Productivity Measurement and Improvement in Management Consulting Companies

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Masters Dissertation

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“Don't find fault, find a remedy. Anybody can complain.”

Henry Ford

Abstract

In management consulting, it's long been understood the importance of knowledge management due to high growth and increasing complexity of the business. However, there is still no known research about productivity measurement and improvement in management consulting companies. The literature describes extensively productivity measurement for industrial applications, but applying this metric to consultants requires several adaptations due to the highly intellectual and relational activities performed. In this dissertation, the development of a data collection model was a major step to reduce effort and complexity of colleting consultants' productivity data that allowed the characterization of the initial situation to be improved. The definition of solutions to improve productivity intends to reduce preparation time, improve training effectiveness, reduce waiting time at the clients and warranty a continuous monitoring of productivity indicator in comparison to cost and quality indicators. The pilot projected implemented reduced the average opening time in 7%, promoting higher motivation of consultants and better results for the company.

Foreword

Firstly, I would like to thank Luísa Tavares and all members of company's development team for guiding me through the project, as well as all consultants for the help in collecting data and implementing several solutions aiming to improve their productivity.

Secondly, I would like to thank my supervisor, Professor Maria Dulce Lopes, from Faculdade de Engenharia da Universidade do Porto, for all the assistance and continuous support provided during the writing of the dissertation.

Finally, I would like to thank my parents and Ana, for supporting me in all these years, for the care, concern and for being with me all the times, making possible the accomplishment of another dream.

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1 Introduction

1.1 Context

Management consulting is a worldwide business based on helping organizations to improve their performance, through structured analysis of existing problems, development and implementation of improvement plans. Consulting companies sell knowledge to their clients in different areas such as operations management, strategic management, IT and human resource management. This business appeared in the end of 19th century by Arthur D. Little, who founded ADL Inc. in 1886 but focused on technical research for the first few years, and Frederick Winslow Taylor, who opened an independent consulting practice in Philadelphia in 1893. Nowadays, Big Four management consulting firms (Deloitte, KPMG, PwC, Ernst & Young) worldwide revenues exceeds $50 billion.

The company that supported this research is a multinational consulting company specialized in lean management consultancy. This company works close to its clients from problem analysis to solutions design and implementation, including training and change management. Nowadays, the company has more than 600 consultants in 35 offices worldwide. The Portuguese office, in which this research was based, has more than 100 consultants and has clients in several countries besides Portugal. As shown in Figure 1, this office has experienced a strong growth in revenues in the last 10 years. Due to high growth, increasing complexity of the business and the ambition of operational excellence, the company intends to develop a project for productivity measurement and improvement within the organization.

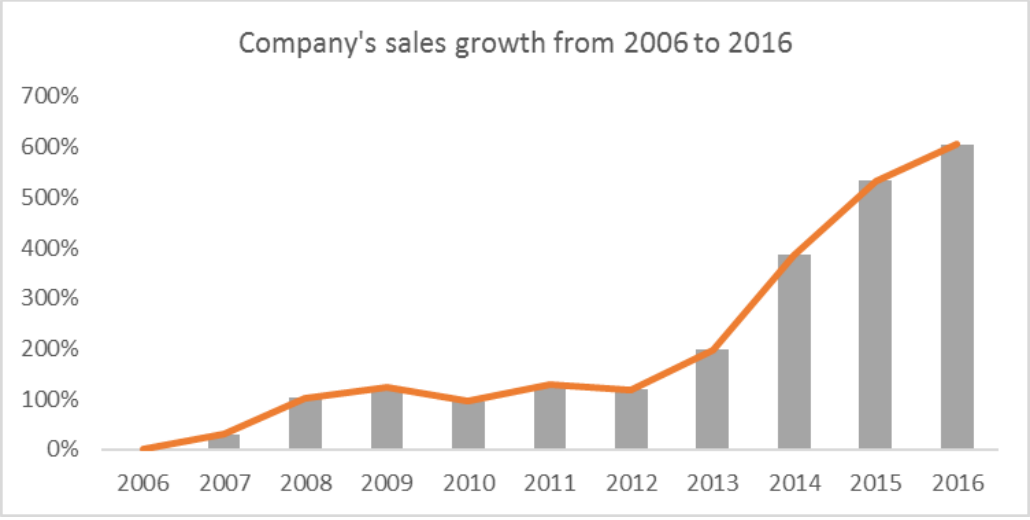

Figure 1 - Company's sales growth from 2006 to 2016

Source: Company's Annual Results Reports

1.2 Framework of the project and objectives

"Performance is more dependent on the capacity to leverage resources than on the ability to ride the wave of an attractive industry" (Dunford, 2000). This theory of strategic management, "resource-based view of the firm", is the one that most fits in sectors where the resources are mostly based on knowledge and not in possession of physical infrastructures. In the management consulting industry, the most important resource of companies is their pool of consultants. Thus, according to Dunford (2000), the performance of these organizations translates their ability to leverage the productivity of their consultants.

However, the improvement in resource efficiency must be followed by improvement in flow efficiency. Traditionally, organizations tend to focus solely on improving resource efficiency, which in the future makes it difficult to create efficient flows. On the one hand, improving resource efficiency aims to maximize resource utilization while reducing costs. On the other hand, the improvement of flow efficiency aims to guarantee a high level of service and reduction of waste, promoting the maximization of customer satisfaction. According to Modig and Åhlström (2011) combining these two forms of efficiency is extra difficult and will only be possible through understanding the functioning of business processes.

This dissertation intends to respond to this theme and the study is based on an organization that is present in several European countries and is in a period of strong expansion. From the perspective of productivity improvement, the impact on results that can be generated in a rapidly growing organization is even more relevant than in low-growth organizations. At the same time, in the case of expensive and intangible resources, the difficulty of increasing their productivity is greater, but the potential gains can have brutal impacts on organizations.

The development of this project aims to achieve four objectives: analysis of methodologies for performance measurement of consultants, characterization of the initial situation in the organization (AS IS), design of solutions (TO BE) and implementation of a pilot and deployment plan. In the first phase, it is necessary to analyze what kind of methodology should be adopted in the measurement of consultants' performance. Unlike equipment performance measurement, which is easily automated at very low cost, the performance measurement of consultants is very complex, mainly due to the analytical nature inherent to the consulting activity, with constant development of work in multidisciplinary teams and in permanent contact with the customer. After defining the performance measurement methodologies to be used, the initial situation characterization (AS IS) based on the collected data will be the starting point for the design of solutions for future vision (TO BE). Finally, the implementation of the pilot will allow to evaluate the potential gains of the proposed solutions and precedes the definition of the implementation plan of all solutions to the organization.

1.3 Methodology

The improvement in productivity applied to consulting activities requires, at an early stage, the definition of the concept of value-added for the client. The activities targeted for optimization were defined from the point of view of increasing productivity by reducing waste inherent to activities without value-added to the customer. At this stage, it is essential to take into account that there are activities without direct value-added that indirectly support activities with value-added. Due to the evolution of the activity typology developed according to the internal level in the organization, it was defined that the target group of this study would be between junior consultants and principals, since at the higher levels such as partners there is a predominance of sales activities instead of operational activities.

The definition of the study beacon was followed by the development and application of productivity data collection methodologies, based on the Overall People Efficiency (OPE) metric and the template developed to ensure uniformity of data. Data collection was done in shadowing and self-assessment format. The database created allowed the development of a productivity collection model that reduces the effort inherent to the monitoring of this indicator. This model, which translates into an online survey, was applied to projects already completed to allow the comparative analysis of the operational cost and quality indicators with the productivity indicator. The need for continuous monitoring has led to the development of a business intelligence dashboard.

The analysis of the various data collected led to the identification of the main problems to be addressed, which were selected through the application of a priorities matrix. For each of the problems identified, solutions were designed and a pilot was implemented.

