teams are prepared to fix most equipment types in these facilities. This includes fuel pumps and all their components (hoses, nozzles, filters, etc.), as well as vehicle washing equipment, and compressors, among others.

The main stages in a Corrective maintenance order are the following: Reception and Registration of the Service Order; Planning; Execution; and Invoicing. Appendix B provides a view of how the main activities in each stage are performed and who is responsible for each task.

The Mean Time to Repair (MTTR) is a KPI used to measure the average time required to repair a system or component after a failure occurs, providing insights into the efficiency and effectiveness of the maintenance process. Company X defines the 'Time to Repair' as the number of days from the moment a service order is registered as "open" in the company's CRM software (CRM stands for *Customer Relationship Management*), till it's successfully "closed" in the system. Thus, this KPI is affected by several stakeholders' efficiency (mainly, maintenance teams, and the HelpDesk department). MTTR can be calculated using equation 3.2. Company X's monthly and yearly values of MTTR from 2019 to 2022 are registered in Figure 3.8.

$$\text{Mean Time to Repair} = \frac{\text{Total Number of Days Spent on Repairing each Service Order}}{\text{Number of Service Orders during that period}} * 100 \tag{3.2}$$

Preventive maintenance involves planned activities aimed at preventing equipment failures (such as routine inspections, cleaning, lubrication, adjustments, and component replacements) and enhancing equipment reliability and performance. The frequency of preventive maintenance depends on the contract established with the customer.

Given the widespread presence of fuel stations across the country, the nature of the maintenance operation often requires extensive travel time to various locations where technical services are provided. In order to optimize the cost and time spent on driving, technicians typically visit

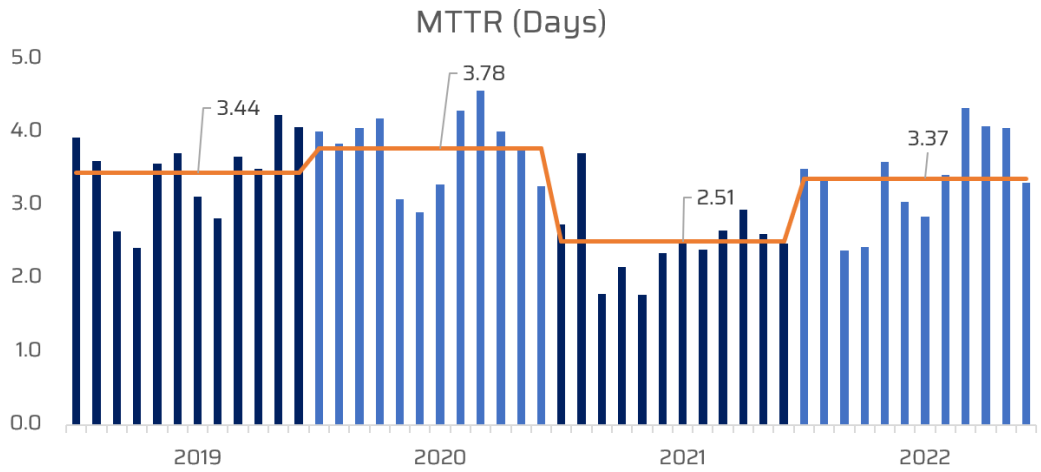

Figure 3.8: Yearly Average of Mean Time to Repair Curative Service Orders (2019-2022)

their warehouse only once at the beginning of the week to replenish their vehicle with the necessary supplies.

The main improvement opportunities found in the Maintenance department are:

- Decreasing the difficulties in identifying the anomaly described by the customer: minimize the situation in which the Planning team allocates the incorrect technicians and materials needed for the service;
- Need for technical training moments: for recent members of the company with a lack of knowledge and for experienced workers who are very specialized in a technical field but feel difficulties when having to fix a different type of anomaly. Lack of expertise causes SLA and FTF levels to decrease, and MTTR to increase;
- Promote visibility of technicians and leaders' performance indicators: This is especially relevant in the case of Coordinators, who lack critical information to make the right decisions in their jobs.

3.4 Support Departments

In order for the company to operate effectively, there is a Support area divided into 3 departments: HelpDesk, Planning, and Backoffice.

The HelpDesk Department acts as a central point of contact, receiving and responding to customer requests. It's the first point of contact with the customer and as such it seeks to troubleshoot problems before assigning them to the Operations teams, in order to prevent unnecessary on-site visits. In case it's not possible to solve the problem remotely, it opens and typifies a service order (SO, in order to select the most appropriate technician to fix it. The department plays a crucial role in maintaining customer satisfaction, enhancing user experience, and facilitating smooth operations by addressing and resolving issues promptly and efficiently.

Planning receives and analyzes information about new projects/service orders and plans the services (striving to meet the client's expectations with the lowest cost and highest efficiency possible). It initiates the logistical processes associated (materials and vehicles), in coordination with the Logistics department, allocates technicians to each Construction/Maintenance service and monitors the execution of the daily and weekly plans, making adjustments whenever necessary.

The Backoffice Department should ensure that the Service-To-Cash (S2C) process occurs in the shortest possible time by overseeing technical records submitted by technicians, executing service valuations to determine which services are billable, obtaining purchase orders, and invoicing.

Problems within a company are often related to the activity of several departments. Some of the improvement opportunities related to the Support department have been identified when understanding the process of Maintenance Orders. These are:

- Standardization of Customer Requests Reception and Registration: requests can originate from various channels, such as email, telephone, or online platforms of MOCs, often bypassing the designated HelpDesk department and reaching coordinators through other "unofficial" channels;
- More efficient processes: Processing customer requests via email can be time-consuming as customers frequently omit crucial information, requiring the HelpDesk team to directly contact customers to gather the required details;
- Improve flexibility in the Backoffice department: certain tasks are exclusive of a single employee who possesses the necessary expertise.

3.5 Other Improvement Opportunities

The exhaustive search for inefficiencies in the company led to the identification of other opportunities explained below.

3.5.1 Continuous Improvement Culture

The values and behaviors that contribute to the unique social and psychological environment of an organization define its culture.

The company is highly dependent on specific individuals with some tenure in the organization, without whom critical processes within the company cannot take place. The knowledge required to perform these tasks is concentrated in these individuals, creating a situation of vulnerability. In the event of their absence or departure, the company faces significant difficulties. This is also linked to a lack of clarity in assigning functions to each position, as the role differs from the person currently fulfilling it. Also, there is a strong focus on fulfilling individual and operational responsibilities, but the practice of continuous improvement is not yet a consistent habit within the organization. Before the start of Project Y, middle management and other employees were

absorbed in "firefighting" activities. The company was focused on resolving day-to-day issues, leaving little time and mental availability to reflect on operations and identify opportunities for improvement. However, three important aspects demonstrate top management's willingness to invest in Kaizen as a priority strategy within the company:

- The investment in a long-term project (Project Y) with a focus on operational and financial improvement following the Kaizen methodology;
- The recent hiring of a Project Management Officer (PMO) dedicated to project management and the implementation of continuous improvement, namely, as the manager of Project Y within the company;
- The high involvement of the CEO in changing mindsets within the organization. He is highly invested in the success of Project Y, for which he's the sponsor, and plays a key role in promoting continuous improvement across all areas.

3.5.2 Visual Management

As mentioned in Chapter 2, one of the Kaizen principles is to *speak with data* - the conviction that reliable, relevant, and easy-to-understand data is necessary for discussing and analyzing a problem. Despite the availability of software that compiles data into visual reports at Company X, not all positions have access to the most relevant indicators for their function. For example, as previously mentioned, the Coordinators reported a lack of timely information when managing a project, often resulting in delayed reactions to deviations from the project's timeline and budget. Another example is found in the HelpDesk department, where employees expressed the need for a dashboard that can help them visualize real-time indicators of the customer call center to make better decisions in the management of resources. Furthermore, the limited visibility of the company's strategy and vision, especially among lower levels of the organization (technicians, team leaders, and coordinators), leads to a lack of motivation and commitment from employees toward the company's growth and development.

It is fundamental to have indicators with clear calculation instructions and defined objectives that everyone involved is updated on, so the organization can assess its performance and set improvement actions.

3.5.3 Talent Retention

Another identified issue is the challenge of talent attraction and retention. Despite some investment in the training of technicians, this investment is sometimes lost as technicians leave the company, particularly for competing firms. Also, it is expected that in 5 years, 30% of technicians will be eligible for retirement. High turnover is negative for organizations because it is costly, disrupts productivity (impacts metrics like FTF and MTTR), impacts customer satisfaction, damages company culture, and lowers employee morale and engagement. The turnover of technical teams serves as a manifestation of employee demotivation and a lack of commitment between the

employee and the company. To ensure that all employees are involved in continuous improvement, it is essential to prioritize their satisfaction. When employees are satisfied they contribute to preserving knowledge and technical expertise within the company. Moreover, their dedication and productivity tend to increase.

3.6 Summary of Improvement Opportunities

The following image (3.9) is a summary of the identified opportunities, solution principles, and their relation to the categories of sustainable continuous improvement mentioned in Chapter 2.

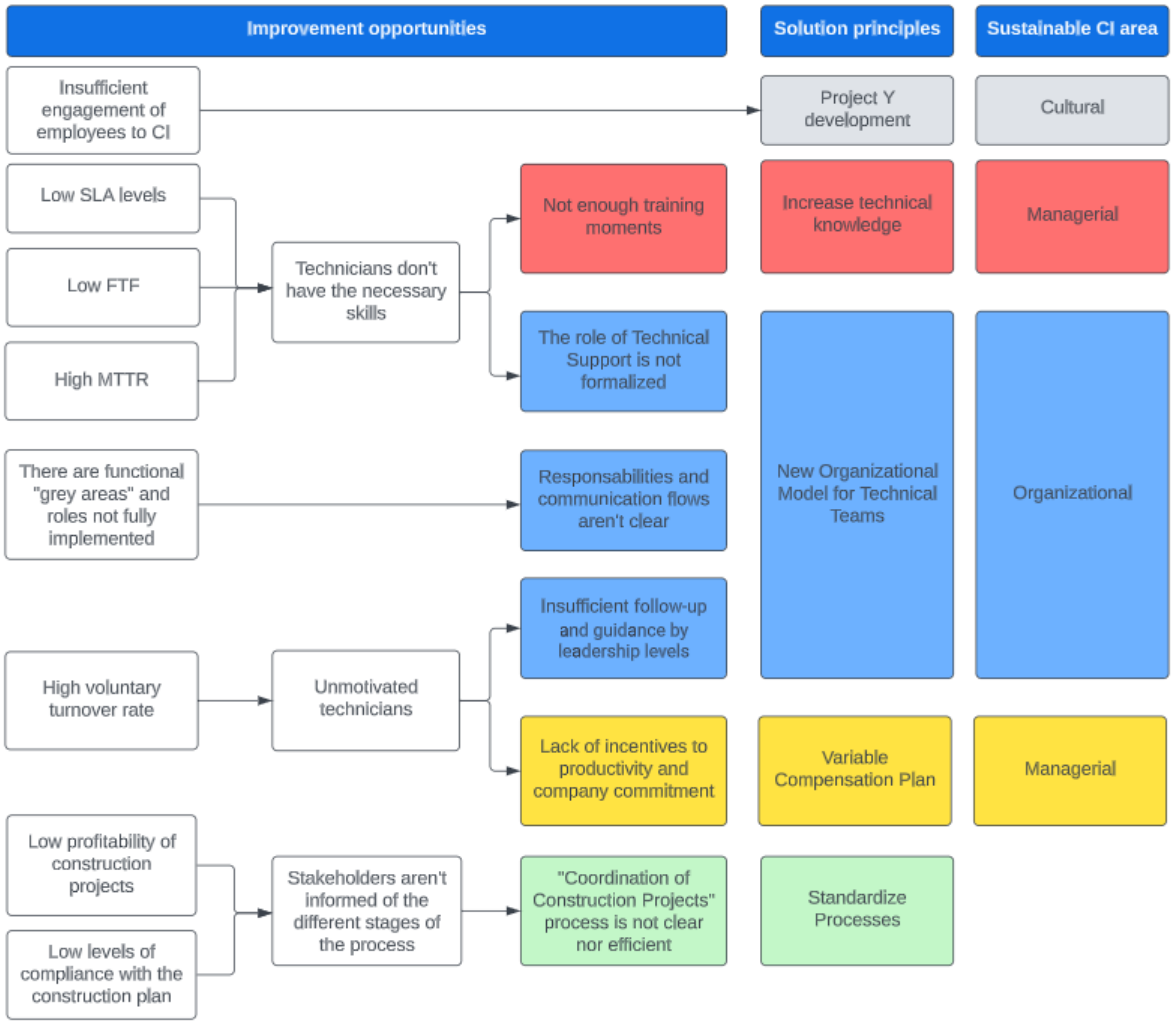

Figure 3.9: Summary of Improvement Opportunities

Chapter 4

Methodology

Project Y represents a concerted effort to implement Kaizen as a strategic priority in Company X to enhance its operational and financial performance. To achieve this, an exhaustive and comprehensive analysis was undertaken across all areas of the organization to discern existing inefficiencies, using the VSM methodology to map the current value chain, analyzing the main information flows, KPIs, and interconnection between departments (Chapter 3).

Given the project's two-year duration, a judicious approach was adopted to prioritize and select initiatives for each phase. For the initial cycle, the utmost importance was placed on creating the conditions for an effective Continuous Improvement project, sustainable in time, as concluded from the Literature Review. Chapter 2 proposes that it is necessary to go through a cultural, organizational, and managerial change. Taking this into consideration, the priorities for this cycle are to establish a solid CI culture, implement a robust organizational structure, and foster talent retention and development. The Kaizen events defined for the first cycle are represented in the Gantt Chart (Figure 4.1). Only upon accomplishing these priorities will the project pivot towards addressing additional Kaizen initiatives (Chapter 6).

SUSTAINABLE CI AREA	SUB-PROJECT	#	KAIZEN EVENT	MAIN KPI	FEB	MAR	APR	MAY	JUN
CULTURAL	IMPLEMENTING A CI CULTURE	0	Governance Model for Project Y	-					
		0	Employee and Management Engagement	-					
ORGANIZATIONAL	NEW ORGANIZATIONAL MODEL FOR TECHNICAL TEAMS	1	Reestructuring Technical Teams	Audits Result					
		2	Standardizing the Role of Technical Support	Audits Result					
		3	Standardizing the Roles of Maintenance and Construction Coordinators	Audits Result					
MANAGERIAL	PEOPLE EMPOWERMENT	4	Training Program for Employees	Completion of Training Plan					
		5	Variable Compensation Plan	Voluntary Turnover					

Figure 4.1: Gantt Chart with Kaizen Events for the First Cycle. Kaizen Events are allocated to Sub-Projects, each one associated with a Sustainable Continuous Improvement Area

4.1 Implementing a CI Culture

4.1.1 Project Y Governance Model

The definition of the project management routines, analysis of load capacity per sub-project, and creation of roles within the project team at the company marks the beginning of the project.

Project Management Routines:

- **Steering Committee**: Every 2 months - To follow updated benefits-tracking and validate workshops guidelines; validate budget and resources allocation; risk and bottlenecks' identification; definition of countermeasures;
- **Mission Control**: Weekly - To share information between departments: updated workshop status and KPIs, risk and bottleneck identification, and definition of countermeasures.