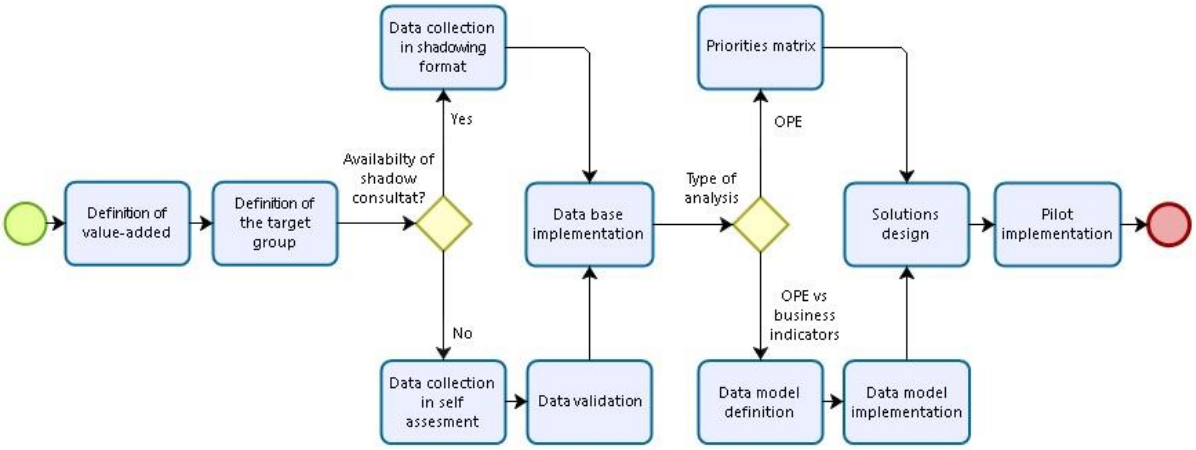

Figure 2 - Methodology adopted during the project

1.4 Structure of the dissertation

This chapter, of an introductory nature, aims to contextualize the project, define objectives, methodology and structure the approach to the proposed problem. In chapter 2 the state of art in the scope of productivity improvement in organizations is reviewed, as well as tools and methodologies commonly used in this area. In chapter 3 it is presented the detailed characterization of the problem and the initial state (AS IS) of the organization's value chain. In chapter 4, the future vision (TO BE) is drawn and solutions are presented that aim at the organizational transformation from the initial state to the future vision. In chapter 5 the implementation of the pilot project is addressed, as well as the results obtained and the implementation plan to the entire organization. Finally, in chapter 6, the main conclusions about the project are discussed and future work actions are defined.

2 Theoretical Review

2.1 Kaizen philosophy

The highly competitive environment involving organizations promotes a need for constant change and adaptation to the new environment conditions. Ensuring high levels of service, high quality and low cost becomes vital to ensure the permanence in the market and sustainable growth. This sustainability requires management models focused on the continuous improvement of processes, seeking to achieve operational excellence through the involvement of all people, every day and in all areas. This philosophy allows organizations to perform exceptionally well when compared to organizations that rely on their improvement only at specific points in time. Kaizen is the Japanese term for "Continuous Improvement" and, unlike traditional approaches, promotes cost reduction, service level improvement and quality by eliminating waste (Imai, 1997). The Kaizen philosophy is based on process improvement and a long-term vision that leads to results of excellence, giving organizations a strong competitive advantage. The human element is a key point of this management model and its wide scope within organization, through the involvement of all employees, guarantees the success of the system in the long term.

With the mission of “improving the world with everyone, everywhere, everyday”, the company also looks within the organization in order to continuous improve internal processes and develop the business. Kaizen in Kaizen is the concept of applying all the principals of this philosophy within the organization.

2.2 Kaizen principles

Imai (1997) defined the 5 fundamental Kaizen principles as the basis for the operational excellence of organizations. These principles are adopted transversally in the most diverse sectors and internally in the own institute in a perspective of Kaizen in Kaizen:

1. Creating value for the customer
   The first Kaizen principle aims to focus organizations on activities with value-added for the client, in order to ensure their maximum satisfaction. Ensuring the alignment of the activities of the organization with the intended by the clients is central to the sustainability of the business.

2. Waste elimination (MUDA)
   The mapping of the processes allows to identify the proportion of time in which the unit of flow is actually getting value-added during the process. It is considered as activity that adds value all the activities for which the customer is willing to pay. Given this definition, the Kaizen philosophy identifies 7 types of waste:

- Overproduction
- People movements
- Materials transport
- People waiting
- Materials stock
- Over processing
- Defects production

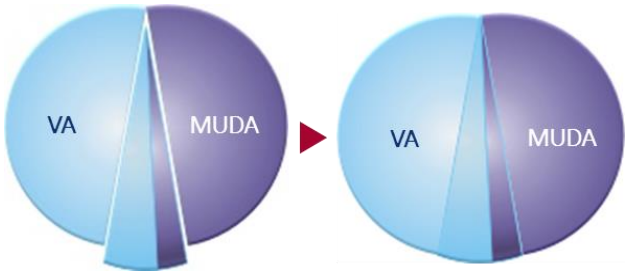

Figure 3 - Traditional methodology to increase value added

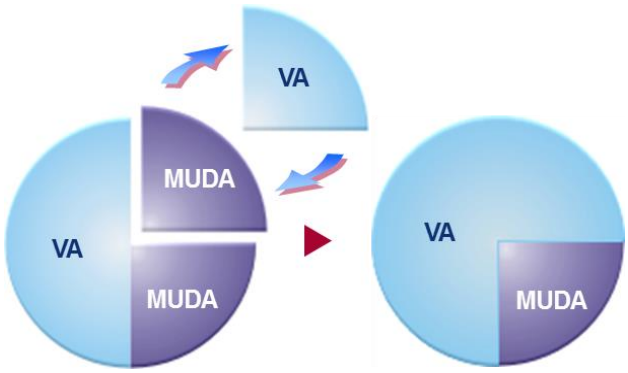

Figure 4 - Kaizen methodology to increase value added

Within the seven wastes, it is important to consider that some types of waste are inducers of other wastes. For example, in the case of overproduction, all other wastes are directly generated. Recognizing the seven types of waste allows organizations to grow through waste elimination, as opposed to growth through the proportional addition of value-added activities and non-value-added activities. These two types of evolution of organizations are exemplified in the Figure 4.

3. Go to GEMBA

Since GEMBA is the place where value is added to the unit flow, it is in GEMBA that the management should be focused, in order to maintain a continuous monitoring of operations. Going to the field, observing the processes and collecting data that allow to draw conclusions make the third principle a fundamental practice for the implementation of the Kaizen philosophy.

4. Employee involvement
   Ensuring the involvement of all employees in the continuous improvement process is the key to success. The development and execution of actions and improvement programs should be done with a strong contribution from the teams, as this is the way to certify that the implemented actions fit the daily needs, promoting the productivity, quality, service and cost reduction, in addition to increasing the motivation of all employees.

5. Visual management
   Identifying and making problems visible is critical to ensuring teams focus on what is truly important. If nobody knows the problems, it is not possible to solve them. The simplification of information transmission is another advantage of visual management, which can be based on the correct use of colors, shapes and images, instead of monochrome and alphanumeric communication tools.

2.3 Kaizen tools

2.3.1 PDCA and SDCA

Normalizing work tasks ensures that teams perform tasks in the most effective way, ensuring the best and most consistent results. Through standardization of tasks, organizations ensure productivity gains, guarantee high standards of quality and improvements in the level of customer service. According to Imai (1997) a standard is the simplest, most efficient and safest way to accomplish a task. Standards also allow to ensure the correct continuity of the task if there is a change of the executor, facilitating coaching and evaluation. The connection between PDCA (Plan, Do, Check, Act) and SDCA (Standardize, Do, Check, Act) cycles is fundamental to the maintenance of good practices. In the PDCA cycle improvement actions are developed which leads to performance gains for the organization. However, if these actions do not continue for the SDCA cycle they do not remain in a sustained way in the organization over time. To ensure the stability of improvement actions, the PDCA cycle must always be followed by the SDCA cycle.

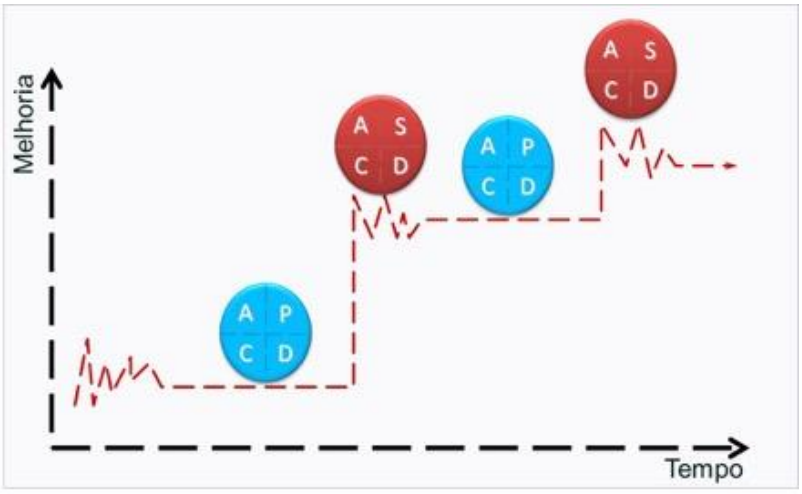

Figure 5 - Improvement with PDCA and SDCA cycles

Source: Kaizen Institute

In management consulting companies there is a huge diversity of knowledge and fields of action, so the preparation and setup time of the consultant is smaller with higher levels of standardization of tasks, methodologies and supporting documents. The relevance of this topic should also be considered in the scope of the new improvements implemented following this project, which should be standardized in order to guarantee its continuity in the organization.

2.3.2 5S

The term 5S (Hiroyuki, 1995) intends to represent the five Japanese words *seiri, seiton, seiso, seiketsu, shitsuke* which means, respectively, sort, storage, clean, normalize and discipline. The implementation of 5S begins with the sorting step, where it is intended to define what should or should not be close to the workstation. After identifying the tools and products needed, storage of all items should be done. The definition of the storage location should be based on the priority of each item, assuming the logic of items with greater frequency of use should be closer to the place of use. Table 1 presents the criteria commonly used.