Project Management Roles:

- **Sponsor for Project Y**: Company X's CEO - Validates the transformation plan (roadmap and budget); attends Steering Committees, solves bottlenecks to ensure the plan's success;
- **Project Manager:** PMO - Defines and manages the transformation plan (initiatives, priorities, roadmap, resources, external partners, budget);
- **Workshop Leaders:** Lead the workshop sessions (Kaizen Events) and the teams, manage action plans and track KPIs, and manage external partners;
- **Internal workshop teams**: Cross-functional team members that participate in the workshop sessions, take decisions, and execute project tasks;
- **External partners**: Developers, consultants, IT architects, data experts, etc. Execute tasks and define solutions.

Another aspect addressed was the implementation of the Mission Control Room (MCR). The MCR is a visual control room for project management, which presents the project's main indicators (see Figure 4.1), a summary for the follow-up of ongoing initiatives, and the overall evolution of the project, using visual management (see Appendix C).

4.1.2 Employee and Management Engagement

The definition of project management roles and routines ensures that all levels of the organization are involved. Upper management participates in Steering Committees; Department leaders and other experienced employees serve as Workshop Leaders and attend Mission Control meetings, and employees often become members of Internal workshop teams, sharing their experience and being part of solutions' development. Also, lessons learned and best practices are documented and shared across the organization, and the MCR can be visited by anyone. By actively involving employees and management in the Kaizen project, organizations can tap into the collective wisdom of their workforce, drive efficiency, and achieve sustainable growth.

4.2 New Organizational Model for Technical Teams

In Chapter 3 it was identified the need for implementing a more cohesive and integrated organizational model for technical teams (Operations). When designing a solution the goals were to:

- Design a simpler organizational model for management and technicians, focused on agile problem-solving and increased levels of productivity and quality service;
- Clarify areas of operation and hierarchical communication routines;
- Standardize management roles, especially those more recent to the structure: Technical Support, Maintenance Coordinator, and Construction Coordinator.

4.2.1 Restructuring Technical Teams

In the initial phase of this study, the primary step involved the formulation of precise departmental definitions, to establish the distinct spheres of operation for each department. Furthermore, an analysis was conducted to identify and delineate the various leadership roles within each team and the examination of interdepartmental relations. The outcomes of this exercise are in Appendix D.

To enhance operational efficiency and communication coherence within the Operations Unit, a crucial step was taken: the standardization of communication routines across hierarchy levels. Data on meetings conducted by mid-level managers, including their names, objectives, frequencies, schedules, attendees, and leaders, was meticulously collected and compiled in an Excel spreadsheet (Appendix E. This spreadsheet served as a central reference point, helping to identify and resolve inconsistencies, such as differing names and schedules for the same meetings. This meticulous process streamlined communication protocols, fostering a more efficient and cohesive operational environment. It also simplifies the process of scheduling new meetings and provides higher management with a more comprehensive overview of the communication routines (see Figure 4.2).

4.2.2 Standardizing Roles

After going through a general approach to the organizational model, where the focus was touchpoints between departments and roles, it was necessary to deep dive into each leadership role. For this, seven main steps were taken (Appendix F includes an example of each step).

1. **Defining Core and Support Responsibilities for each Role**: Core and Support responsibilities [1] were defined and categorized (see definition in the footnote below). An Excel spreadsheet was employed to facilitate comparisons among leaders and guarantee that the division of functions remained consistent, clear, and comprehensive. This approach eliminated ambiguities - it ensured that all responsibilities were clearly assigned and that equivalent responsibilities were consistently described across all roles;

[1] Core Responsibility: Function that does not occur without the presence of the person in question. Support Responsibility: Function for which the person gives support / is consulted but it can proceed even without the person's presence/interaction.

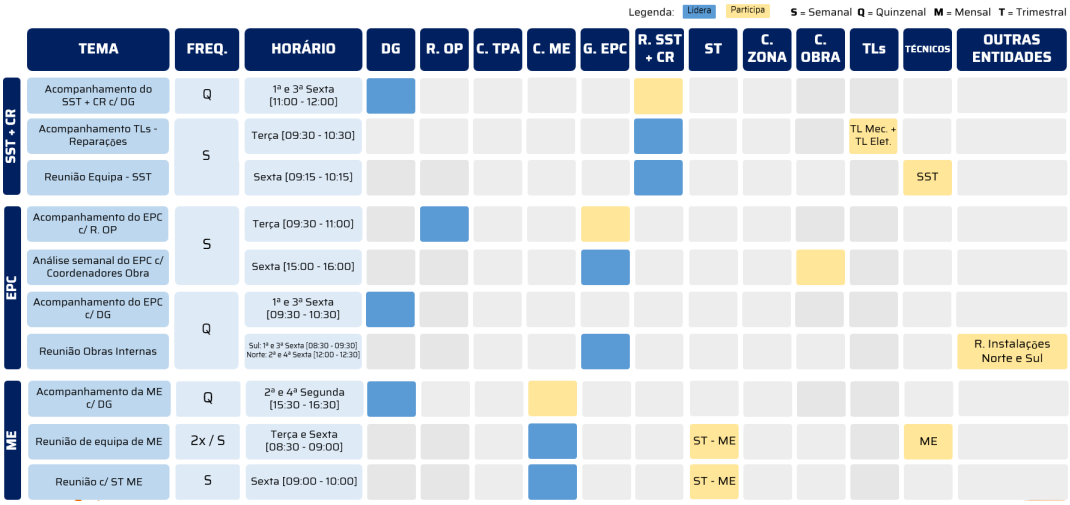

Figure 4.2: Standard Communication Routines between Hierarchy Levels in the Operations Department. This is an example that doesn't include all routines. The top row identifies the role; the first row identifies the purpose of the meeting; then, its frequency and schedule. Blue identifies leaders and yellow is for participants.

2. **Scheduling and Conducting Audits**: Audits were scheduled and conducted to determine which functions were already implemented and which required follow-up or training;
3. **Designing Standardized Agendas:** After defining communication routines, standardized agendas were designed for each leader. It was essential to ensure that all possible Core functions were included in these agendas. The agendas were formatted consistently and employed visual management techniques, utilizing colors to distinguish the different responsibility categories and the distribution of time spent on each;
4. **Clarifying the Help/Communication Chains**: To establish a clear flow of communication regarding relevant topics (e.g. vacations, salaries, vehicles, materials, etc.) within the organization, from the point of view of each leadership position;
5. **Identifying Necessary Physical and Digital Tools**: The physical and digital tools required for each position were identified, ensuring that each role had the necessary resources to carry out its functions effectively;
6. **Defining Key Performance Indicators**: KPIs were identified following the GQCDM structure and the guidelines provided by the Quality Department. Clear performance levels were defined, and Operational Performance Levels (OPLs) were established for the calculation of all KPIs;
7. **Designing Mock-ups for Execution Control Dashboards**: The vision for the monitoring dashboards was designed, specifically tailored for Coordinators, which will later be implemented in PowerBI with support from the IT Department.

These steps were meticulously executed to optimize operational processes and communication within the organization. The roles of Technical Support, Maintenance Coordinator, and Construction Coordinator were, as previously explained, critical in this process due to their recent addition

to the organizational structure.

Ultimately, a comprehensive manual was compiled, incorporating all the aforementioned information. After being approved by the Administration, this manual undergoes an internal normalization process within the Quality Department before being disseminated across the entire organizational structure. This internal review ensures that the manual aligns seamlessly with the company's quality standards and policies, guaranteeing its effectiveness as a valuable reference guide for all stakeholders.

4.3 Training Program for Technical Teams

In any organization, the training and development of employees are foundational elements, particularly within industries heavily reliant on the proficiency of their technical personnel in efficiently resolving a wide range of challenges. When conducting an examination of the existing technical teams it was possible to identify potential vulnerabilities and reaffirm the criticality of developing a training program. The analysis revealed a noteworthy statistic: approximately 30% of the company's technicians are aged 55 or older. While this signifies a substantial cohort of seasoned professionals presently contributing to the organization's capabilities, it also forewarns a forthcoming expertise gap. In a decade's time, the organization is poised to face the gradual loss of these retiring workers, underscoring the essential investment in comprehensive training initiatives to sustain and replenish the pool of skilled talent necessary for continued operational excellence.

Upon analyzing the role of Technical Support, it was determined that a new core responsibility would involve defining and implementing the training plan for technicians. Given the novelty of this responsibility, there was the potential to establish a standardized process for the continuous training planning of teams.

4.3.1 Developing Materials

There are two distinct roles within the organization for Technical Support (TS): one for (Oil) Maintenance and one for Electric Mobility (Maintenance). Consequently, the development of a training plan and technical materials was required for both of these departments.

Given the extensive range of equipment and types of failures that the company addresses, it was necessary to assess priorities. To achieve this, the four most frequently reported failures for each type of equipment were identified. This mapping process represented in Figure 4.3 served as the basis for establishing priorities in the development of technical literature, which will later serve as training material for technicians and become readily accessible for reference at any time. This material will consist of work instructions in video format, digitally organized in a "virtual library" (cloud storage).

The Human Resources department utilizes a tool known as the Competency Matrix to regularly assess the competency level of each technician across various technical competency areas within the company (on a scale of 1 to 5). With this matrix as a reference, the minimum competency level required for technicians to autonomously address each type of failure was identified. Then, while

considering the training program that was yet to be created, the team (led by the "TS duo" - the two people holding the role of TS) determined the number of training sessions (measured in days) required to instruct a technician until reaching the aforementioned minimum competency level.

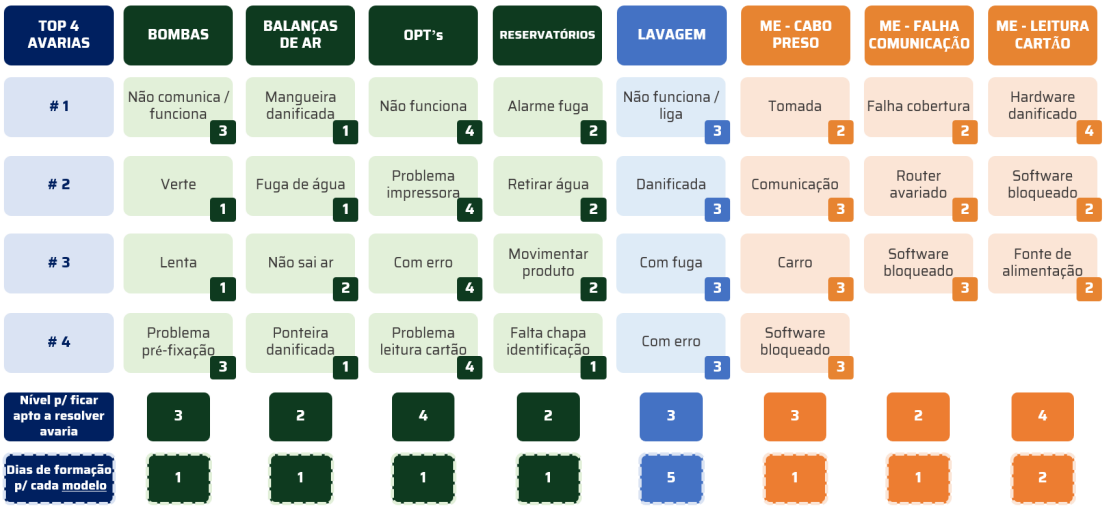

Figure 4.3: Organization of the Virtual Library by Type of Equipment and Top 4 Reported Failures. For each failure type, the level necessary is on the right corner. The level required to be proficient in each equipment is the maximum level associated with that equipment (second row, counting from the bottom.

4.3.2 Creating a Standardized Process

While the need for establishing a training program was evident, the procedures for initiating this process and its utilization over time were not well-defined. To address this, a standardized process was developed to guide the Technical Support role in every instance of a triggering event or when they identify a training requirement.

Step 1: Trigger

There are three types of factors that can trigger the need to create a new training plan.

- Scheduled: Every 6 months the TS reviews it; annually, the HR Department will need to propose a new annual training plan and can then collaborate with the "TS duo" to create a program for technical teams;
- Reactive: There is feedback from the HelpDesk, Coordinators, Leaders, or Technicians sharing the need to improve expertise levels (e.g., FTF levels are low, there is a high volume of backlog (buildup of service orders that need to be completed);
- Strategic: For example, a new business area in the company.

Step 2: Diagnosis

Each TS checks the Competency Matrix to identify the potential areas that lack training in their departments. For the same type of equipment, there can be different brands and models with different requirements. Thus, the priorities are equipment produced by Group A and equipment that is more present in the fuel stations installed by Company X. Since there is also a wide range

of failures for each, the training materials should focus on the top 4 reported failures by equipment (identified previously) and, eventually, recent failures that have been systematic. From here, a list with the training themes (type of equipment or specific model) for the next plan is created.

Step 3: Target Audience

For each training theme, the TS lists all technicians whose level of expertise (according to the matrix) is lower than the minimum level required, defined in Figure 4.3.

Step 4: Training Sessions

For each session, there will be groups limited to a maximum of three technicians. Training encompasses both theoretical knowledge and hands-on practical exercises, so smaller groups facilitate a more efficient and personalized learning experience. The duration of each training session should align with the specifications outlined in the "Virtual Library Map". Training materials will encompass the developed work instructions and prototypes of equipment to facilitate hands-on learning.

Step 5: Evaluation

Following the training, technicians will be progressively assigned to repair the equipment on which they received training. This approach allows them to actively cultivate their expertise in practice. Three months later, each technician will undergo an evaluation conducted by the TS to assess their acquisition of the specified skill. If successful, their competency level will be updated in the Competency Matrix. Additionally, technicians will have the opportunity to provide feedback on the quality of the training session and their trainer (most often the ST) through a comprehensive 360º evaluation process.

4.3.3 Designing a Tool for Creating a Training Program

This tool was developed with the objective of assisting the Technical Support in identifying training needs, planning training sessions over time, and providing the Planning Team with visibility into the workload and availability of technicians.

Figure 4.4 displays the main elements of the tool (an Excel spreadsheet) and step-by-step instructions on how to use it. Every time the ST needs to create a training plan, he will collect the following inputs: Training themes that will be addressed; Technicians who will be included in the training plan; and identifying the themes each technician will learn. Then, the ST will adjust the details of each training theme, starting by locating the training in time (week of the year). The combination of a theme and a week corresponds to a specific training team. Technicians are then allocated to teams (3 elements max.). The plan can last for as many weeks as are added in the tool. To add a week, simply add a column. The details on how to use the tool are in Appendix G.

This tool relies heavily on the principles of visual management to help the ST make quicker decisions and have a better overview of the plan's progression. The model's output is a training plan that can be analyzed by individual technicians, broken down by week, and categorized by theme. It also provides insights into the temporal distribution of the training, possible overload, and the level of completion of the plan.