Priority	Frequency of use	Where should be stored
Low	Once a year or less	Central location
Medium	Once a semester, monthly	Department location
High	Hourly, daily, weekly	Close to the point of use

Table 1 - Products/information storage by type of priority

The third step intends to clean the workstation, i.e. restore the initial conditions of machines and infrastructure. The fourth step is normalizing all the procedures through visual standards to ensure the sustainability of this process. Despite being the last step, the discipline of the teams is crucial for the success of 5S implementation. The most common tool used to ensure that standards are followed is auditing.

The organization of the workstation is the basic pillar of continuous improvement and is fundamental to ensure a correct management of resources. According to Bayo-Moriones et. al (2010), 5S is a system to reduce waste and optimize productivity and quality through maintaining an orderly workplace and using visual cues to achieve more consistent operational results.

The applicability of this topic to the area of management consulting is also associated with the IT component. Ensuring the correct location and ease of access to the vast databases of information and knowledge of organizations ensures higher levels of productivity. The process of implementing digital 5S must be based on the traditional 5S methodology, ensuring the adaptations required by the absence of physical items.

2.3.3 Structured problem solving

The correct resolution of a problem implies the resolution of its root cause, since this is the only way to avoid its recurrence. To ensure successful problem solving, structured problem-solving tools such as 3C, *Kobetsu Kaizen* or 8D should be implemented. The 3C tool, aims to

simplify problem solving by focusing teams in just four steps: case, causes, countermeasures, and verification of results. Figure 6 shows the cycle of implementation of 3C methodology. The first step aims to describe the problem to be solved and define the objective to be achieved. At this stage, the team should focus on identifying problems and not solutions, going to Gemba to visualize the problem and look for data, MUDA and variability symptoms. In the second step, root causes are identified using the Ishikawa tool. The third step starts with the brainstorming of solutions and is followed by the definition of solutions to be implemented and the creation of the action plan to the implementation phase. Finally, it is fundamental to validate the impact of the actions triggered in the results and, if necessary, return to the description of the case.

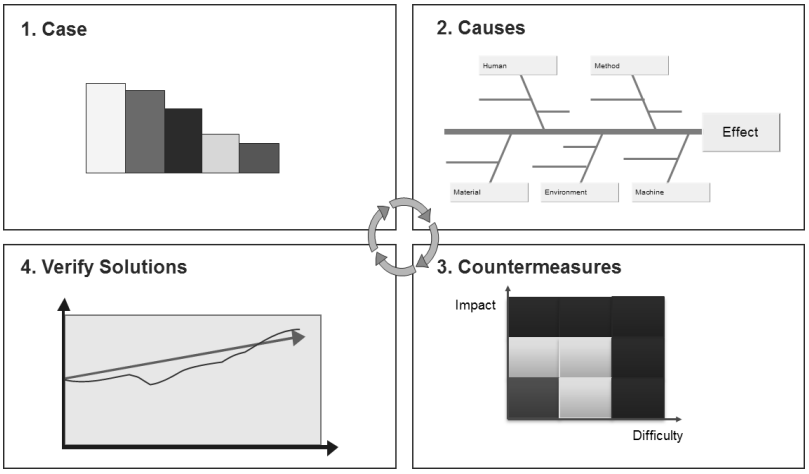

Figure 6 - 3C methodology implementation

Source: Kaizen Institute

2.4 Lean services

The Lean Production model intends to describe the practices that led to the success of the automotive industry in Japan in the 1980s. Compared with the western industrial culture, it was a totally innovative management model, in which the reduction of inventories, optimization of flows and focus on the management of processes that add value where the basis to reduce the occurrence of defects and increase productivity. The designation Lean Production is born by the hand of John Krafcik to refer to the Toyota Production System (Monden, 1998). According to Liker and Morgan (2006), Toyota's Production System is based on “lean” principles including a focus on the customer, continual improvement and quality through waste reduction, and tightly integrated upstream and downstream processes as part of a lean value chain. Most manufacturing companies have adopted some type of “lean initiative,” and the lean movement recently has gone beyond the shop floor to white-collar offices and is even spreading to service industries. Although the origins of the Lean concept are associated with the automotive industry, the evolution of the research in this area is increasingly focused on specific models for different industries, such as Lean Healthcare, Lean Services or Lean Construction. These adaptations arise in the wake of the resistance shown by other sectors to the application of concepts of the automotive industry to completely different sectors. The Lean Services comes with the application of Lean concepts to the service sector, such as transportation, banking, retail and utilities. Table 2 presents the connection between MUDA in industry and services, according to Robinson et. al (2012).

MUDA in industry (Ohno, 1998)	MUDA in services (Bicheno and Holweg, 2009)
Transportation: moving products that are not actually required to perform the processing.	**Unclear Communication** and the wastes of seeking clarification, confusion over product or service use, wasting time finding a location that may result in misuse or duplication.
Inventory: all components, work in process and finished product not being processed.	**Incorrect Inventory**: Out of stock, unable to get exactly what was required.
Motion: people or equipment moving or walking more than is required.	**Unnecessary Movement**: Queuing several times, lack of one-stop, poor ergonomics in the service encounter.
Waiting (Delay): waiting for the next production step.	**Delay** on the part of customers waiting for service, for delivery, in queues, for response, not arriving as promised.
Overproduction: production ahead of demand.	**Opportunity Lost** to retain or win customers, failure to establish rapport, ignoring customers, unfriendliness, and rudeness.
Over-processing: resulting from poor tool or product design creating activity.	**Duplication**: Having to reenter data, repeat details on forms, copy information across, answer queries from several sources within the same organization.
Defects: the effort involved in inspecting for and fixing defects.	**Errors** in the service transaction, product defects in the product/service bundle, lost or damaged goods.

Table 2 - MUDA in industry and MUDA in services.

Source: Robinson et. al (2012)

2.5 Methodologies for measuring people productivity

Productivity measurement can be characterized as the process of quantifying the efficiency and effectiveness of a given action. An indicator is the metric used in this quantification (Neely, Gregory, & Platts, 1995). The indicators most often addressed in organizations are financial, but they are not enough to properly measure the performance of a business (Kaplan and Norton, 1996). Thus, it is fundamental to complement the measurement of the financial performance with the measurement of the operational performance of organizations, having in mind that there are several points of contact between a good operational management and good financial results.

Industry performance measurement, often associated with the Overall Equipment Effectiveness (OEE), is widely studied and applied across a wide range of industries. However, in services that involve highly intangible resources, such as management consulting activities, the great asset of companies is the knowledge generated and captured by the organization itself through its human assets. It is imperative to measure the potential for improvement of the human element. Thus, an adaptation of the OEE, called Overall People Efficiency (OPE) or Overall Labor Efficiency (OLE) is a metric that is becoming more common both in industry and services. It is also subdivided into availability, performance and quality losses.

The calculation of the OPE is similar to the calculation of the OEE, once it is considered the percentage of value-added per unit of opening time:

$$OPE = \frac{Value\ Added\ Time}{Opening\ Time}$$

Being the value-added time given by:

$$Value\ Added\ Time = Opening\ Time - Productivity\ Losses$$

Opening time is an easy measurable variable, while productivity losses are extremely difficult to measure. With the goal of categorize all the activities that the customer is not willing to pay for, the adaptation of the OPE by Kaizen Institute defined concrete typologies for each of the segments of losses of this metric:

Home Preparation

- Understand: time spent understanding activities to be performed.
- Prepare: time spent preparing files to be used at the client.

Availability, planned

- Empty planner: rigidity due to strong weekly planning pattern with fixed due dates.
- Time with supervisor: team leaders spend on average more than 30% of their time on content related work and 20% on leaderships tasks.
- Travelling: time spent travelling to the client and between clients.
- Training: time spent in ineffective training[1].

Availability, unplanned

- Disruption: interruptions by unexpected meetings, by colleagues, disturbance by noise, environmental influences of all kind, non-availability of technical items, etc.
- Setup/multitasking: time needed to actually start adding value after starting an activity or time losses due to multitasking.
- Waiting: time spent looking for information, materials or people.

Performance

- Task complexity: system failures (computer, printer), broken-down equipment, copiers, no permission, lack of software. Many interfaces, missing process descriptions, ambiguities, no system integration, data transfer errors, duplicate input, manual data import and export, unclear responsibilities.
- Individual variation: varying performance levels of team members; efficiency loss due to lack of standards sharing and no plan.
- Support: preparation/coordination of meetings and writing support reports.

[1] Ineffective training relates to training that takes longer than needed or unnecessary training.

Quality

- Checking: wrong data in system; mistrust of system leads to unnecessary double checking; errors of master data; low quality of data, wrong document.
- Relearning: changes of customer requirements at a late stage in a project.
- Redoing: decisions by management without consulting the project team.

2.6 Knowledge management

The implementation of a knowledge management system in a management consulting firm poses some risks to be taken into account. The first generic challenge facing a consulting firm that is seeking to establish an effective knowledge management system is to ensure that the quality of information in the system is high (Dunford, 2000). The quality of the information can be affected by the consultants' low feed of the database, or by incorrectly feeding content due to unappropriated form or characterization, which makes it difficult to search. The consultants may intend to write up lessons they have learned, or solutions they have developed, for subsequent addition to databases - where they will be available to other consultants in the firm - but they simply do not “find the time'” (Davenport and Hansen, 1998). The second generic challenge facing a consulting firm that is seeking to establish an effective knowledge management system is to ensure that the system, once established, is used (Dunford, 2000). Chard (1997) notes the existence of variation across engagement teams, while Pasternack and Viscio (1998) note that in Booz, Allen & Hamilton, while junior staff quickly responded to the availability of the knowledge management system, senior staff were slower adopters, sometimes due to the unwillingness of some partners to accept others as experts. For knowledge management to work it may require “a shift in mindset and culture, away from hoarding knowledge and towards sharing ideas" (March, 1997).

3 Initial situation analysis

The characterization of the initial situation regarding the consultants' productivity was divided into three distinct stages. In an initial phase, data was collected using the OPE model in shadowing and self-assessment format. Shadowing format consists of having one consultant doing the time writing of another consultant, whereas in the self-assessment format it is the evaluated consultant that performs his/her own data collection. In the second stage, using the database developed in the first phase, it was developed a model that measures the productivity of a consultant in a project using a simple and quick-response survey, whose results were validated with data obtained through shadowing. The great advantage of using this data model is the drastic reduction of the data collection effort. In the case of time writing, it is necessary to record the type of activity developed by the consultant every fifteen minutes, while with the developed data model it is possible to obtain the productivity result in about five minutes, enabling monitoring over time without overloading resources. Finally, in the third phase, the developed data model was applied and the results obtained were compared with existing cost and quality indicators, in order to establish a possible relationship between these variables.

3.1 OPE – Shadowing and self-assessment data

The data collection of OPE began with the application of the time writing grid to the consultants of the target group of this study. The time writing grid is presented in Appendix A. Each selected consultant was accompanied by a second consultant, during a two-week period, in order to describe daily activities and obtain a final result regarding the percentage of value-added, as well as the respective productivity losses. The data collection period for each consultant was defined in two weeks in order to reduce the impact of variability between more productive days and less productive days within one planning cycle. The evaluated consultants were selected to represent the organization as a whole, so they belong to different geographies, sex, hierarchy level and experience.

In parallel, the data collection was repeated using the self-assessment method. This time it was used a larger number of consultants due to the lower need for resource allocation to collect data. The data collected by self-assessment was validated by the data collected in shadowing and outliers were excluded.

Data about the preparation of work outside the established work schedule, called "home prep", were obtained through a survey to all consultants in the target group. These data was integrated with the data collected in shadowing and self-assessment relative to the traditional worktime, in order to obtain a single and integral indicator of consultants' productivity.

3.1.1 Initial database results

The overall OPE results of the consultants under study translated a percentage of value-added around 37% (4.60 hours). As shown in Figure 7, on average, only 4.60 hours of work per day translate into value-added for the customer, compared to an average opening time of 12.30 hours. The opening time obtained should be analyzed with caution, since it was considered that all work is performed on working days, i.e. work done at the weekend was diluted on weekdays, promoting increased opening time. However, for the purpose of calculating the percentage of value-added, this effect has no impact.

The main productivity losses identified are associated with preparation and planned losses related to travel and training, totaling 38% (4.71 hours) of the total opening time. The remaining productivity losses due to unplanned downtime, performance or quality account for 16% (1.88 hours) of the opening time. The residual component "other NVA" represents unrecorded productivity losses and therefore not eligible for analysis. This component amounts to 9% (1.10 hours) of the opening time.

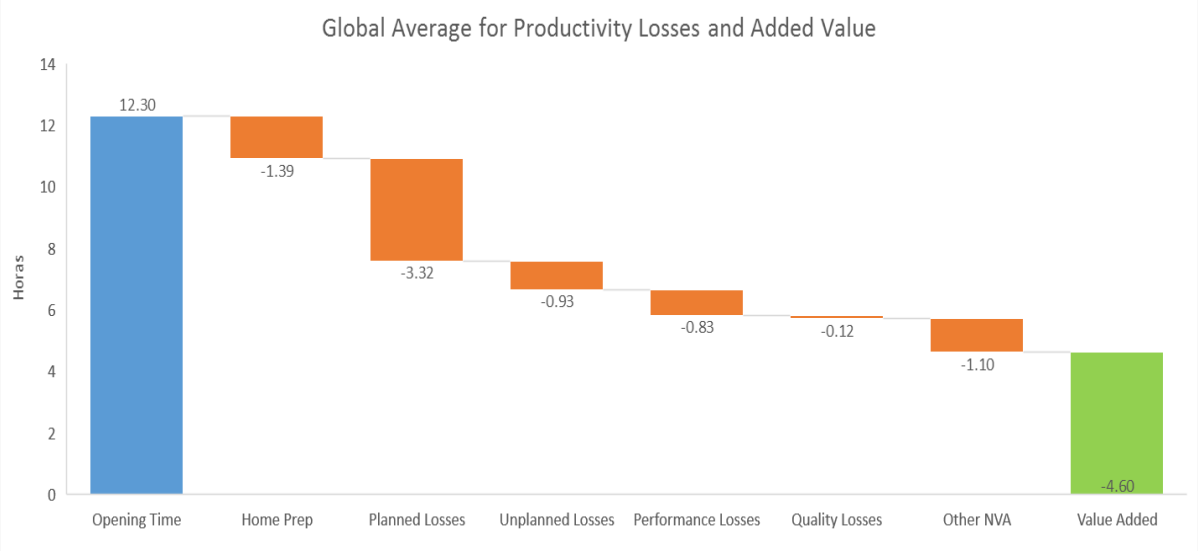

Figure 7 - Global average for productivity losses and value-added

The “home prep”, which translates the average daily time spent in preparation after hours, was analyzed in more detail according to the years of experience of each consultant. This analysis was divided into two areas: study the topic to be presented and preparation of associated files or materials. As shown in Figure 8, the time dedicated to study the methodology assumes an upward trend during the first years of experience, which later becomes a sharp downward trend until stabilizing around 1.5 hours per week. The initial behavior may be associated with the increase in the complexity of projects during the first years, which leads to a higher preparation requirement. The downward trend observed for intermediate levels of hierarchical seniority may come from the beginning of the repeatability of some topics. Figure 9 shows the downward evolution of the time spent weekly in the preparation of files and materials based on the consultant's years of experience. At the more junior levels there is a need for approximately 5.0 hours per week, while at the higher levels there is a 50% lower need, amounting to approximately 2.5 hours per week. This reduction might be explained with the use of older versions of files that consultants already have in their possession, which leads to the use of non-up-to-date materials.

Extrapolating the results obtained for the different levels of seniority, it is concluded that each consultant spends, on average, 7.0 hours a week in preparation of work. For a weekly schedule of 40 hours, the preparation assumes a weight of 18% of the time. However, taking into account a weekly schedule of 60 hours, more in line with the reality under study, it represents 12% of the total opening time.

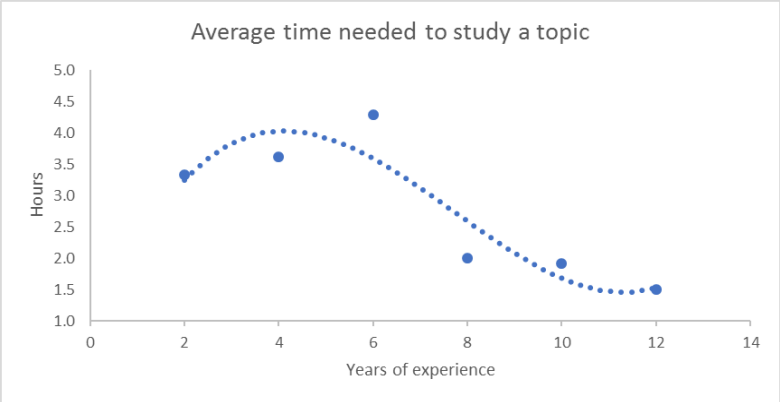

Figure 8 - Average time needed to study a topic

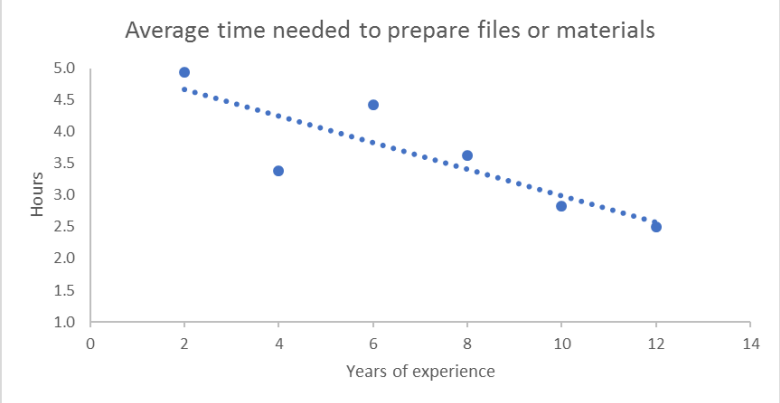

Figure 9 - Average time needed to prepare files or materials

Planned losses are the main source of waste, accounting for 27% of the opening time. As can be seen in Figure 10, these losses are subdivided into travelling and training, representing 85% and 15%, respectively. For a daily average of 3.32 hours of planned availability losses, it is concluded that, per week, each consultant spends about 14.0 hours on trips and 2.5 hours on training. It should be noted that the training plan of the organization in which this study was carried out contemplates approximately 5 hours of training every two weeks. Despite being a fundamental component to guarantee high standards of quality in the service provided, it is crucial to ensure its maximum effectiveness taking into account the significant impact on productivity. Time spent on travel is an inherent component of the business and where there is high variability among consultants. This component covers the total time of travel from the consultant's place of residence (private house or hotel in the case of projects outside the area of residence) to the client and return.