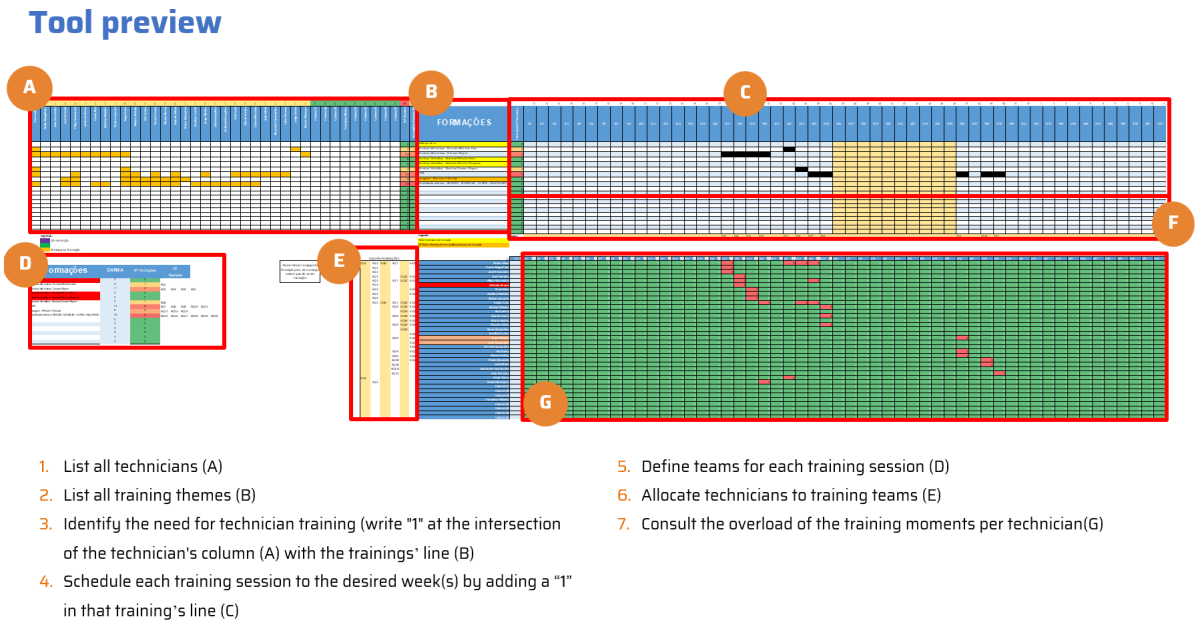

Figure 4.4: Tool for Creating a Training Program. From A to F are the different elements of this tool. From 1 to 7 are the general steps for creating a new training plan

4.4 Implementing a Variable Compensation Model

When analyzing KPIs from the Human Resources Dept., it was identified that annual voluntary turnover was relatively high, at 1.6%. Upper management also revealed the need to make the organization more attractive to the job market and to increase talent acquisition, retention, and productivity. There was already a yearly compensation plan in place - employees could be compensated once at the end of the year in case the company achieved the goals established and the individual goals were achieved. Yet it wasn't clear to the employee if he was eligible for the prize and, more importantly, how to act on it. Employees didn't have visibility on their individual results and some of the selected KPIs for the model weren't actionable by their performance.

The solution consisted of replacing the company's existing compensation model with a renewed monthly model, which would result from weighting various individual, team, and company KPIs. This encompassed various key aspects: analyzing the ongoing model, defining the plan's scope, establishing pertinent evaluation metrics, undertaking both quantitative (financial) and qualitative (stakeholders' feedback) analyses, and laying out the next steps for implementation and continuous improvement of the model. It is worth noting that, at the time of writing, the model was designed and being tested within a pilot group. Implementation remains subject to internal validation processes, due to financial and legal implications.

The goals of this project were to decrease the voluntary turnover rate, promote meritocracy, and increase productivity.

4.4.1 Scope

The first step was to define the employees to include in the compensation plan. The long-term goal is to make this model applicable to the whole organization, but it was important to first guarantee its viability by applying it to a smaller group of employees - the pilot group. The application of the model was planned to be done in 4 phases:

1. **Pilot Group:** One Maintenance team in which the model is tested during an experimental period;
2. **Construction and Maintenance:** Once the pilot is validated, the tool expands to all technical teams from the Construction and Maintenance departments.
3. **Operations Unit:** All technical teams are included in the compensation model (adds the Repair Centre and Electric Mobility).
4. **Company X:** Long-term objective - implementing monthly variable compensation in the entire company's structure.

Only employees with seniority exceeding 1 year are eligible for the program.

4.4.2 Metrics

After, specific metrics were defined in order to evaluate workers' performance, taking into consideration the existing means to calculate them. As mentioned, there were 3 categories: individual, team, and company; Individual metrics are meant to reflect each worker's performance and promote meritocracy; Team metrics should promote teamwork and provide a stronger model for when individual metrics are difficult to calculate; Finally, the company indicator (monthly EBITDA results) ensures the company is only awarding monetary compensation in months in which the financial results were positive. Since the goal is to compensate employees' efforts, only metrics in which the worker can have a direct impact were selected for the individual and team components.

The defined metrics followed the objectives set by the Kaizen methodology - GQCDM (mentioned in Chapter 2). For each indicator, evaluation intervals were established. Monthly, the indicators for each technician will be extracted; according to the interval to which they belong, there is a grade that determines the indicator's contribution to the total monthly variable compensation. All metrics and intervals for the Maintenance and Construction teams are listed in Appendix H. Table 4.1 presents the metrics for Maintenance teams. Intervals followed the existing evaluation system put in place by the Quality Dept.

Table 4.1: Metrics for Maintenance Teams are divided in 3 categories

Category	Weight	Indicator	GQCDM	Weight inside Category
Individual	30%	SLA	Delivery	30%
		Daily Average Service Orders	Delivery	25%
		FTF	Quality	20%
		MTTR	Delivery	15%
		Attendance	Motivation	5%
		Work Accidents	Motivation	5%
Team	20%	SLA	Delivery	40%
		Daily Average Service Orders	Delivery	30%
		MTTR	Delivery	25%
		FTF	Quality	5%
Company	50%	EBITDA	Growth	100%

To be eligible for monetary compensation, certain conditions must be met each month: the company's financial performance is considered positive (EBITDA > 4%), the employee has no work accidents, no disciplinary processes, and no unjustified absences.

4.4.3 Designing the Model

To calculate the monthly compensation that each employee was eligible for, a Kaizen Event was conducted with Coordinators, members of the HR department, Technical Support, and the PMO. During these meetings, the roles, data sources, and monthly deadlines were defined (this information is in Appendix I). The compensation awarded each month is directly linked to the worker's performance two months prior, meaning that the reward given in month N is based on the performance from month N-2. This allows sufficient time for the IT team to extract indicator results, for the HR team to process and facilitate payroll, and for any corrections to the indicators to be made (e.g., justifying absences).

The project team decided that, for the first iteration of the model, the prize should have a maximum value equivalent to that of everyone in the organization. To determine this value, a financial analysis was conducted (see Appendix J). Scenario 4 - with a max. prize of 110 € / month - was chosen. Using data from Maintenance and Construction teams' indicators in 2022, it was calculated that each worker would have achieved, on average, 44.56% of the prize. It was also possible to infer that the monthly bonus could have been awarded in 9 months of the year (in which EBITDA was >4%). By applying the social security tax (23.75%) to every compensation paid and the previously calculated average achievement rate of 44.56% over 9 months, the yearly cost of the compensation plan would have resulted in a total of 48 K€ for the Maintenance and Construction Departments (although the pilot group will only include one team, the financial analysis included a wider scope to give the Administration a better perspective on the impact of the program). When the decision is made to expand the program to other teams, it will become necessary to establish

the most suitable metrics for evaluating their performance. Subsequently, a new financial analysis will be undertaken to assess the overall impact of this program. The yearly budget for the variable compensation plan of technicians in 2022 was 59 K€ (yet it wasn't used), thus meaning the new model would have been within budget constraints.

In all scenarios, employees (field technicians) benefit from the introduction of the new variable compensation model compared to the previous one. The implementation of the new variable compensation model is profitable for productivity increases higher than 2% (see Table 4.2 and Appendix J). Productivity gains were calculated according to the following equation: *Productivity Gains (€) = FTE* [2] ** Cost per FTE (€) * Productivity Increase (%).*

Table 4.2: Financial Analysis for Scenario 4, for Different Productivity Improvement Levels

Scenario	Productivity Increase	Productivity Gains	Impact
Max Monthly Prize: 110€	1%	24 K€	- 24 K€
	1.5%	36 K€	- 12 K€
	2%	48 K€	0 K€
	2.5%	60 K€	12 K€
Investment: 48 K€	3%	72 K€	24 K€
	5%	120 K€	72 K€

4.4.4 Next Steps

To validate the model, it was decided to test it within the pilot team first, which is still under approval by the Administration. It will be crucial to inform the entire organization about the project, its upcoming implementation, and its projected impact on employees and the company. To achieve this, an Announcement Plan was devised, involving Department Leaders and the CEO, to outline the communication approach. Once the model is validated, it should be improved based on feedback received from employees and on the productivity results achieved, following a continuous improvement approach. Also, the implementation should expand, following the plan defined in "Scope". It's important to create a more robust and automated tool for the calculation of the prize. Monthly, the results must be analyzed, and a report should be generated to convey the outcomes to the company.

[2]Full-time equivalent (FTE) - measures the total amount of full-time employees working at any one organization. In this case, it applies to the total amount of Maintenance and Construction workers

Chapter 5

Results

In the previous Chapter, the solutions implemented within the scope of the project carried out at Company X have been described. It is now relevant to conduct a comprehensive evaluation, assessing the impact and results stemming from the application of these proposed improvements.

5.1 New Organizational Model

The improvement initiatives of Restructuring Technical Teams and Standardizing Roles, while being fundamental for building a more agile and adaptable organization, are not expected to yield any immediate results. To grasp an idea about the implementation success of standardizing roles in the Operations leadership, an auditing plan was conducted to follow the implementation of responsibilities in those roles that weren't implemented before. The audits began in April and will continue until the end of Project Y (December 2024). The results are in Table 5.1. Since the audits began right after the end of the Kaizen events, it was expected that the first results would show low levels of success. This is an opportunity for the company to gain visibility in the areas that lack support and propose countermeasures, such as training, creating standards, or a review of the role itself. In the following months, new responsibilities will be audited, alongside those that started in April (to confirm if they are lasting results or check if any countermeasures have been successful).

Table 5.1: Audit Results for Implementation of New Responsibilities in Operations (Apr-23 to Jun-23). Each audit corresponds to a responsibility that's being implemented in an existing role.

	April	May	June
# Audits conducted	4	9	2
# Audits with positive result	2	4	2
Success rate	50%	44%	100%

According to feedback from several leaders in the organization, the development of a manual has been a helpful source of information, especially for those more recent in the organization. Standardizing meetings and agendas made leaders less worried about daily management and more available for value-adding work.

5.2 Training Program for Technicians

After KI and the project team designed the process and tool for the Training Program, the Maintenance Technical Support promptly created a training plan to implement throughout the remainder of the year. To monitor the success of the implementation, an additional round of audits is currently underway. Among the 9 planned training sessions, 5 have been successfully completed, resulting in a 56% confidence level in the plan's execution. The other 4 training sessions were not conducted due to the unavailability of technicians, as the Planning Team had to assign them to address urgent service orders. This situation coincided with the start of the summer vacation period. It is anticipated that once the service workload returns to normal, the plan can resume its intended course.

Because the Training Program has only recently begun its implementation, the results of this project remain uncertain. However, if the training plan administered by the TS is successfully executed by year-end, it is anticipated that, within all teams, a minimum of 50% of members will possess the necessary competency level to provide technical assistance for all equipment manufactured by Group A.

5.3 Variable Compensation Model

As previously explained in Chapter 4, this model is still under development and the initial results will come once the Pilot Model starts to be implemented. It is expected that this program will improve productivity and decrease voluntary turnover.

5.4 Other Results

Service Level Agreement

Besides the results achieved by individual projects, there are other indicators that can provide insight into project success. One of them is the Compliance with Service-Level Agreement (%). Figure 5.1 illustrates the progression of SLA compliance since 2019. Since Project Y started, there has been a favorable upward trend. The average SLA compliance for the period of February to June 2023, stands at 87%. Although this figure falls short of the annual target of 94%, it appears achievable within Project Y's time frame, with the implementation of further initiatives in the upcoming months. The improvement in SLA compliance may not result in direct financial gains, but it does mitigate the risk of client penalties due to a failure to meet contracted service levels.

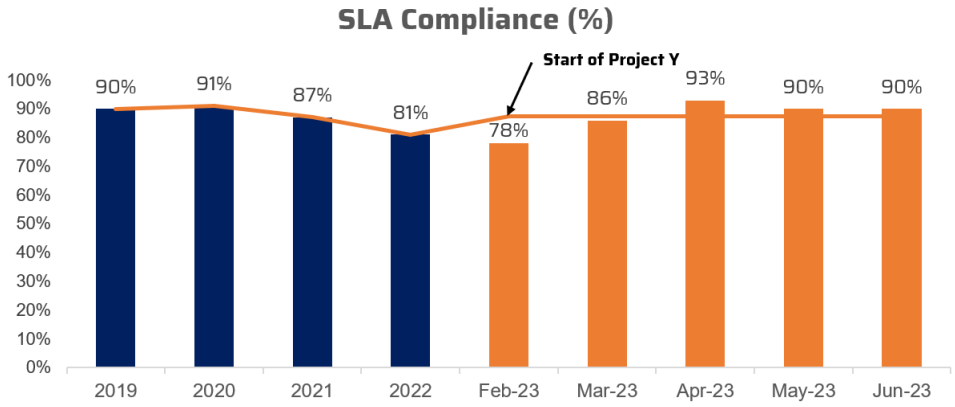

Figure 5.1: SLA Compliance Before (average yearly values for 2019 to 2022) and After the Start of Project Y (average monthly values for Feb-23 to Jun-23)

First Time Fix

Another metric that was monitored during this project is the FTF. The results are in Figure 5.2. In the first five months of the project, there has been an increase in the FTF, followed by a stabilization in values. Although it is still early on to conclude the reasons for this positive response, it could be due to better support given to the technicians by the two people who perform the roles of Oil and Electric Mobility Technical Support. By standardizing their agendas and redefining responsibilities, these people have now more time dedicated to assisting technicians, in replacement of performing administrative tasks.