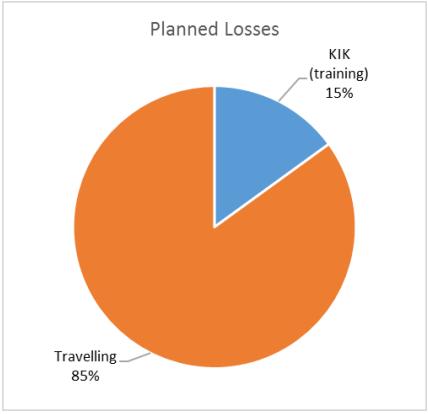

Figure 10 - Planned losses by type

In terms of the losses due to unplanned unavailability, performance and quality losses, taking into account its reduced impact, it was decided to proceed with a joint Pareto analysis for all these subcategories. This analysis, presented in Figure 11, resulted in the identification of subcategories that can be classified by the ABC criterion. Subcategories classified as A correspond to a small percentage of total subcategories, but have a high impact on productivity loss. About these subcategories, the most important are the preparation of meetings and waiting, which together account for about 50% of the losses. It should be noted that several subcategories of this group had zero results, therefore, they were considered occasional productivity losses with reduced impact. The remaining subcategories, categorized as B and C, represent the majority of existing subcategories but have a low individual impact.

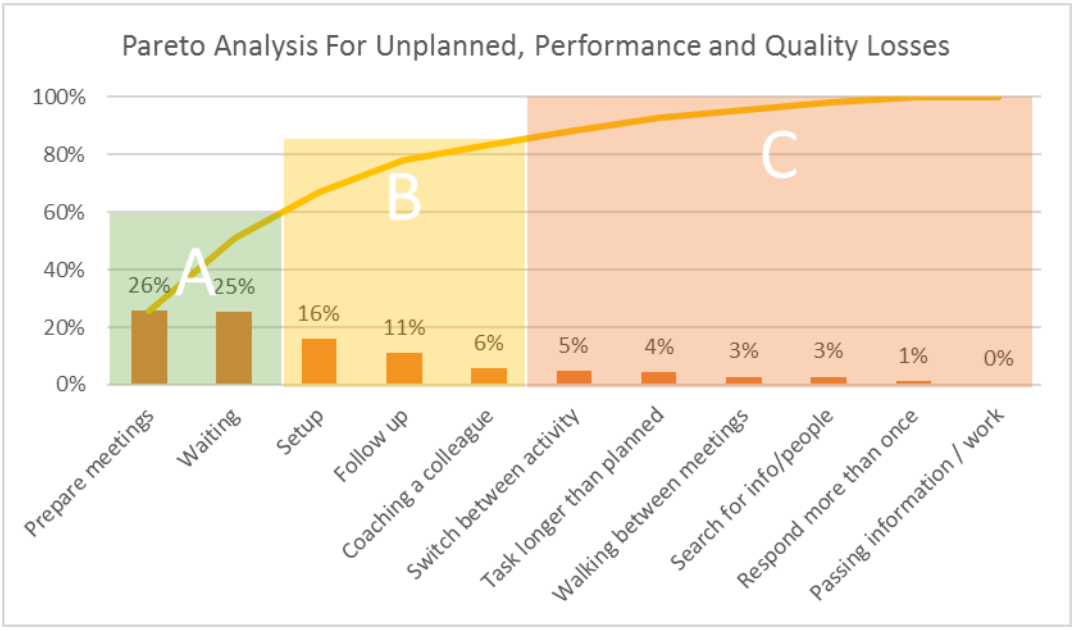

Figure 11 - Pareto analysis for unplanned, performance and quality losses

Finally, it was important to analyze the impact of the type of activity of the consultant on the productivity. In the organization studied, consultant days can be classified as a workshop or follow-up day. In the case of a workshop day, the consultant typically performs an event previously defined together with the team and according to a standard kaizen methodology in

the customer field. The workshop days result in action plans to be implemented by the teams. Thus, in the follow-up days the consultant performs the follow-up of the implementation by the team. In this type of activity, where the consultant has a less rigid schedule, a less favorable time distribution is observed. As can be seen in Figure 12, more than half of the workshop days analyzed have a productivity higher than the maximum productivity in follow-up days. While the follow-up days have a productivity range of 30% to 75%, workshop days range from 45% to 95%. It is important to emphasize that in this analysis the effect of travel and preparation outside working hours was deduced in order to obtain directly comparable results. Taking into account that half of the workshop days present productivity greater than 80%, it is concluded that the workshop days are highly productive. However, it should be noted that the workshop days are the ones that present the greatest need for preparation. In turn, more than half of the days of follow-up have productivity below 55%. Despite the low productivity of these days, they contribute in a very impressive way to the quality of the project, allowing greater guarantees of compliance with results that promote the good reputation of the organization worldwide.

It should be noted that outliers presented in the global value-added graph correspond to the bi-weekly planning and training day set up in the organization, which is considered a necessary productivity loss, since it indirectly and positively impacts the value-added of the consultant in the working days at the client.

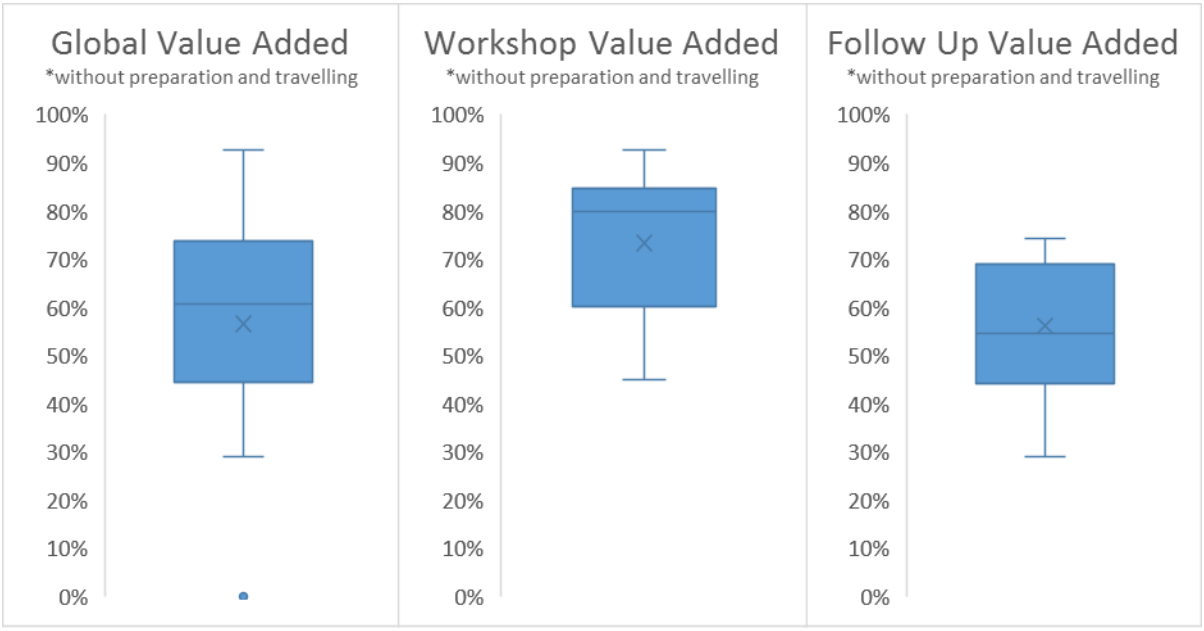

Figure 12 - Value added range per type of activity

3.2 Data model for project productivity measurement

The industrialization of the consultants' productivity monitoring proves difficult in the way in which the initial data collection took place. On the one hand, the need for an extra consultant in the shadowing method involves a fairly high cost and potentiates some bad feeling because of the presence of an assessor. On the other hand, collecting data by self-assessment reduces the consultant's focus on normal working activities throughout the day or reduces the quality of data, depending on the time spent and frequency of updating the time writing grid. Thus, to implement massive data collection on the consultants OPE, there is a need to simplify the process of measuring it. To do so, a data model was created based on the database collected in

shadowing and self-assessment formats, which allows the definition of the productivity of a consultant in a given project through the answer to a survey. The survey is composed of 19 questions from which 14 out of the 18 variables that compose the model are extracted. The remaining 4 variables, which allow the beaconing of each of the entries in the model, are obtained through the historical database. This model, besides being based on the database created, incorporates the same categories of productivity losses, allowing not only the definition of the final productivity value but also its analysis by type of loss. The function that translates the model is:

$$OPE = f(OT, TT, UL(a,b,c), PL(d,e,f), QL, OL(g,h,i), AJ(j,k,l,m,n,o))$$

In this function, we can observe the main variables in capital letters and the secondary variables in lowercase letters. The main variables correspond to the groups of productivity losses, with the exception of the variable OT and AJ, which correspond to the opening time and the adjustment component. The secondary variables allow, through sub models, the calculation of the main variables. When a main variable has no secondary variables, its value is obtained directly through an answer of the consultant in the survey. Table 3 lists all the main and secondary variables that are built into the model, as well as their units.