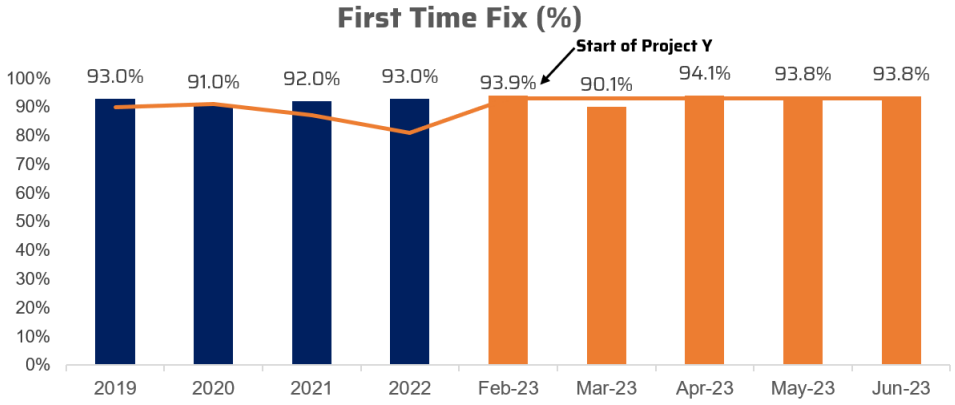

Figure 5.2: SLA Compliance Before (Yearly values for 2019 - 2022) and After the Start of Project Y (Monthly values for Feb-23 - Jun-23)

The financial benefits from this increase are presented in Table 5.2 and were calculated according to the following expressions:

Benefits from FTF Increase = Benefits from Labour Hours Reduction + Benefits from Kms Reduction

*Monthly Benefits from Labour Hours Reduction = # Service Orders (SO) in Month X * (FTF in 2022 - FTF in Month X) * (Average # Hours in Transportation per SO + Average # Hours in Technical Assistance per SO) * Technicians Cost per Hour*

*Monthly Benefits from Kms Reduction = # Service Orders in Month X * (FTF in 2022 - FTF in Month X) * Average Cost per Km * Average # Kms per SO*

Table 5.2: Financial Benefits from the Improvement of Monthly FTF Values (Feb-23 to Jun-23). Since the beginning of Project Y, 5 out of 6 months have presented FTF levels higher than the baseline defined (Yearly Average in 2022). This yields to a total benefit of 3.9K€

	2022	**Feb-23**	**Mar-23**	**Apr-23**	**May-23**	**Jun-23**	**Total**
FTF (%)	93%	93.9%	90.1%	94.1%	93.8%	93.8%	-
Total Benefits	-	1,016€	0€	1,162€	881€	836€	3,895€
Km Reduction	-	475€	0€	543€	412€	391€	1,820€
Labour Hours Reduction	-	541€	0€	619€	469€	445€	2,075€

Voluntary Turnover

One of this project's goals is to increase technicians' motivation and decrease their voluntary turnover. Although this indicator is usually a result of long-term efforts, it is already valuable to monitor it. Figure 5.3 shows that since the project began, the results have been positive, as they are below the previous year's annual rate of 1.36%.

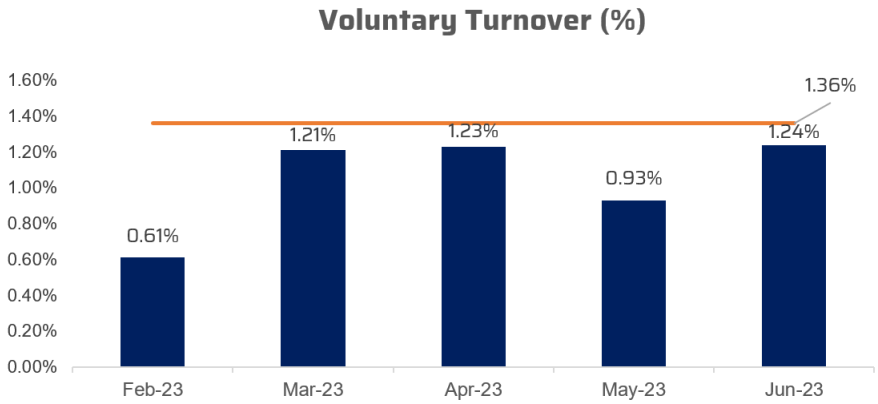

Figure 5.3: Monthly Voluntary Turnover (Feb-23 to Jun-23). Since the start of Project Y, turnover has remained below the goal of 1.36%, (based on previous years)

Chapter 6

Discussion

6.1 Results

Change, being constant and contagious, is an opportunity for companies to take the first step and strive for continuous improvement every day. When KI was called upon to intervene in Company X, a Construction and Maintenance company, the expected results at the end of the 2 years were to significantly enhance the company's operational and financial performance, namely its EBITDA, but the ultimate purpose was to instill a culture of rigor and continuous improvement throughout the organization (i.e., among all employees). Therefore, an exhaustive search for inefficiencies in the company led to the identification of several improvement opportunities.

The initiatives undertaken during the first cycle, while not immediately yielding significant financial savings, play a pivotal role as the cornerstone for fostering continuous improvement within the company. These carefully chosen endeavors lay the groundwork for a more agile and adaptable organization, poised to optimize its resources and enhance overall performance in the long run. By prioritizing the establishment of a solid organizational structure, fostering talent retention and development, and standardizing critical processes, the company creates a framework that promotes efficiency, collaboration, and adaptability.

The benefits of these foundational initiatives extend beyond the immediate financial impact. They imbue the company with a culture of improvement and innovation, empowering employees at all levels to contribute to the organization's growth and success. As the first cycle progresses, the company gains invaluable insights into its operations, identifying bottlenecks and inefficiencies that, when rectified, contribute to the company's resilience and adaptability in a rapidly changing business landscape.

Furthermore, the emphasis on continuous improvement ensures that the company remains proactive rather than reactive, constantly seeking opportunities for refinement and advancement. This mindset allows the organization to stay ahead of competitors and maintain a strong market position. As the first cycle paves the way for future iterations of improvement initiatives, the company becomes increasingly adept at identifying areas of potential growth, innovation, and cost optimization.

6.2 Future Work

Kaizen Events for Future Cycles in Project Y

In order to foster benefits from the work developed, it's important to continue developing some of the initiatives started in the first phase of the project. For example, by expanding the training program to other teams within the company, particularly the Support teams, where a low level of versatility has been observed. Still with respect to the training plan, as the company pivots to a model in which technicians have a broader set of skills and expertise, it can be relevant to review the division of maintenance teams in technical specialties and explore alternative approaches, thus addressing the flexibility of the organization.

Also, it should continue to develop and enhance the Variable Pay Model and implement the aforementioned expansion plan (Pilot Group > Construction and Maintenance > Operations > Company X).

Besides, following the standardization of the Maintenance and Construction Coordinators roles, it's crucial to improve and standardize the process of Construction Projects' Coordination. This is vital for the improvement of Construction projects' profitability, which plays a significant role in Company X's financial results. It will be necessary to design and clarify a new process for planning and controlling a project, implement visual management for budget and deadline control, standardize documentation and communication procedures in projects with phase gates, and assign clear roles for everyone involved in this process, not just the Coordinators (this includes the Sales, Procurement and Planning departments).

To start fostering significant financial benefits, other Kaizen Events should be initiated:

- Design a Global Planning Model that includes Routes Optimization (the expected financial benefits can go up to 1M€ in the first 2 years of implementation, due to the huge impact that the number of Kms by Service Order holds in the company's total expenses);
- Implement Daily Kaizen in all teams, starting with the Operations unit;
- Review Procurement and Sales process efficiency - namely by implementing tracking routines and tools for the improvement of contracts and services' profitability;
- Implement Standard Work and other projects for better Operational Execution;
- Review Logistics processes, such as Stock Management, as it plays a significant role in having a healthy cash flow;
- Implement workflows, robotic process automation (RPA), chatbots and call queue management systems to increase productivity in the Support teams.

Long-Term Partnership

Since Company X is part of Group A, a multinational company, the initiatives from Project Y could be deployed to other companies within the group operating in the same sector. With this in mind, a 5-step deployment plan was designed, involving Kaizen Institute and the Continuous Improvement Team from Group A - see Table 6.1.

Table 6.1: Deployment Plan to Expand to other Geographies

Step 1 **Workshops in Company X**	**Step 2** **Deployment Manual**	**Step 3** **Training other Geographies**	**Step 4** **Autonomous Implementation**	**Step 5** **Audits and Leveling**
Implement workshops - Project Y's plan	Create an implementation manual for other geographies with best practices and steps to follow	Define project leaders per geography; CI Team trains leaders according to the manual	Leaders implement, following the expansion manual; CI Team provides support	CI Team audits implementation results; Best practices are shared to promote leveling
Kaizen Consultants; Group A's CI Team; Project Y Team	Kaizen Consultants	Group A's CI Team; Team Leaders (other geographies)	Group A's CI Team; Team Leaders (all geographies)	CI Team; Team Leaders (all geographies)

Naturally, when developing the deployment manual for other geographies, a VSM will have to be conducted again, in every company, to identify the specific needs of each geography.

Another relevant aspect that may arise from this long-term partnership is the improvement of leadership and team management skills within Company X through training facilitated by KI. Although the goal is to make Company X independent in the application of continuous improvement, it is a methodology that can and should be trained, continuously.

6.3 Final Remarks

In conclusion, although the initial cycle of initiatives may not yield immediate financial gains, their significance lies in establishing the foundation for a culture of continuous improvement. By prioritizing essential elements such as organizational structure, talent development, and process standardization, the company positions itself for sustained success and long-term growth. Through this commitment to continuous improvement, the company optimizes its resources, enhances its operational efficiency, and secures a competitive advantage in the dynamic business landscape.

The solutions and findings that resulted from this paper are to be applied at Company X, to implement Kaizen as a strategic priority. Nevertheless, this dissertation can be used as an example to help validate the application of Kaizen methodologies in the construction and maintenance sectors. This can offer valuable proof of the ongoing expansion of the Kaizen approach within comparable organizations where conventional management methods are falling short of meeting the essential quality and cost criteria.

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Appendix A

Swimlane Diagram for the Coordination of a Construction Project

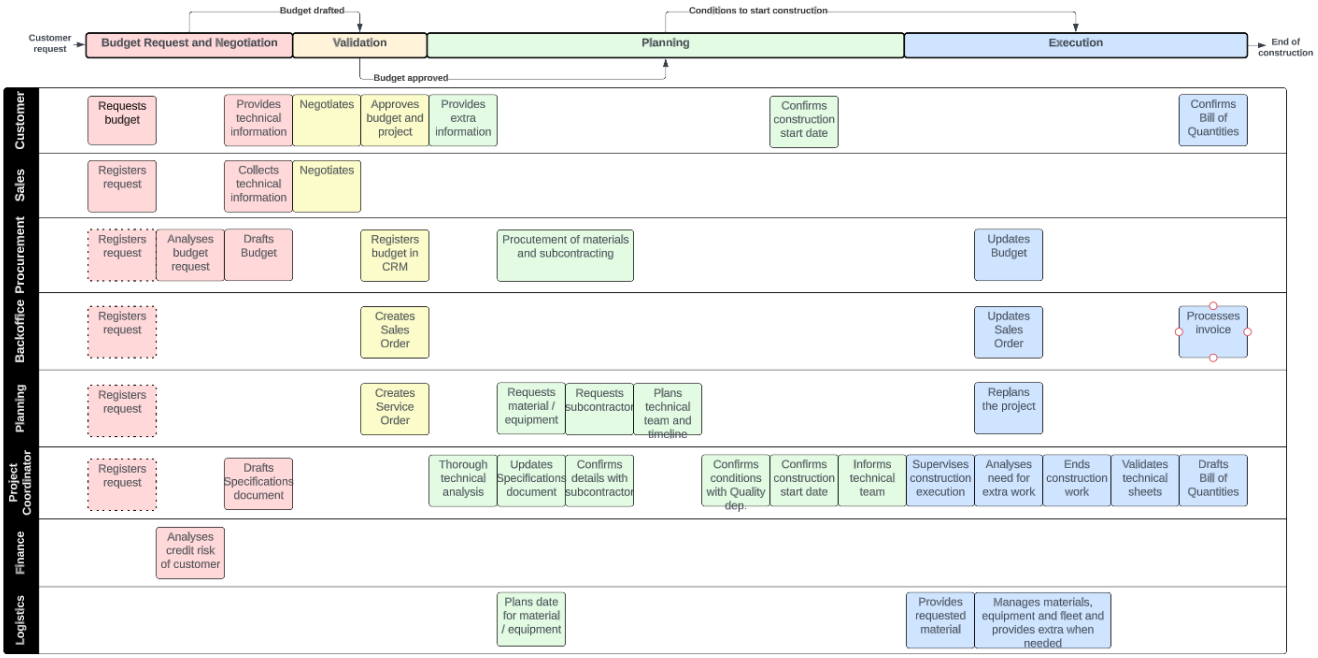


Figure A.1: Swimlane diagram for the coordination of a construction project. The main triggers are at the top of the image: customer requests the project; the budget is drafted and approved; when conditions to start construction are met, the execution takes over

Appendix B

Swimlane Diagram for a Corrective Service Order

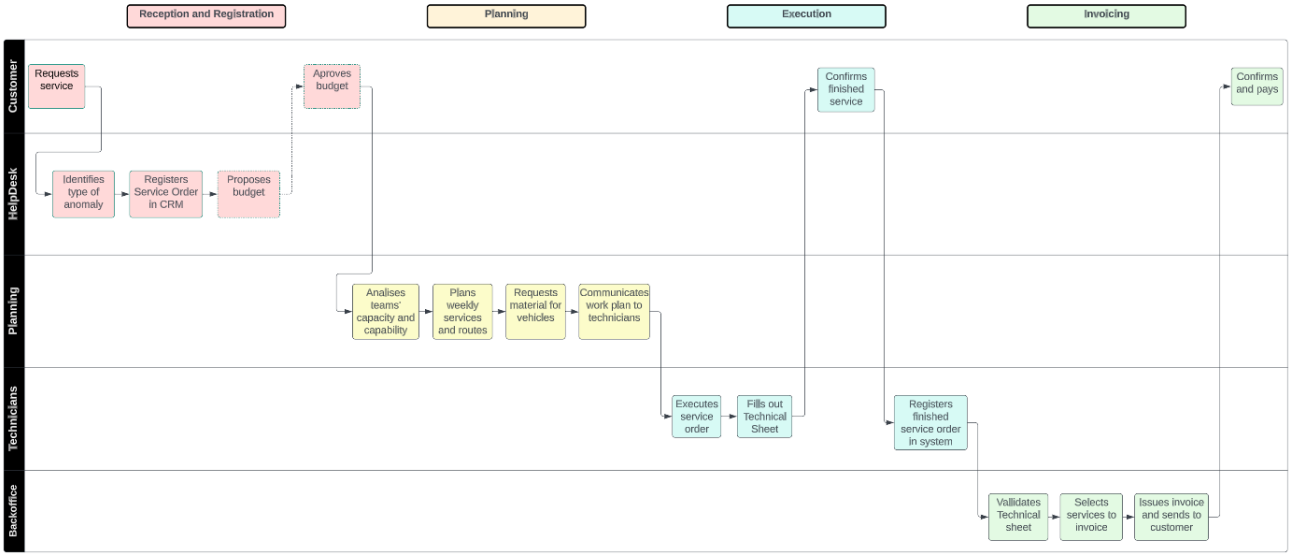


Figure B.1: Swimlane diagram for a Corrective Service Order. From Reception and registration, Planning, Execution, and Invoicing, the information flows through several stakeholders

Appendix C

Mission Control Room

Figure C.1: Overview of the Mission Control Room

Figure C.2: Detailed view of the Mission Control Room: Attendance List, General Agenda for MCR status, Project Tracking, Audits Plan

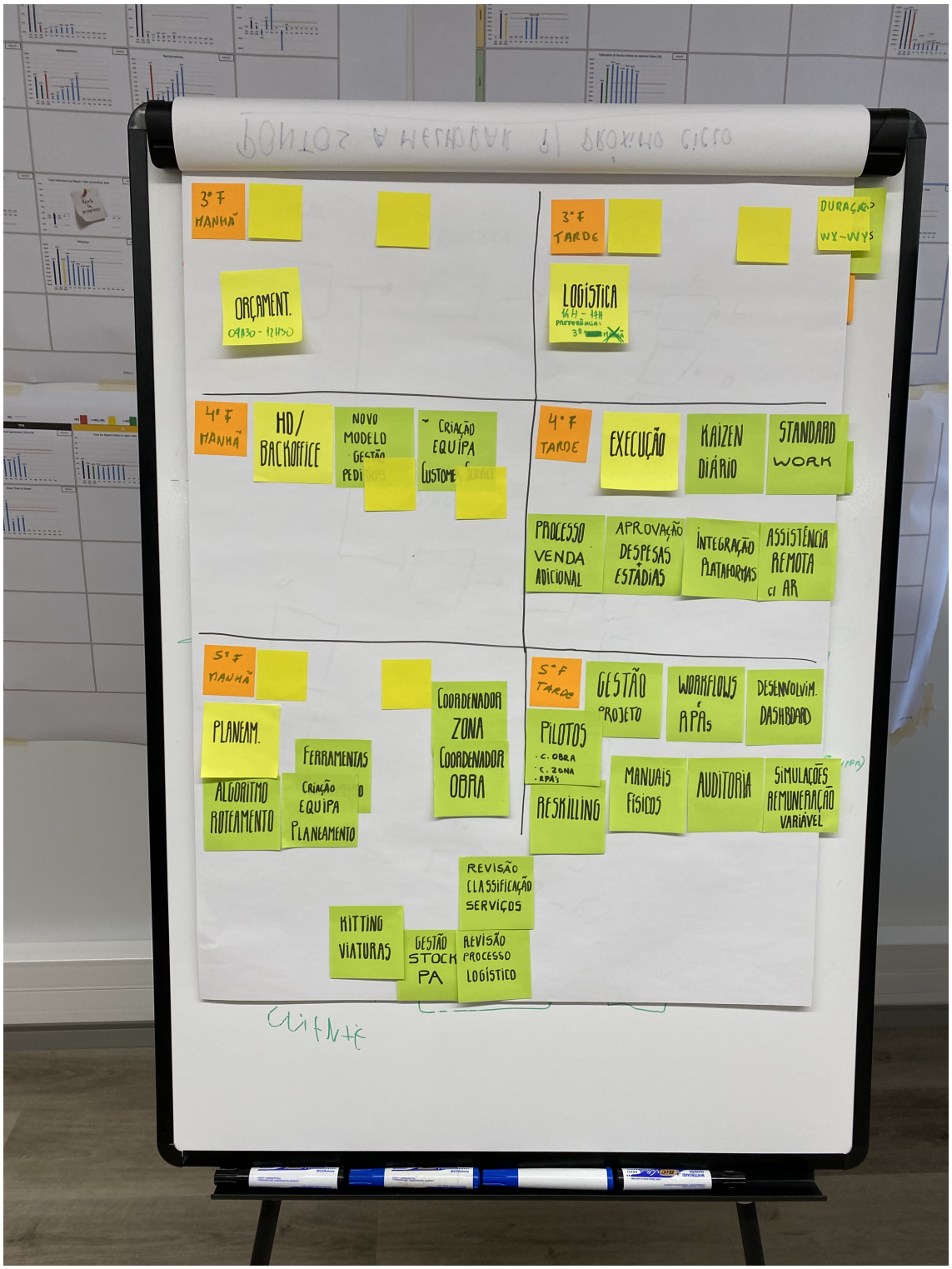


Figure C.3: Brainstorm of Kaizen Events

Appendix D

Departmental Definitions and Interdepartmental Relations

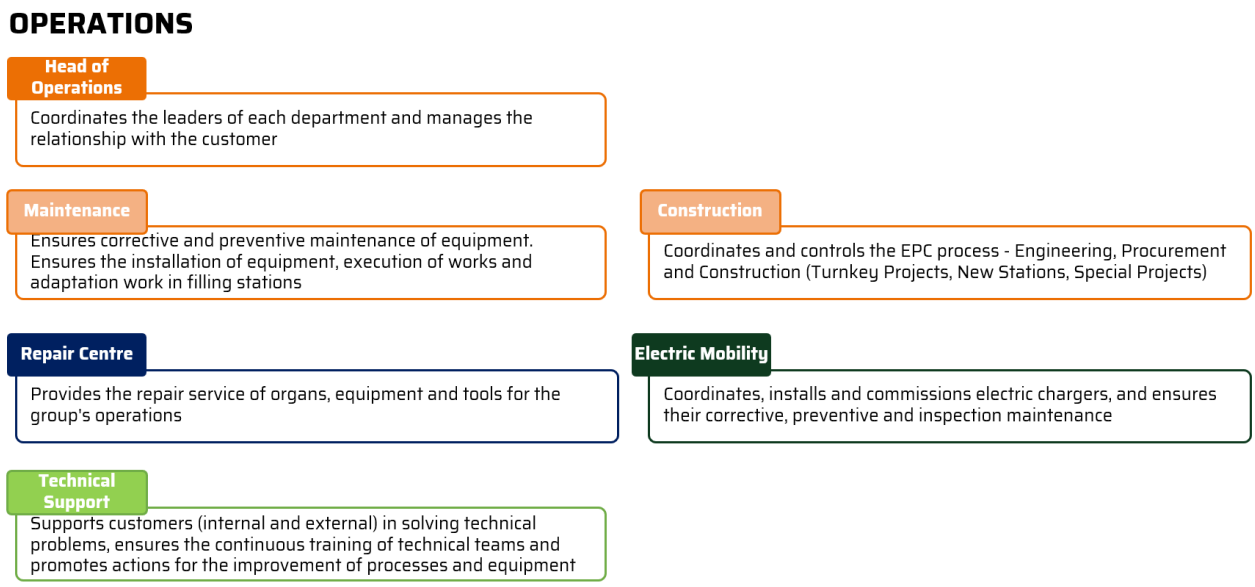


Figure D.1: Formulation of Precise Departmental Definitions

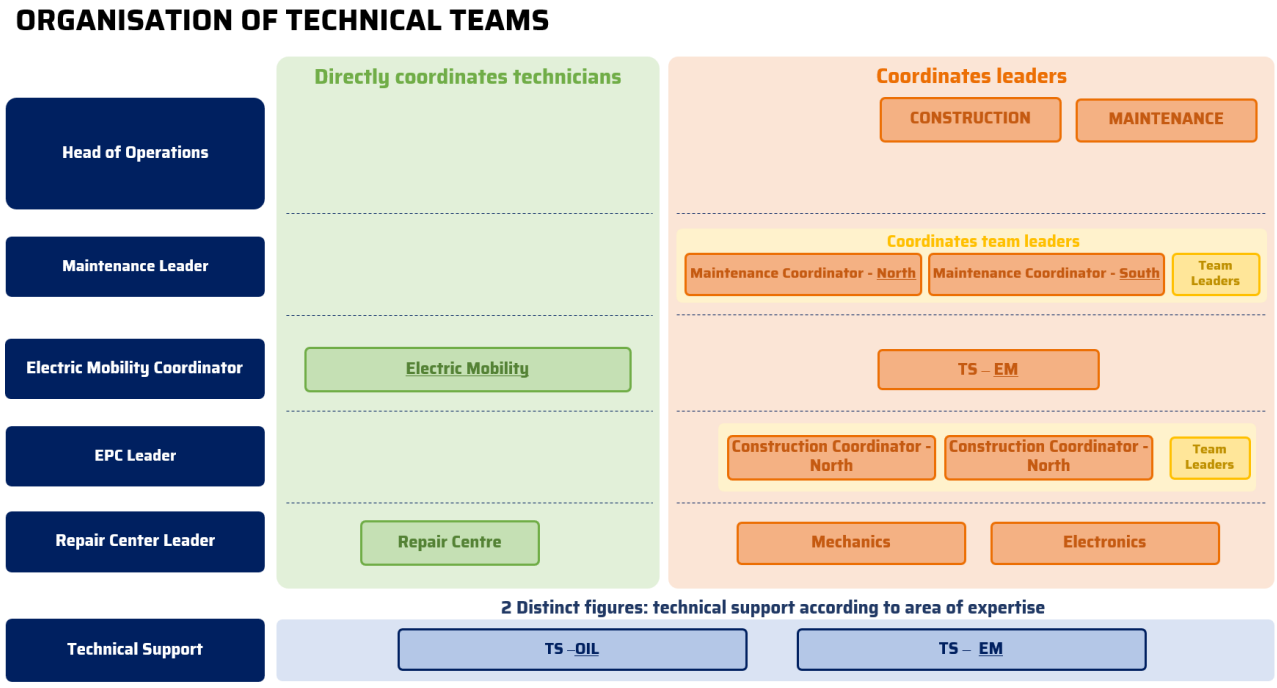
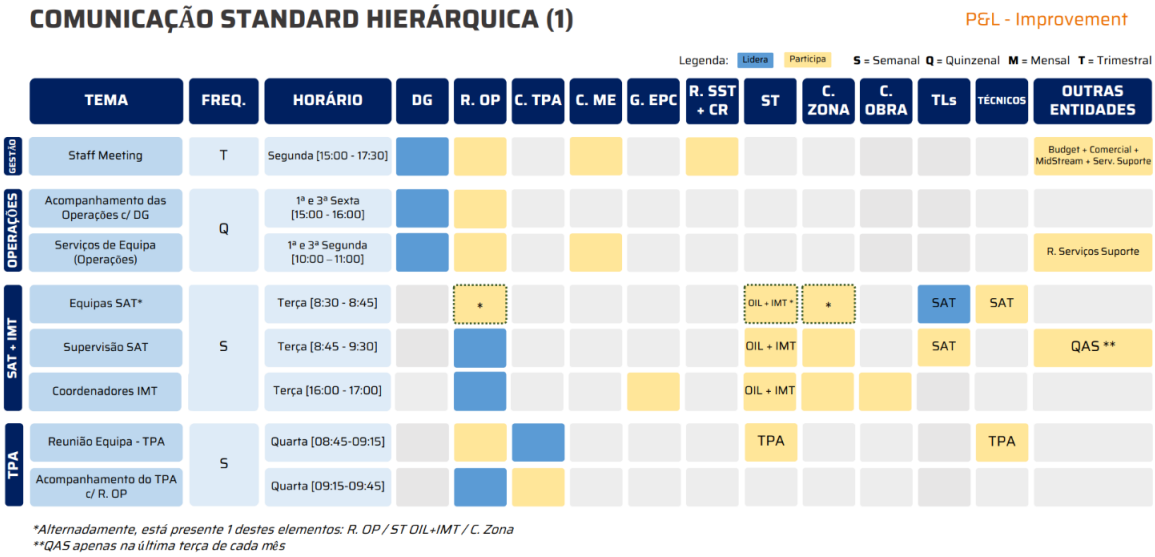


Figure D.2: Delineation of the various leadership roles within each team and interdepartmental relations

Appendix E

Standardization of Communication Routines in the Operations Unit



COMUNICAÇÃO STANDARD HIERÁRQUICA (1)

P&L - Improvement

Legenda: Lidera | Participa | S = Semanal Q = Quinzenal M = Mensal T = Trimestral

	TEMA	FREQ.	HORÁRIO	DG	R. OP	C. TPA	C. ME	G. EPC	R. SST + CR	ST	C. ZONA	C. OBRA	TLs	TÉCNICOS	OUTRAS ENTIDADES
GESTÃO	Staff Meeting	T	Segunda [15:00 - 17:30]												Budget + Comercial + MidStream + Serv. Suporte
OPERAÇÕES	Acompanhamento das Operações c/ DG	Q	1ª e 3ª Sexta [15:00 - 16:00]												
	Serviços de Equipa (Operações)		1ª e 3ª Segunda [10:00 – 11:00]												R. Serviços Suporte
SAT + IMT	Equipas SAT*	S	Terça [8:30 - 8:45]		*					OIL + IMT *	*		SAT	SAT	
	Supervisão SAT		Terça [8:45 - 9:30]							OIL + IMT			SAT		QAS **
	Coordenadores IMT		Terça [16:00 - 17:00]							OIL + IMT					
TPA	Reunião Equipa - TPA	S	Quarta [08:45-09:15]							TPA				TPA	
	Acompanhamento do TPA c/ R. OP		Quarta [09:15-09:45]												

*Alternadamente, está presente 1 destes elementos: R. OP / ST OIL+IMT / C. Zona
**QAS apenas na última terça de cada mês

Figure E.1: Partial Summary of Meetings by Department

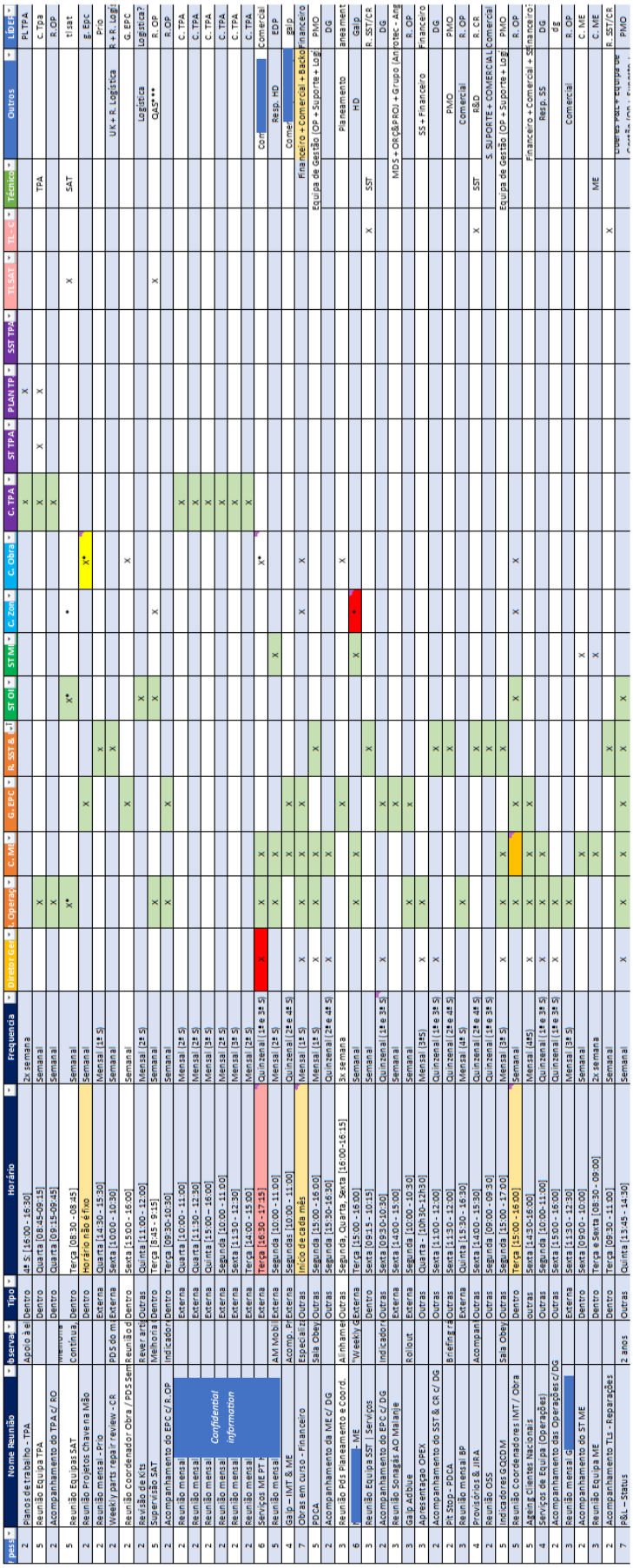


Figure E.2: Compilation of meetings' information in an Excel spreadsheet

Appendix F

Standardization of Roles in the Operations Unit: 7 Steps

Cargo	Core	Implementado	Na agenda
ST - OIL	1.**Execução Técnica da Função**		
	1.Comunicação de Bit's | QAS	S	S
	2.Criação da Pasta de Partilha de Manuais Técnicos e Backup BD | QAS	S	NA
	3.Definição e Revisão de Kits das Viaturas	S	S
	4.Elaboração de Relatórios Técnicos	S	NA
	5.Suporte Técnico às diversas Equipas Petroassist	S	NA
	2.**Gestão de Equipa**		
	1.Aprovação de Notas de Despesa da Equipa	S	S
	2.Elaboração de Mapas de Piquete	S	S
	3.Formação Contínua das Equipas | SAT – IMT	N	S
	4.Participação nas Entrevistas de Recrutamento e Seleção de Pessoas	S	NA
	5.Reuniões das Equipas	S	S
	3.**Melhoria Contínua**		
	1.Controlo da Evolução dos Indicadores de Performance do ST	N	S
	2.Controlo da Implementação da Estratégia da Empresa	S	NA
	3.Identificação de Projetos/Iniciativas de Melhoria Contínua - Processos e/ou Equipamentos	S	S