Variable	**Sub variable**	**Units**
OT – Opening Time	OT – Opening Time	Hours
TT – Travel Time	TT – Travel Time	Hours
UL – Unplanned Losses	a – Waiting frequency	Scale 1 – 4
	b – Waiting impact	Minutes
	c – Setup impact	Minutes
PL – Performance Losses	d – Low speed frequency	Scale 1 – 4
	e – Low speed impact	Minutes
	f – Follow up impact	Minutes
QL – Quality Losses	QL – Quality Losses	Minutes
OL – Other Losses	g – N/C losses impact	Minutes
	h – NVA meetings frequency	Scale 1 – 4
	i – NVA meetings impact	Minutes
AJ – Adjustment Parameter	j – Workshop minimum OPE	%
	k – Workshop maximum OPE	%
	l – Follow up minimum OPE	%
	m – Follow up maximum OPE	%
	n – Consultant OPE feeling	%
	o – proportion of workshop days	%

Table 3 - Data model variables

The OT variable is the basis for calculating OPE since it is the denominator of the AV / OT fraction. The TT variable corresponds to the planned losses that are limited to the travelling losses, since the training losses are concentrated on a day in every two weeks period and are not carried out on a project basis.

The UL variable corresponds to unplanned losses and results from a sub model that includes waiting and setup times:

$$UL = a * b + c$$

The variable PL intends to translate the performance losses due to the team's low speed and due to the existence of high performance penalizing follow-up tasks, also resulting from a sub model:

$$PL = d * e + f$$

The QL variable does not have secondary variables, since all types of rework are involved in the same category. The OL variable allows the consultant to translate other types of losses that are not identified in other sections of the model, i.e. less relevant or very specific. This variable also allows to monitor the quality of the model, since a more effective model will present less unlabeled losses. The sub model for OL is:

$$OL = g + h * i$$

Finally, the AJ variable comes from a sub model that generates an adjustment of all other parameters based on the existing history and the perception of the consultant. This sub model defines, for each entry, the maximum and minimum admissible values, taking into account the proportion of days in workshop and follow-up of each of the consultants in a given project. It is important to emphasize that the beaconing defined by the historical is isolated from the effect of travelling, in order to incorporate this variable directly by the TT variable. By incorporating the factor associated with the perception of productivity by the consultant, it is possible to cancel possible errors of data recording, capturing the estimate of value-added of the executor. Thus, for a given entry in the model that translates into a OPE of 67% and whose perception of the consultant is a OPE of 40%, taking into account a proportion of 30% workshops that produces a range of OPE between 36% and 72%, the final value generated by the model is 53% of value added. The sub model for AJ is:

$$If\ OPE_{base} < (o * j + (1 - o) * l) \Rightarrow AJ = ((o * j + (1 - o) * l) + n) / 2$$

$$If\ OPE_{base} > (o * k + (1 - o) * m) \Rightarrow AJ = ((o * k + (1 - o) * m) + n) / 2$$

$$Else\ AJ = (OPE_{base} + n) / 2$$

3.2.1 Model results

The implementation of the data model has as main objective the sustainability of the data collection, in order to base future studies on a larger database and more prolonged in time. Thus, it is fundamental to validate the data obtained through the model with the data obtained by the shadow and self-assessment method.

The OPE results of the consultants under study translated a value-added percentage around 41% (4.67 hours). As can be seen in Figure 13, on average, only 4.67 hours of work per day translate into value-added for the customer, compared to an average opening time of 11.53 hours. For the initial database, these values were 4.60 hours and 12.30 hours, respectively. As

in the initial database, the opening time obtained should be analyzed with caution, since it was considered that all work is performed on working days.

The main productivity losses identified are associated with the preparation, planned losses related to travelling and performance losses, totaling 41% of the total opening time. The remaining productivity losses due to unplanned unavailability or quality amount to 10% of the opening time. The residual component "other NVA" represents unrecorded productivity losses and, therefore, cannot be qualified for analysis. This component amounts to 8% of the opening time.

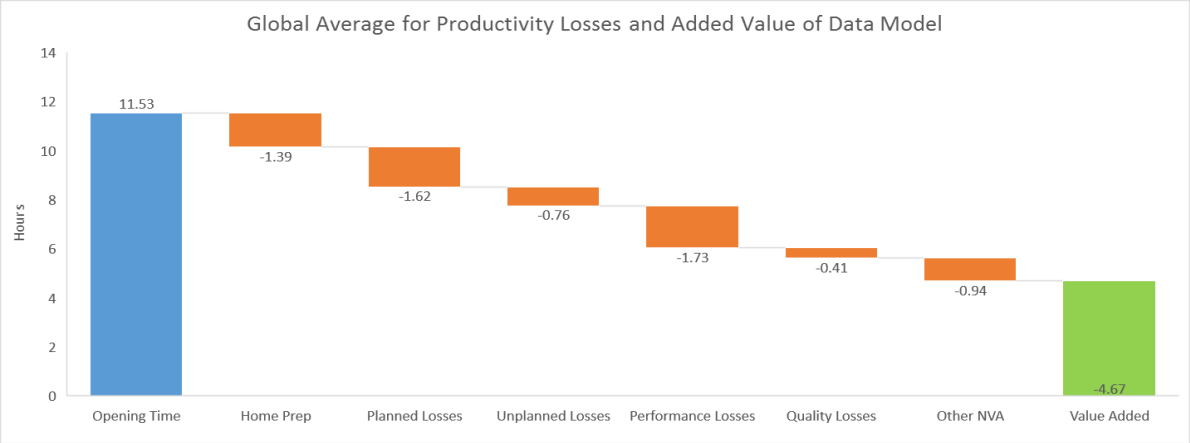

Figure 13 - Global average for productivity losses and value-added of data model

Figure 14 shows the relative weight of performance losses and value added in the data model and in the initial database. It is observed a smaller relative weight of the component planned losses, which is directly related to smaller trips, which is not an ambiguous variable. However, an equitable distribution of this difference should be observed for the remaining components and this is not the case in the performance loss component. This component had a much higher weight in the data obtained through the data model. This component, which reflects the perceived loss from the consultant's point of view regarding the performance of the team, indicates that there may be an excessive penalization of the team by the consultant. This may be due to the fact that there are significantly different perceptions about the normal speed of conceptualization and execution by a consultant or might indicate less developed teams on the projects under the study. All other variables assume normal behavior in the data model when compared to the initial database.

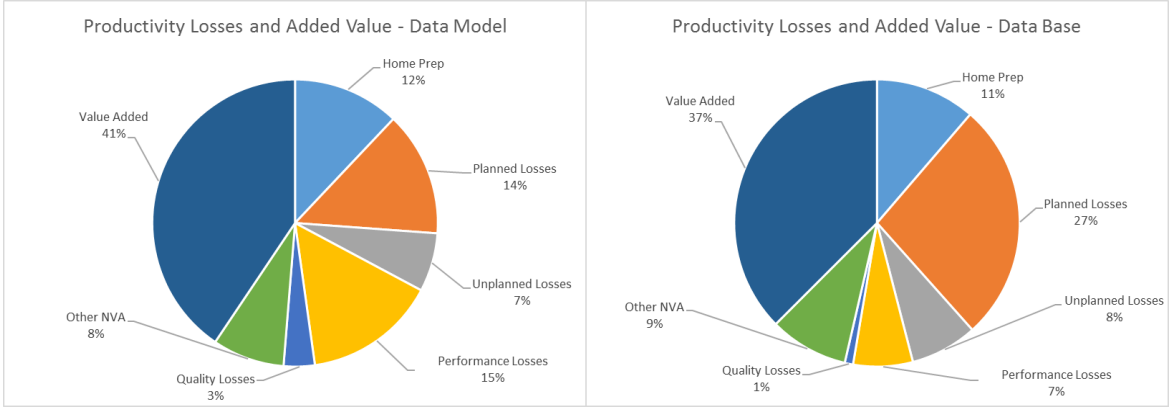

Figure 14 - Productivity losses per type of data collection model

Table 4 presents the detailed results for the data model compared to the initial database. This comparative analysis aims to identify possible macro inconsistencies related to the data model, but does not imply the full validation of the model, since it is normal to have variability between projects since the projects captured in the database are different from the projects captured by the model. Thus, this analysis intends to validate the model in macro terms and detect large errors, and the finer analysis will be done using a control project where the analysis will be more detailed in order to validate the detail of the data.