Suporte	Implementado	Na agenda
A.**Execução Técnica da Função**		
A.Análise e Identificação de Solução de BNC (Notas QM) | QAS	S	NA
B.Apoio Técnico em Projetos Pilotos | QAS /ENGENHARIA	S	NA
C.Avaliação do Material no Armazém 80 para Sucatar | Logística	S	NA
D.Atualização de Cadastros	N	N
E.Coordenação da Interface com a Direção Comercial na Elaboração de Propostas e Soluções	S	NA
F.Identificação de Materiais | Logística	S	NA
G.Identificação de Materiais Compatíveis entre Si | Logística	S	NA
H.Identificação de Materiais (Códigos) | Backoffice / HelpDesk	S	NA
I.Participação em Auditorias Internas e Externas	S	NA
J.Suporte à Direção na Elaboração de Relatórios e Apresentações	S	NA
K.Suporte à QAS na Organização de Reuniões com Técnicos e na Elaboração de Procedimentos	S	NA
L.Suporte ao Help Desk na Análise de Pedidos e Ações a Implementar	S	NA
M.Verificação de Reclamações | Comercial - QAS	S	NA
B.**Gestão de Contrato**		
A.Acompanhamento de Clientes em Ações Específicas	S	NA
B.Apoio ao Departamento Jurídico	S	NA
C.Elaboração do Orçamento, Investimentos e Acompanhamento da Execução (Budget Anual)	S	NA
E.Gestão de Penalidades	S	NA
F.Reuniões com Clientes	S	NA
G.Suporte ao Planeamento e Help Desk na Elaboração de Respostas a Clientes	S	NA
C.**Gestão de Equipa**		
A.Avaliação dos Técnicos	S	NA
B.Gestão da Plataforma Uman para a Equipa	S	NA
C.Levantamento de Necessidades de Formação na Equipa	S	N
D.Levantamento de Necessidades de Recrutamento e Seleção de Pessoas	S	NA
E.Participação no Acolhimento de Novos Colegas	S	NA
F.Validação da Proposta de Mapa de Férias	S	NA
D.**Melhoria Contínua**		
A.Participação em Projectos Internos (GRUPO PETROTEC)	S	NA

Figure F.1: (Step 1) Overview of Responsibilities for each Leader - Example for the Oil Technical Support Role

By listing all core and support responsibilities of the Oil Technical Support, it was possible to identify which ones were already implemented and which ones weren't - the latter would enter the auditing plan for implementation. Also, all the responsibilities that were possible to be scheduled (have a certain frequency), were identified and later added to this Role's Standardized Agenda.

After listing all responsibilities for each role, they were all included in a table for each category (e.g. Contract Management) and compared. This way it was possible to guarantee that no role was missing a responsibility and to compare which roles had a core responsibility or just support for each task.

FUNÇÕES – GESTÃO DE CONTRATO P&L - Improvement

FUNÇÃO	R. OP		C. TPA		C. ME		G. EPC		R. SST + CR		C. ZONA		C. OBRA		ST	
	Core	Suporte	Core	Suporte	Core	Suporte	Core	Suporte	Core	Suporte	Core	Suporte	Core	Suporte	Core	Suporte
Acompanhamento de Clientes em Ações Especificas	X		X		X		X		X		X		X			X
Análise Ageing Clientes Nacionais	X					X										
Análise de Cadernos de Encargos de Novos Contratos de Manutenção ou Renovação dos Existentes	X		X													
Análise de Processos após Adjudicação e Contacto com Cliente													X			
Apoio a Clientes, Fiscalização e Departamentos de Apoio													X			
Apoio ao Departamento Jurídico		X		X		X		X		X		X		X		X
Atualização Mensal das Avenças em CRM		X		X												
Contacto com Fornecedores e Parceiros nas Actividades (Procurement)		X		X	X		X			X		X	X			
Controlo do Cumprimento dos Contratos e Encomendas que lhe são Atribuidos	X		X		X		X		X		X		X			
Controlo Orçamental (Custos) e Rentabilidade de Obra					X		X				X		X			
Divulgação de Contratos de Manutenção		X				X										
Elaboração do Orçamento, Investimentos e Acompanhamento da Execução (Budget Anual)	X			X	X		X		X			X		X		X
Gestão de Penalidades	X		X		X		X		X			X		X		X
Gestão de Relação com Clientes Bancários			X													
Reuniões com Clientes	X		X		X		X									X
Suporte ao Help Desk na Interpretação de Condições Contratuais		X		X		X				X						
Suporte ao Planeamento e Help Desk na Elaboração de Respostas a Clientes		X				X		X		X		X		X		X

Figure F.2: (Step 1) Overview of Responsibilities for each Leader - Example for Contract-Management-related responsibilities

FUNÇÕES DO GESTOR DE PROJECTO E PRODUÇÃO EPC P&L - Improvement

Funções - CORE

1. **Execução Técnica da Função**
   1. Coordenação do Projeto, Procurement e Produção
   2. Elaboração de Relatórios Técnicos
   3. Elaboração do Relatório Mensal de Atividade
   4. Interface do EPC com a Direção Comercial na Elaboração de Propostas, Soluções e Relatórios
   5. Interface do EPC com a Operação noutros Mercados
   6. Participação em Auditorias Internas e Externas
2. **Gestão de Contrato**
   1. Acompanhamento de Clientes em Ações Especificas
   2. Contacto com Fornecedores e Parceiros nas Actividades (Procurement)
   3. Controlo do Cumprimento dos Contratos de Manutenção e Encomendas que lhe são Atribuidos
   4. Controlo Orçamental (Custos) e Rentabilidade de Obra
   5. Elaboração do Orçamento, Investimentos e Acompanhamento da Execução (Budget Anual)
   6. Gestão de Penalidades
   7. Reuniões com Clientes
3. **Gestão de Equipa**
   1. Acompanhamento e Suporte Técnico à Equipa
   2. Aprovação de Notas de Despesa da Equipa
   3. Coordenação do Departamento
   4. Gestão da Plataforma *Uman* para a Equipa
   5. Levantamento de Necessidades de Formação na Equipa
   6. Levantamento de Necessidades de Recrutamento e Seleção de Pessoas
   7. Reuniões das Equipas
   8. Validação da Proposta de Mapa de Férias
4. **Melhoria Contínua**
   1. Controlo da Evolução dos Indicadores de Performance da Equipa EPC
   2. Controlo da Implementação da Estratégia da Empresa
   3. Identificação de Projetos/Iniciativas de Melhoria Contínua - Processos e/ou Equipamentos

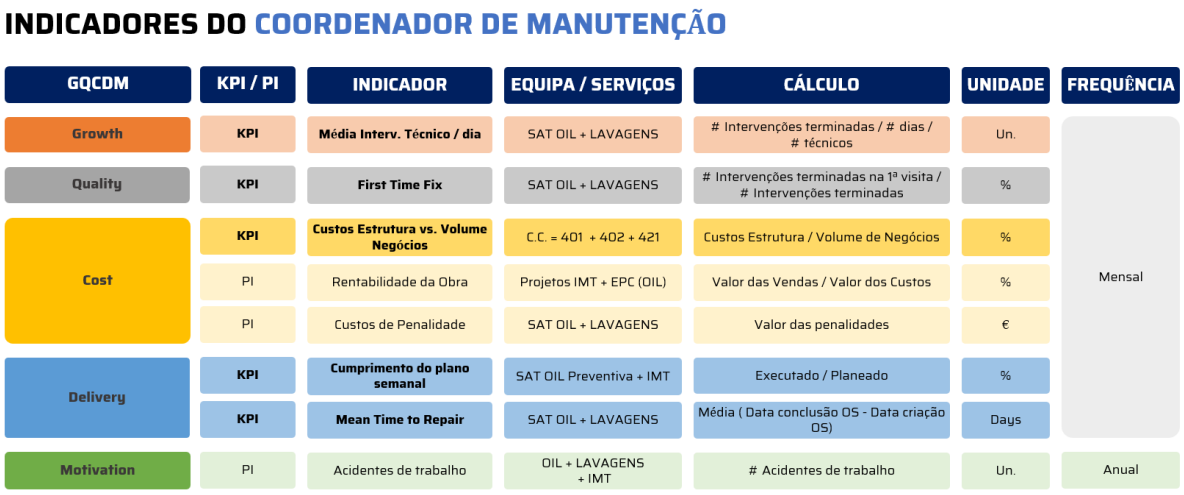
Figure F.3: (Step 1) Core Responsibilities - Example for the Leader of the Construction Department

Figure F.4: (Step 2) Scheduled Audits - Example for the new responsibilities of the Leader of the Construction Department

Figure F.5: (Step 3) Standardized Agenda - Example for the Head of Operations (the names of clients were crossed out)

Figure F.6: (Step 4) Help/Communication Chains - Example for the Team Leader

Figure F.7: (Step 5) Necessary Physical and Digital Tools - Example for the Coordinator



INDICADORES DO COORDENADOR DE MANUTENÇÃO

GQCDM	KPI / PI	INDICADOR	EQUIPA / SERVIÇOS	CÁLCULO	UNIDADE	FREQUÊNCIA
Growth	KPI	Média Interv. Técnico / dia	SAT OIL + LAVAGENS	# Intervenções terminadas / # dias / # técnicos	Un.	Mensal
Quality	KPI	First Time Fix	SAT OIL + LAVAGENS	# Intervenções terminadas na 1ª visita / # Intervenções terminadas	%	
Cost	KPI	Custos Estrutura vs. Volume Negócios	C.C. = 401 + 402 + 421	Custos Estrutura / Volume de Negócios	%	
	PI	Rentabilidade da Obra	Projetos IMT + EPC (OIL)	Valor das Vendas / Valor dos Custos	%	
	PI	Custos de Penalidade	SAT OIL + LAVAGENS	Valor das penalidades	€	
Delivery	KPI	Cumprimento do plano semanal	SAT OIL Preventiva + IMT	Executado / Planeado	%	
	KPI	Mean Time to Repair	SAT OIL + LAVAGENS	Média (Data conclusão OS - Data criação OS)	Days	
Motivation	PI	Acidentes de trabalho	OIL + LAVAGENS + IMT	# Acidentes de trabalho	Un.	Anual

Figure F.8: (Step 6) Defining Key Performance Indicators - Example for the Maintenance Coordinator

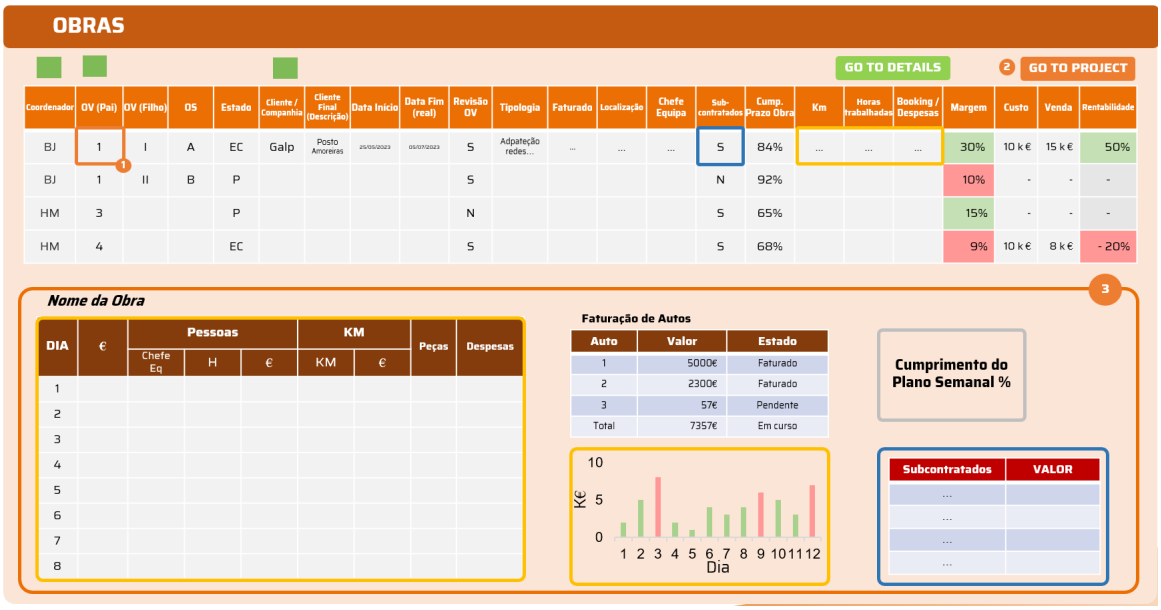


Figure F.9: (Step 7) Designing Execution Control Dashboards in PowerBI - Example for the Coordination of Construction Projects

Appendix G

Tool for Creating a Training Program

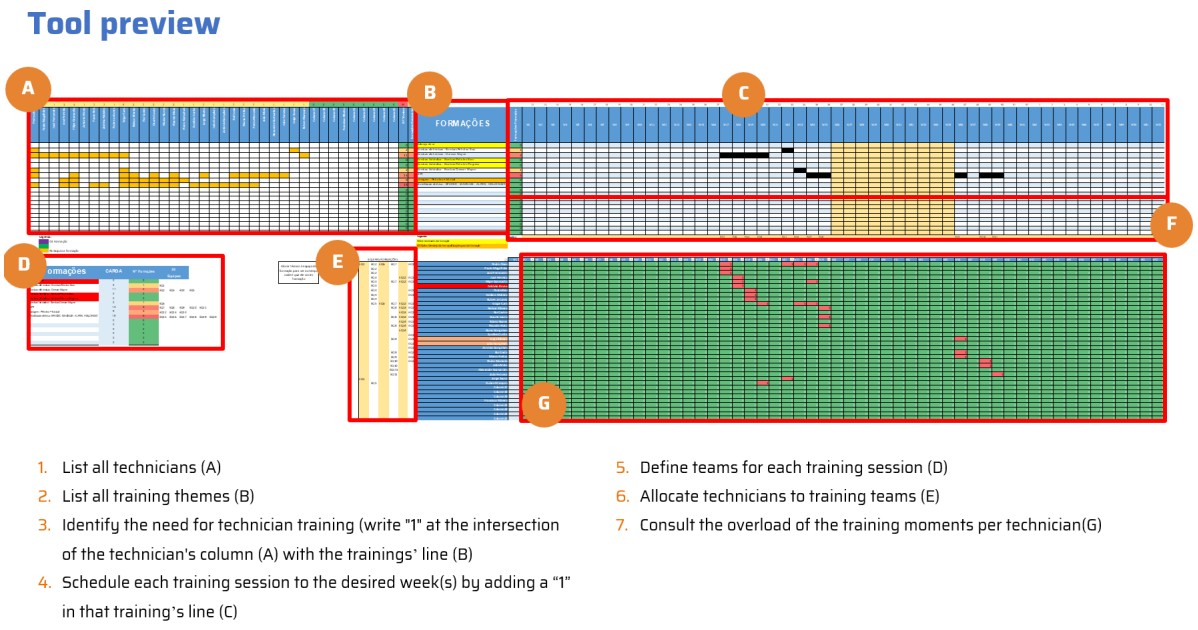


Figure G.1: Tool Overview: General

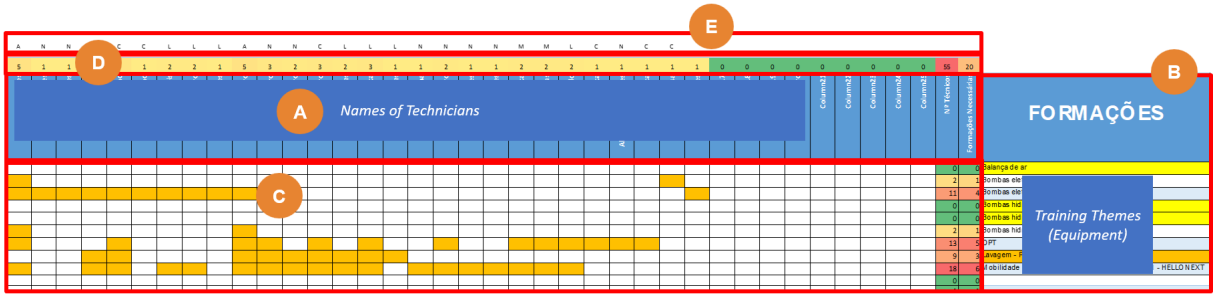
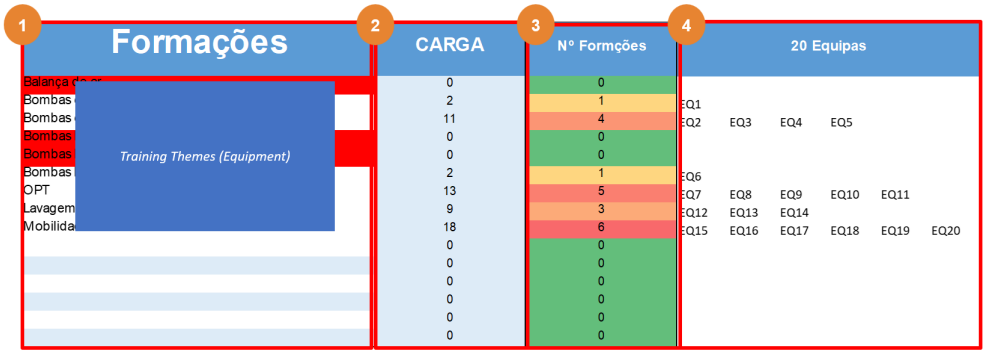
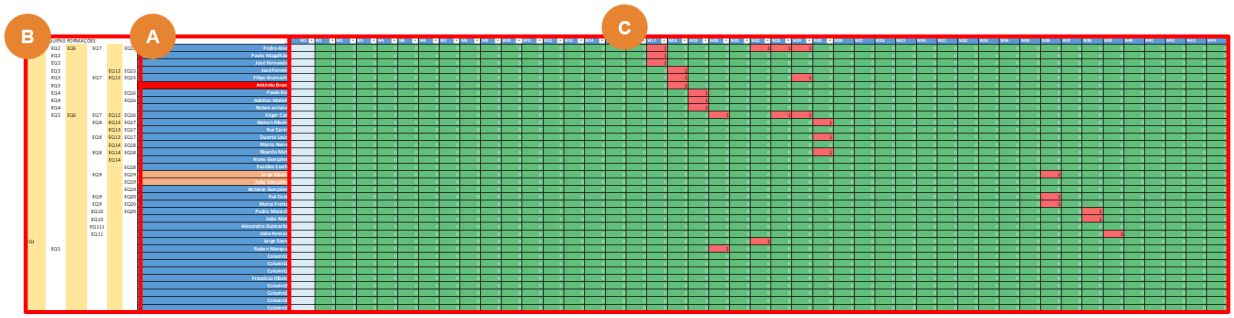


Figure G.2: Tool Overview: Initial inputs - Technicians and Training Themes



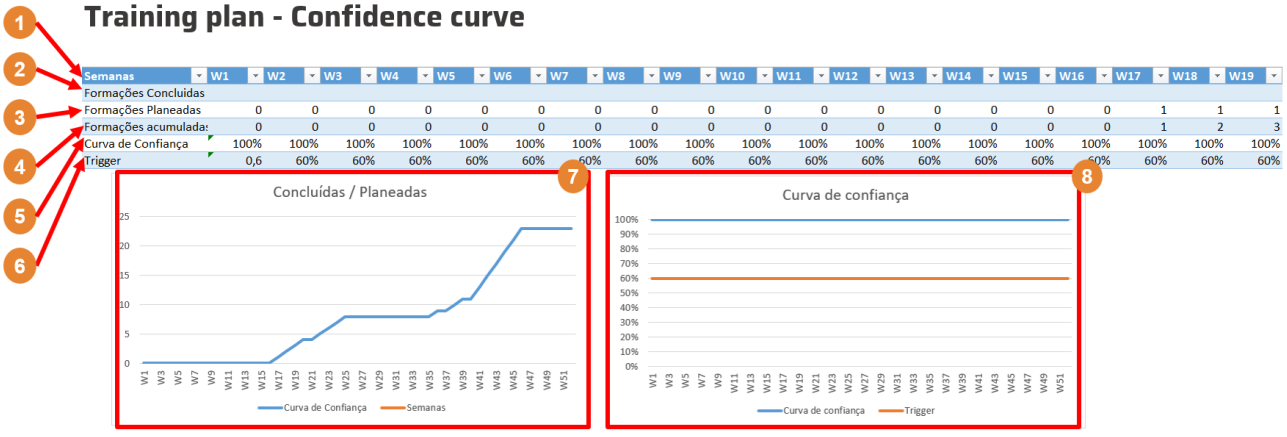
A. Training themes
B. Number of technicians per training theme
C. Number of training sessions needed (# groups = # technicians / 3)
D. Training groups

Figure G.3: Tool Overview: Creating Teams per Training Theme



A. List of allocated technicians
B. Allocation of technicians in teams
C. Overview of temporal distribution of the training plan

Figure G.4: Tool Overview: Assigning Technicians to Teams and Getting the Overview of the Plan to Identify Possible Overload



1. Weeks of the year
2. Training sessions held in week X
3. Training sessions planned for week X
4. Training sessions planned for until week X
5. Confidence curve (completed/planned training sessions)
6. Trigger (when the rate of compliance of the plan drops below the trigger, the ST must escalate the problem)
7. Weekly evolution of the no. of concluded / planned training sessions
8. Weekly evolution of the confidence curve

Figure G.5: Tool Overview: Confidence Curve for the Completion of the Training Plan

Appendix H

Monthly Indicators for the Variable Compensation Plan

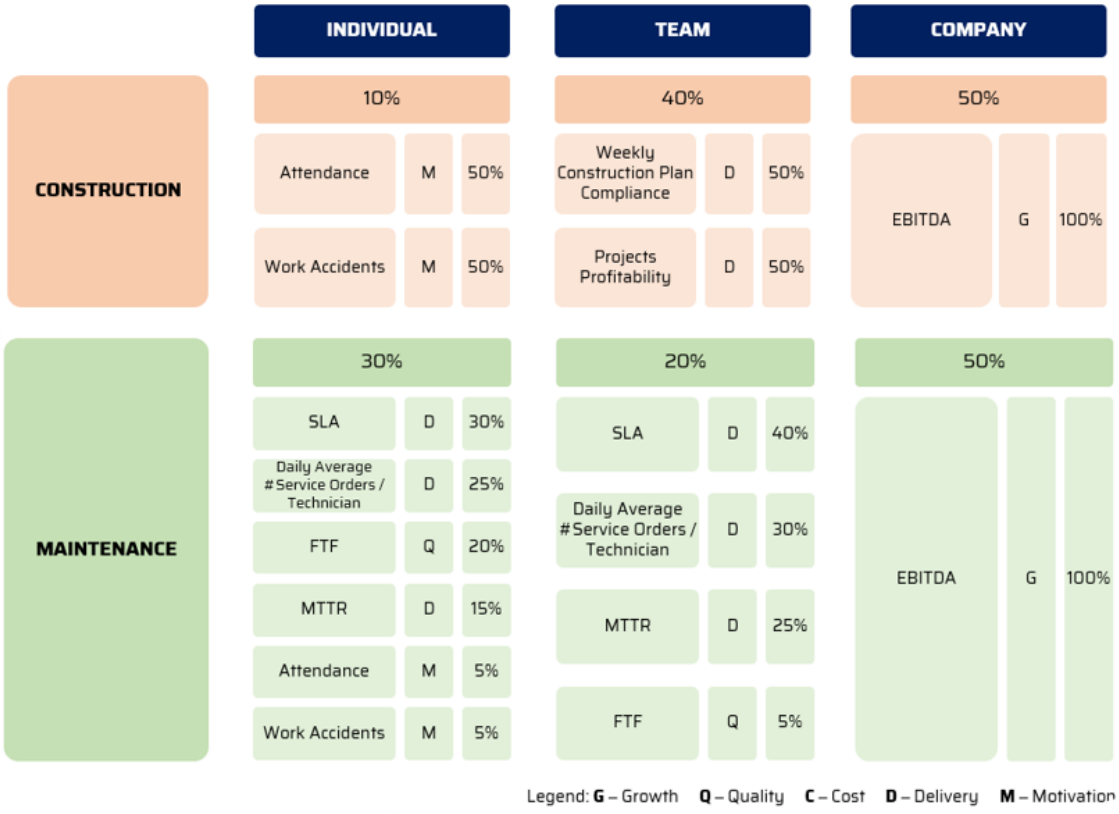


Figure H.1: Monthly Indicators for the Variable Compensation Plan

INDICATOR	INTERVAL	EVALUATION
EBITDA [%]	< 4%	0%
	[4%; 4,5%[	25%
	[4,5%; 5,9%[	50%
	[5,9%; 7,3%[	75%
	≥ 7,3%	100%
Weekly Construction Plan Compliance Rate [%]	< 90%	0%
	[90%; 92,5%[	25%
	[92,5%; 95%[	50%
	[95%; 97,5%[	75%
	≥ 97,5%	100%
SLA [%]	< 83%	0%
	[83%; 85%[	25%
	[85%; 90%[	50%
	[90%; 95%[	75%
	≥ 95%	100%
FTF [%]	< 91%	0%
	[91%; 92%[	25%
	[92%; 93%[	50%
	[93%; 94,0%[	75%
	≥ 94,0%	100%
Attendance [# Absences]	> 2 Justified Absences Or 1 Unjustified Abs.	0%
	2 Justified Absences	50%
	1 Justified Absences	90%
	0 Abscences	100%

INDICATOR	INTERVAL	EVALUATION
Compliance with Annual Preventive Maintenance Plan [%]	< 90%	0%
	[90%; 91%[	25%
	[91%; 92%[	50%
	[92%; 93%[	75%
	≥ 93%	100%
Project Profitability [%]	< 34,6%	0%
	[34,6 %; 38,9%[	25%
	[38,9 %; 43,2%[	50%
	[43,2 %; 47,5%[	75%
	≥ 47,5%	100%
Daily Average No. Of Service Orders per Technician [#]	< 2,7	0%
	[2,7; 3,1[	25%
	[3,1; 3,4[	50%
	[3,4; 3,8[	75%
	≥ 3,8	100%
MTTR [Hours]	≥ 3,9	0%
	]3,9; 3,7]	25%
	]3,7; 3,5]	50%
	]3,5; 3,3]	75%
	<3,3	100%
Work Accidents [#]	> 0	0%
	0	100%

Figure H.2: Intervals for the Evaluation of the Indicators on the Variable Compensation Plan

Appendix I

Monthly Routine for the Variable Compensation Plan

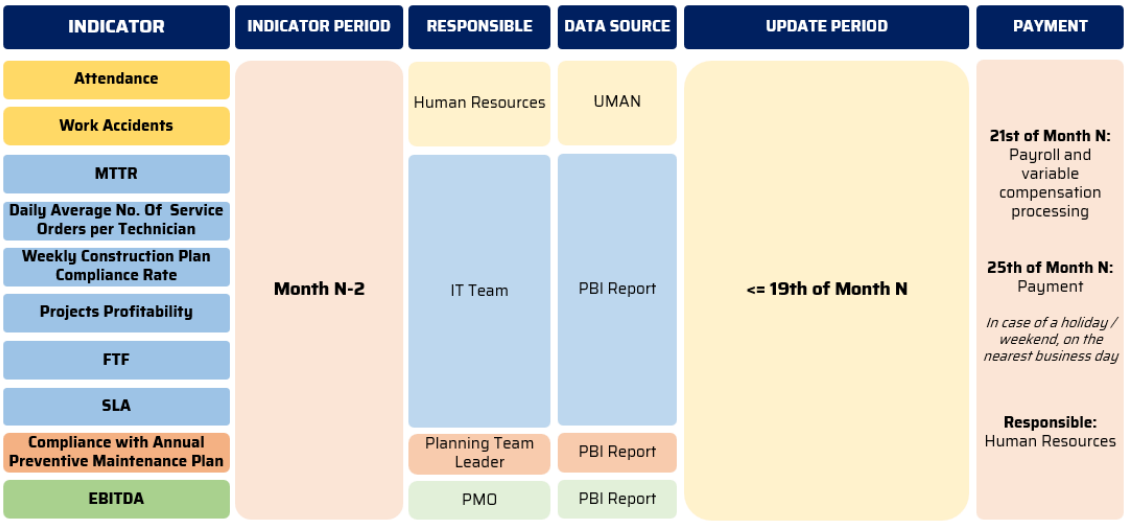


Figure I.1: Monthly Routine for the Variable Compensation Plan

In the "Responsible" field, only the department is mentioned due to confidentiality reasons. The specific individual has been determined, but their identity is not pertinent to this document.

In the "Data Source" field, only the software used is referenced to maintain confidentiality. The exact data source (e.g., specific PowerBI Report) has been specified, but these details are not relevant within this document.