In the initial database, it is possible to separate the results for workshop days and follow-up days (except for "home prep"), while the model measures the productivity in the project, evaluating a proportion of the workshop that varies between 0% and 100%, being the average of the projects evaluated around 47%. Analyzing the data in Table 4, it can be seen that the data model values are within the ranges observed in the database with the exception of planned losses and performance losses. In the case of planned losses, this relates to projects where the need for travelling time is lower, not being a problem of the model. In the case of performance losses, the change from 7 to 11 percentage points translates into a higher weight of losses related to the team speed penalty. The quality losses are also above the range, however, considering that this is a residual value, it is not considered a vulnerability of the model.

All projects			
Variable	**Initial Data base**	**Data model**	**Variation**
Opening Time	WS – 13.05 h	Global – 11.53h	-12%
	FU – 12.29 h		-6%
Home Prep	Global – 11%	Global – 12%	+1 p.p.
			+1 p.p.
Planned Losses	WS – 21%	Global – 14%	-7 p.p.
	FU – 27%		-13 p.p.
Unplanned Losses	WS – 4%	Global – 7%	+3 p.p.
	FU – 9%		-2 p.p.
Performance Losses	WS – 8%	Global – 15%	+7 p.p.
	FU – 4%		+11 p.p.
Quality Losses	WS – 1%	Global – 4%	+3 p.p.
	FU – 1%		+3 p.p.
Other NVA	WS – 2%	Global – 8%	+6 p.p.
	FU – 12%		-6 p.p.
Value-added	WS – 54%	Global – 41%	-13 p.p.
	FU – 34%		+7 p.p.

Table 4 - Variation analysis with all projects between methods of collecting data

A more detailed analysis was based in the analysis of the data regarding project X obtained in the initial data collection compared to the data obtained by the model for the same project. As can be seen in Table 5, the overall value of the OPE differs only by 1 percentage point, although the distribution of losses by the different categories has some variability. It is worth noting that there is a change in productivity losses between unplanned and performance losses, i.e. the lower impact of unplanned losses obtained by the model is absorbed by the higher impact of performance losses. The components of opening time, home preparation and planned losses are the ones that present the highest degree of certainty in the model, since they translate easily characterized variables. In view of the changes in the relative impact of each type of loss, it is verified that the adjustment made by the model based on the history enhances the reliability of the overall indicator, absorbing errors of characterization of losses.

Project X			
Variable	**Initial Data base**	**Data model**	**Variation**
Opening Time	12.14 h	12.89 h	+6%
Home Prep	11%	11%	+0 p.p.
Planned Losses	23%	19%	-4 p.p.
Unplanned Losses	19%	3%	-16 p.p.
Performance Losses	2%	13%	+11 p.p.
Quality Losses	0%	4%	+4 p.p.
Other NVA	4%	10%	+6 p.p.
Value-added	41%	40%	-1 p.p.

Table 5 - Variation analysis with a control project between methods of collecting data

Analyzing the overall results of the data model, from the macro comparison to the detailed analysis of a project, there are good indications about the feasibility for the use of this model in the collection of data for project productivity. It should be noted that there is a subjective component in the evaluation of some types of losses, which, coupled with the fact that the evaluator is also the executor, leads to a greater penalization of the team's speed, to the detriment of a penalty of the consultant himself or the conditions of the environment. Therefore, the performance loss component must be analyzed with greater caution. It is also concluded that the adjustment of the model against the historical data increases the reliability of the data which allows the use of this indicator with a high level of security. Segregated use by type of loss is also possible, albeit with the safeguards previously presented.

It is worth noting the enormous usefulness of this tool in the continuity of the present study, as well as the day-to-day applicability within the organization with a view to a greater follow-up of this indicator throughout the projects. Otherwise, the collection of OPE data would be unfeasible or merely punctual, and would not be considered an indicator for decision-making.

3.3 OPE and main business KPI's

The definition of value-added established at the beginning of this study allows the design of possible relations between the cost and quality operational indicators and the OPE. At the same time, the strategic component of the business and its impact on the operational indicators should be analyzed, since strategic options may negatively affect the indicators but prove to be advantageous in the future. The operational indicators to be studied in comparison with the OPE are the percentage of invoiceable days against the total days delivered in a given project (cost indicator) and the percentage of objectives reached (quality indicator). The cost indicator translates the execution of a given project over time, i.e. a project that was expected to be implemented in X days and took X + Y days promoted a budget slip for the consulting company. However, this phenomenon is frequent in order to try to guarantee a good level of the quality indicator, i.e. working days in the client are prolonged in the expectation of reaching the goals, which may even represent an extra revenue (variable fee) for the company that compensates the budget slippage.

The introduction of OPE in this equation intends to study a possible relation between project productivity and quality and cost indicators, i.e. whether projects with higher productivity translate into projects with lower budget overruns and / or a higher percentage of objectives achieved.

Figure 15 shows the structure for relations analysis and respective indicators. The impact of strategic decisions on operating results made it consider a variable associated with the business strategy in order to perceive its impact on the OPE and other operational indicators. This variable translates the consultant's weekly frequency into the project.

Continuous improvement appears at the base as a key tool for operational excellence transversally to the themes of quality and cost. In this particular study, it is intended to enhance the global results of the organization by continuously improving the productivity of consultants.

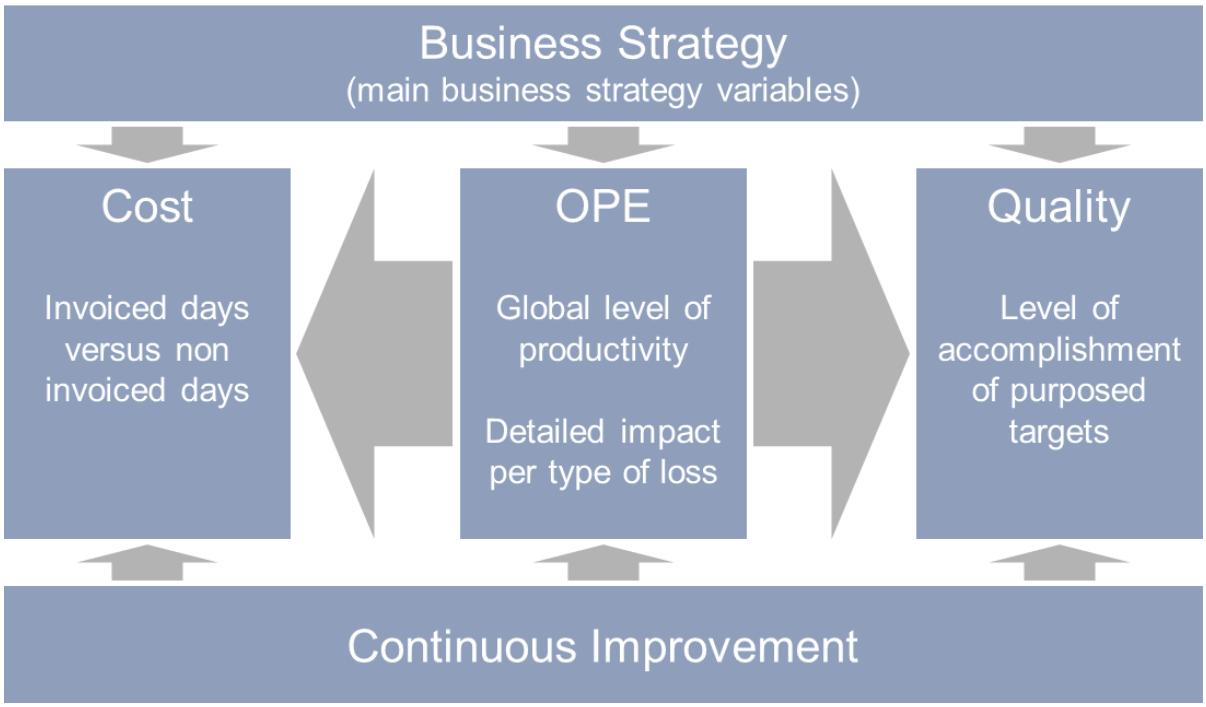

Figure 15 - Possible relations between OPE and business KPIs

The analysis of possible relations between business indicators and the OPE began with a superficial analysis to identify the most probable relations. Given the high number of possible relations, it was necessary to do this first screening in order to identify the relations to be studied in greater detail.