Appendix J

Financial Analysis for the Variable Compensation Plan

VENCIMENTO MENSAL 2022

Cenário	Valor fixo máximo prémio €	Impacto €
Cenário 1	75 (8,3%)	33K€
Cenário 2	90 (10%)	39K€
Cenário 3	100 (11,1%)	44K€
Cenário 4	110 (12,25%)	48K€
Cenário 5	120 (13,3%)	53K€
Cenário 6	130 (14,5%)	57K€

Cenários analisados

Recomendação Equipa Projeto
-Valor fixo mensal
-Ponderação peso equipa

Taxa Social Única 23,75 % | Prémio (Budget 2022) 58 565€ | Atingimento Médio 44,56 % | Custo FTE - 34 332 €

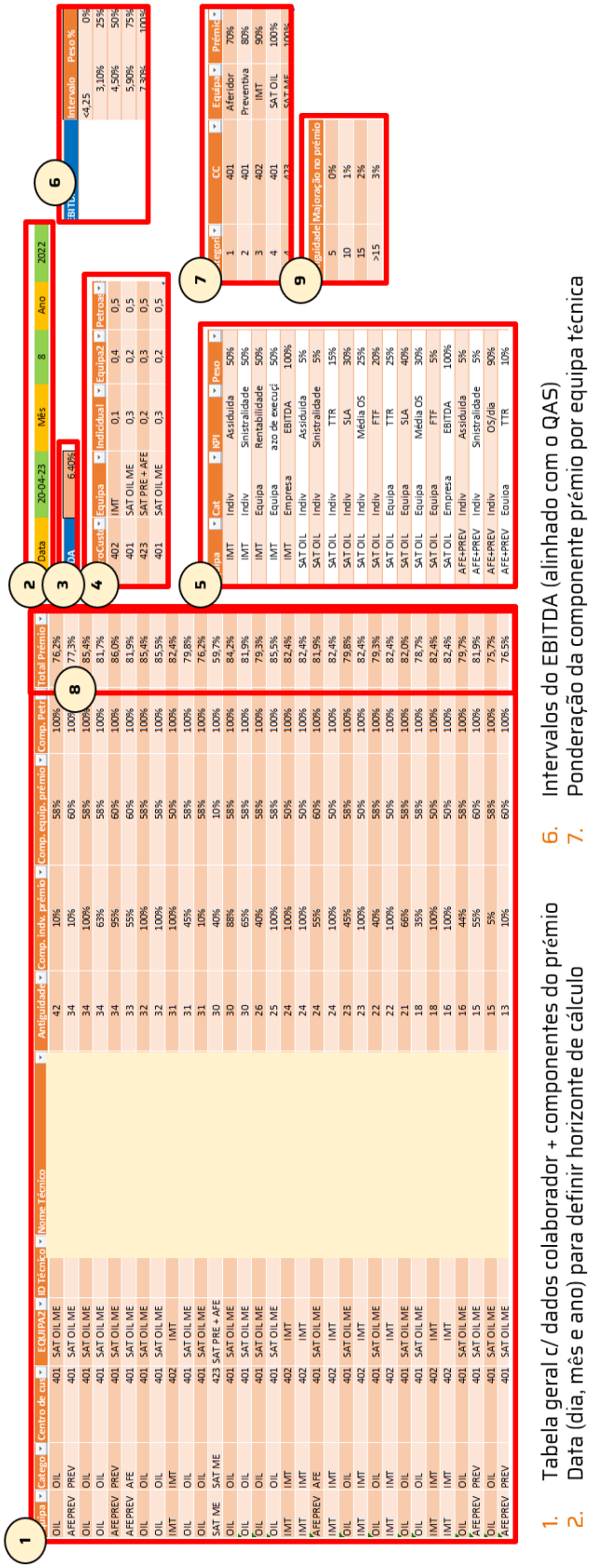
Aumento de produtividade		1%	1,5%	2%	2,5%	3%	5%	10%
Cenários	Custo total/Ganho total	24K€	36K€	48K€	60K€	72K€	120K€	240K€
Cenário 1	33K€	-9K€	3K€	15K€	27K€	39K€	87K€	207K€
Cenário 2	39K€	-16K€	-4K€	8K€	20K€	32K€	80K€	200K€
Cenário 3	44K€	-20K€	-8K€	4K€	16K€	28K€	76K€	196K€
Cenário 4	48K€	-25K€	-13K€	-1K€	11K€	23K€	71K€	192K€
Cenário 5	53K€	-29K€	-17K€	-5K€	7K€	19K€	67K€	187K€
Cenário 6	57K€	-33K€	-21K€	-9K€	3K€	15K€	63K€	183K€

J F M A M J J A S O N D → 2022 – atribuição do prémio | 49 € / Técnico

Figure J.1: Financial Analysis Using Different Scenarios according to Prize Value and Productivity Improvements

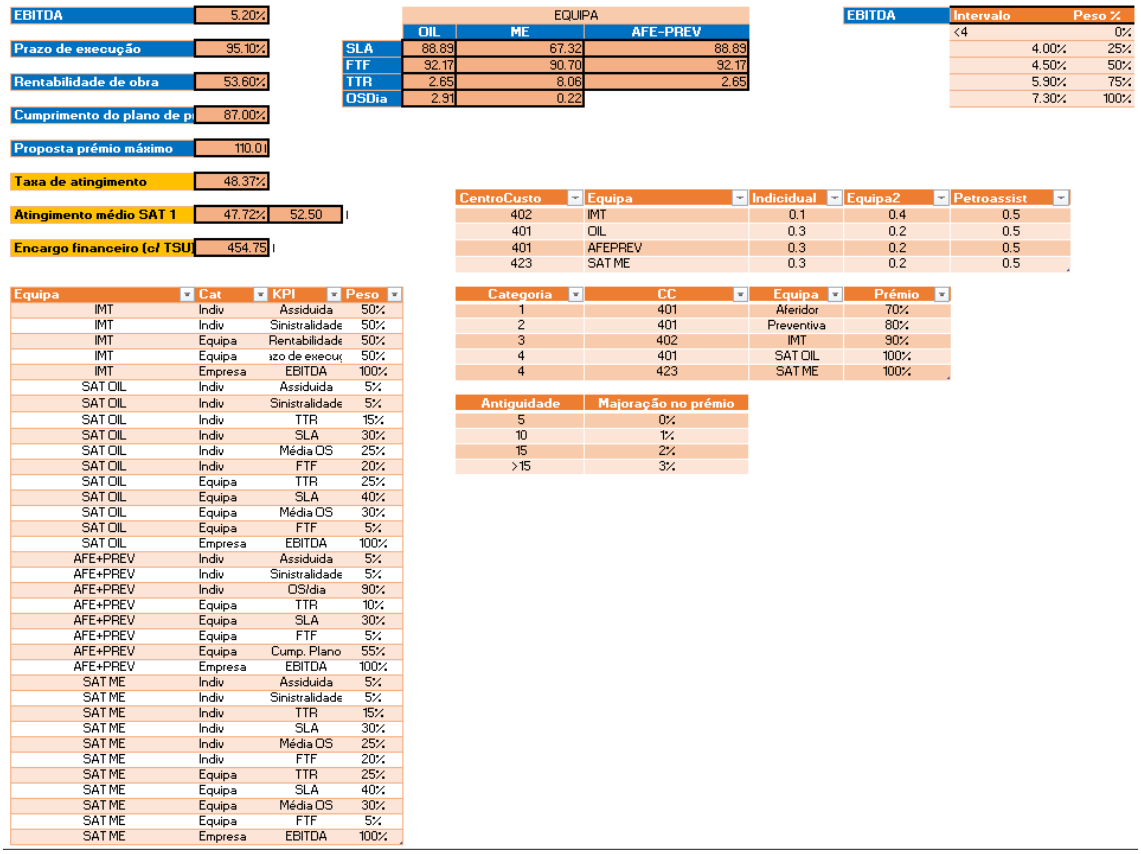
6 different scenarios were considered for the possible value of the maximum monthly prize per worker.

Data regards the Maintenance and Construction teams from 2022 was used.



1. Tabela geral c/ dados colaborador + componentes do prémio
2. Data (dia, mês e ano) para definir horizonte de cálculo
3. EBITDA (input manual)
4. Peso das componentes macro (ind, equi, empresa) por equipa técnica
5. Peso das componentes micro (ind, equi, empresa) por equipa técnica
6. Intervalos do EBITDA (alinhado com o QAS)
7. Ponderação da componente prémio por equipa técnica
8. Peso do Prémio de cada colaborador
9. Componente antiguidade

Figure J.2: Instructions for Using the Variable Compensation Tool (Excel)



EBITDA	5.20%
Prazo de execução	95.10%
Rentabilidade de obra	53.60%
Cumprimento do plano de p	87.00%
Proposta prémio máximo	110.0
Taxa de atingimento	48.37%
Atingimento médio SAT 1	47.72% 52.50
Encargo financeiro (c/ TSU	454.75

	EQUIPA		
	OIL	ME	AFE-PREV
SLA	88.89	67.32	88.89
FTF	92.17	90.70	92.17
TTR	2.65	8.06	2.65
OSDia	2.31	0.22	

EBITDA	Intervalo	Peso %
	<4	0%
	4.00%	25%
	4.50%	50%
	5.90%	75%
	7.30%	100%

CentroCusto	Equipa	Indicidual	Equipa2	Petroassist
402	IMT	0.1	0.4	0.5
401	OIL	0.3	0.2	0.5
401	AFEPREV	0.3	0.2	0.5
423	SAT ME	0.3	0.2	0.5

Equipa	Cat	KPI	Peso
IMT	Indiv	Assiduida	50%
IMT	Indiv	Sinistralidade	50%
IMT	Equipa	Rentabilidade	50%
IMT	Equipa	azo de execuç	50%
IMT	Empresa	EBITDA	100%
SAT OIL	Indiv	Assiduida	5%
SAT OIL	Indiv	Sinistralidade	5%
SAT OIL	Indiv	TTR	15%
SAT OIL	Indiv	SLA	30%
SAT OIL	Indiv	Média OS	25%
SAT OIL	Indiv	FTF	20%
SAT OIL	Equipa	TTR	25%
SAT OIL	Equipa	SLA	40%
SAT OIL	Equipa	Média OS	30%
SAT OIL	Equipa	FTF	5%
SAT OIL	Empresa	EBITDA	100%
AFE+PREV	Indiv	Assiduida	5%
AFE+PREV	Indiv	Sinistralidade	5%
AFE+PREV	Indiv	OS/dia	90%
AFE+PREV	Equipa	TTR	10%
AFE+PREV	Equipa	SLA	30%
AFE+PREV	Equipa	FTF	5%
AFE+PREV	Equipa	Cump. Plano	55%
AFE+PREV	Empresa	EBITDA	100%
SAT ME	Indiv	Assiduida	5%
SAT ME	Indiv	Sinistralidade	5%
SAT ME	Indiv	TTR	15%
SAT ME	Indiv	SLA	30%
SAT ME	Indiv	Média OS	25%
SAT ME	Indiv	FTF	20%
SAT ME	Equipa	TTR	25%
SAT ME	Equipa	SLA	40%
SAT ME	Equipa	Média OS	30%
SAT ME	Equipa	FTF	5%
SAT ME	Empresa	EBITDA	100%

Categoria	CC	Equipa	Prémio
1	401	Aferidor	70%
2	401	Preventiva	80%
3	402	IMT	90%
4	401	SAT OIL	100%
4	423	SAT ME	100%

Antiguidade	Majoração no prémio
5	0%
10	1%
15	2%
>15	3%

Figure J.3: Assumptions for the Variable Compensation Plan using Scenario 4

Equipa	Catego	Centro de cus	EQUIPA2	EQUIPA SA	ID Técnico	Nome Técnico	Antiguidade	Comp. indv. prémio	Comp. equip. prémio	Comp. Petr	Total Prémio	Prémio
OIL	M	401	OIL	5	3		42	10%	66%	50%	42.5%	46.74
AFEPREV	P	401	OIL	6	15		35	100%	33%	50%	63.3%	69.68
OIL	M	401	OIL	2	17		35	100%	66%	50%	70.3%	77.33
OIL	M	401	OIL	2	18		35	78%	66%	50%	63.3%	69.68
AFEPREV	P	401	OIL	6	19		34	100%	33%	50%	63.3%	69.68
AFEPREV	AF	401	OIL	6	23		34	100%	33%	50%	63.3%	69.68
OIL	M	401	OIL	2	35		33	80%	66%	50%	64.1%	70.53
OIL	M	401	OIL	2	42		32	89%	66%	50%	66.8%	73.50
IMT		402	IMT		48		32	100%	88%	50%	72.1%	79.31
OIL	M	401	OIL	6	49		31	45%	66%	50%	53.3%	58.63
SAT ME	ME	423	SAT ME	1	55		31	30%	10%	50%	37.1%	40.79
OIL	E	401	OIL	1	60		31	48%	66%	50%	54.1%	59.48
OIL	M	401	OIL	5	61		30	74%	66%	50%	62.2%	68.40
OIL	M	401	OIL	2	91		26	81%	66%	50%	64.5%	70.95
OIL	M	401	OIL	2	106		25	94%	66%	50%	68.4%	75.20
IMT	E	402	IMT	1	118		25	100%	38%	50%	51.5%	56.65
AFEPREV	AF	401	OIL	6	124		24	100%	33%	50%	63.3%	69.68
OIL	M	401	OIL	2	128		24	66%	66%	50%	59.9%	65.86
IMT		402	IMT		134		23	100%	38%	50%	51.5%	56.65
OIL	E	401	OIL	4	149		22	40%	66%	50%	51.8%	56.93
IMT		402	IMT		150		22	100%	38%	50%	51.5%	56.65
OIL	E	401	OIL	1	160		21	64%	66%	50%	59.1%	65.01
OIL	M	401	OIL	5	210		18	55%	66%	50%	56.4%	62.03
IMT		402	IMT		211		18	100%	38%	50%	51.5%	56.65
IMT		402	IMT		248		16	100%	0%	50%	36.1%	39.66
IMT		402	IMT		251		16	100%	38%	50%	51.5%	56.65
OIL	M	401	OIL	2	263		16	60%	66%	50%	57.9%	63.73
AFEPREV	P	401	OIL	6	282		16	100%	33%	50%	63.3%	69.68
OIL	E	401	OIL	1	290		15	33%	66%	50%	49.4%	54.38
AFEPREV	P	401	OIL	6	330		13	10%	33%	50%	35.2%	38.71
OIL	L	401	OIL	3	390		12	45%	66%	50%	52.8%	58.06
AFEPREV	AF	401	OIL	6	440		11	100%	33%	50%	62.7%	69.00
OIL	M	401	OIL	3	447		10	10%	66%	50%	42.1%	46.28
OIL	M	401	OIL	5	457		10	18%	66%	50%	44.4%	48.81
OIL	M	401	OIL	5	483		10	49%	66%	50%	53.9%	59.33
OIL	M	401	OIL	5	526		9	40%	66%	50%	50.8%	55.83
AFEPREV	P	401	OIL	5	559		9	100%	33%	50%	62.1%	68.33
AFEPREV	P-AJ	401	OIL	6	649		7	10%	33%	50%	34.8%	38.33
OIL	M	401	OIL	2	650		7	93%	66%	50%	66.7%	73.33
SAT ME		423	SAT ME		670		7	10%	10%	50%	30.3%	33.33
IMT		402	IMT		682		7	100%	38%	50%	50.5%	55.55

Figure J.4: Testing the Variable Compensation Plan using Scenario 4 for April 2023