Table 6 presents the results of the initial analysis of relations between the OPE and the other indicators defined. Considering the vulnerability identified in the categories of unplanned losses and performance losses, in which a loss allocation error was detected, it was decided to treat the two categories as only one. Thus, the sum of unplanned and performance losses was analyzed, since the impact of allocation errors is eliminated.

Among the 15 possible relations, 4 potential relations were identified, excluding the remaining because they did not appear to be related or because they presented residual values that could not be compared. The first potential relationship is between the OPE and the percentage of objectives reached in the project, with the expectation that projects with higher productivity will translate into projects with a higher percentage of objectives achieved. The second possible relations relates the sum of unplanned losses and performance losses to the percentage of goals achieved, and it is expected that projects with lower losses in these categories will translate into a higher percentage of goals achieved. It is important to note that the first relations identified may result from the second relations, so that this contact point should be taken into account in the detailed analysis. The third probable relations is between the planned losses and the percentage of days invoiced, where it is suspected that projects with higher losses of this type, i.e. travelling, translate into projects with a higher percentage of invoiced days. Finally, the fourth potential relations to be analyzed involves the consultant's weekly frequency in the project and the sum of unplanned losses and performance losses, where it is suspected that the consultant's intensity in the project has an impact on the sum of the losses of these categories.

OPE vs Indicators	**% Objectives**	**% Invoiced Days**	**Frequency**
OPE	Possible relation	No relation	No relation
Planned Losses	No relation	Possible relation	No relation
Unplanned Losses	Possible relation	No relation	Possible relation
Performance Losses			
Quality Losses	Residual values	Residual values	Residual values
Other NVA	No relation	No relation	No relation

Table 6 - Analysis of relations between OPE and other indicators

All the initial analysis of the relations between variables were performed through simple correlational analysis, in order to eliminate the relations that do not completely exist and to define the relations to be studied in more depth.

Considering the interaction between the first two relations studied, if the relation between the sum of unplanned losses and losses of performance with the percentage of objectives reached is proved, it is also proved the relation of the OPE with this same quality indicator. Figure 16 shows boxplots for the sum of unplanned losses and performance losses for projects with objectives achieved up to 33% and over 33%. As can be seen, low-compliant projects have

significantly higher unplanned and performance losses, when compared with projects with higher goal compliance rates. With the exception of one outlier, the projects with the highest goals achieved present, at most, about 20% of losses of this category, while the remaining projects are, mostly, above this value. The central interval for this category of losses in projects with lower objectives achieved is between 20% and 40%. Thus, the relationship between the OPE and the project quality indicator is demonstrated, being the categories of unplanned and performance losses responsible for this same relationship.

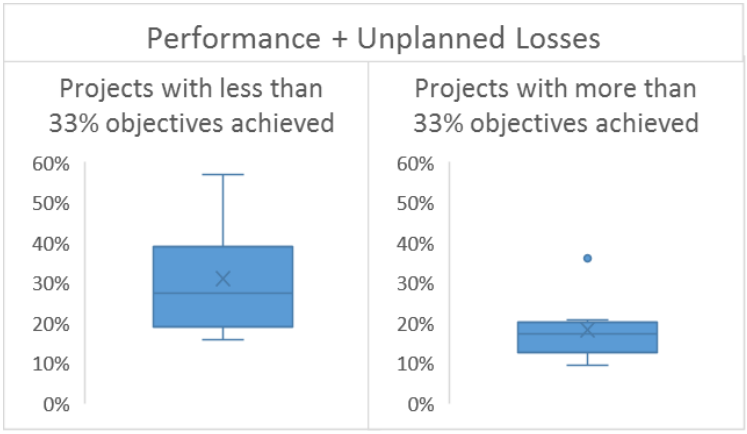

Figure 16 - Relation between performance and unplanned losses with low objectives

The detailed analysis between the planned losses and the percentage of days invoiced was made through a linear correlation that gave rise to a correlation factor of 0.7092, as shown in Figure 17. Taking into account the typology of the data under analysis, it is considered that the degree of correlation is high which translates into the conclusion that projects with greater traveling time potentiate projects with greater percentage of invoiced days. Thus, although it is not possible to detect the overall impact of the OPE, this category of losses directly influences the cost indicator, but in the opposite direction to what would seem to be suspected. This impact can be explained by the client's unavailability to afford high travel costs, forcing compliance with the budget forecast, or by the greater intensity in the presence of the consultant because of the greater logistical impact that a customer visit implies.

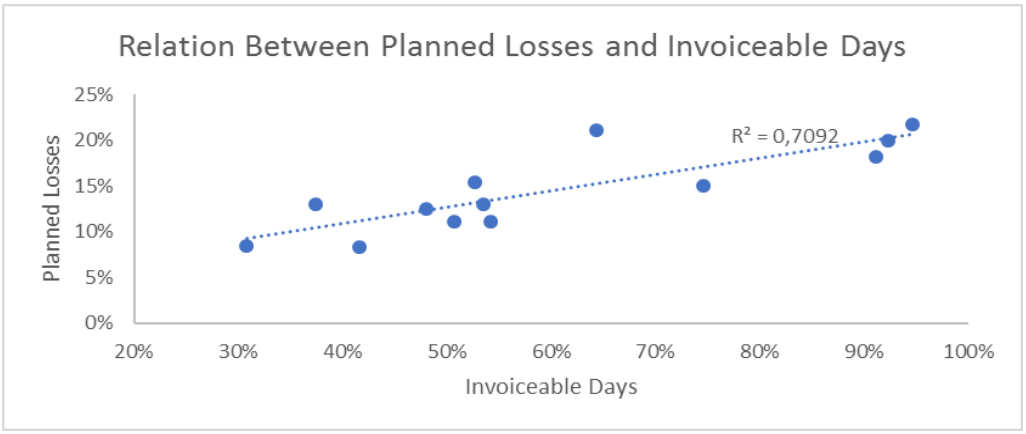

Figure 17 - Relation between planned losses and invoiceable days

Figure 18 shows boxplots for the sum of unplanned losses and performance losses as a function of the consultant's frequency at the client. As can be seen, there is a slight impact of the frequency intensity policy on the customer in unplanned productivity and performance losses, although this relationship is not as evident as the previous ones. The central interval for this sum of losses in the projects with the lowest visit frequency is between 20% and 40%, while in projects with the highest frequency of visits it is between 13% and 28%.

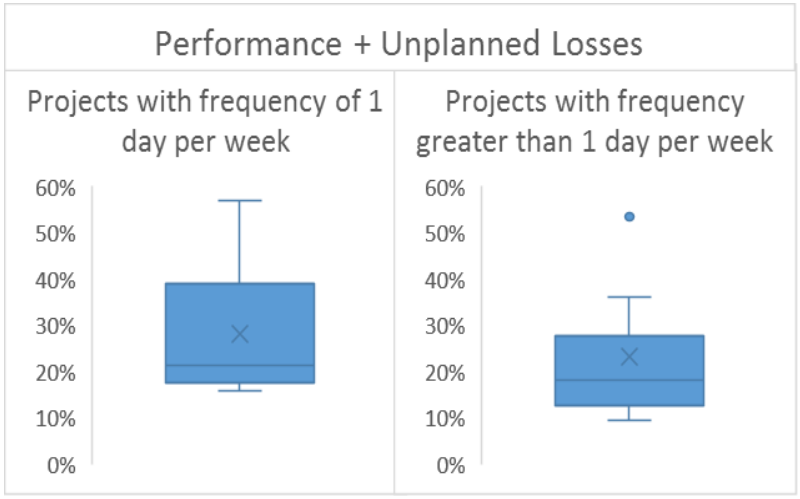

Figure 18 - Relation between performance and unplanned losses with frequency per week

After analyzing the relationships between the OPE and the selected operational and strategy indicators, a similar comparative analysis was carried out between the indicator of percentage of objectives reached and percentage of days invoiced. This analysis intends to identify the existence of cross-impacts in more than one indicator, i.e. it is an attempt to identify if the cost indicator is impacted by the quality indicator. If proved, it can be concluded that the OPE directly impacts the quality indicator and indirectly impacts the cost indicator. At the same time, the demonstrated relationship between customer visiting frequency and OPE would generate a chain of impact from strategic decision to operational results.

In Figure 19 is presented the boxplots for the percentage of invoiced days according to the quality group of the project. The quality groups were defined maintaining the previous criterion of 33% for the level that separates projects with low and high objectives achieved. As can be seen, there is a significant difference between the distribution of the percentage of invoiced days according to the percentage of objectives achieved. For projects with fewer targets achieved, the percentage of invoiced days presents a very wide range of values, which is between 25% and 85%. For projects with good goal achievement rate, the percentage of days invoiced is always above 85%, with the exception of the outlier identified. This relationship shows that the quality of a project is not a function of the total number of days, relating only to the rate of invoiced days. This conclusion calls into question the policy of using days for free as an attempt to achieve objectives. However, this conclusion should be analyzed with caution, once worst project execution might be related to wrong project planning. A link between days for free and follow-up days could also be suggested, which would promote the lower productivity of these days.

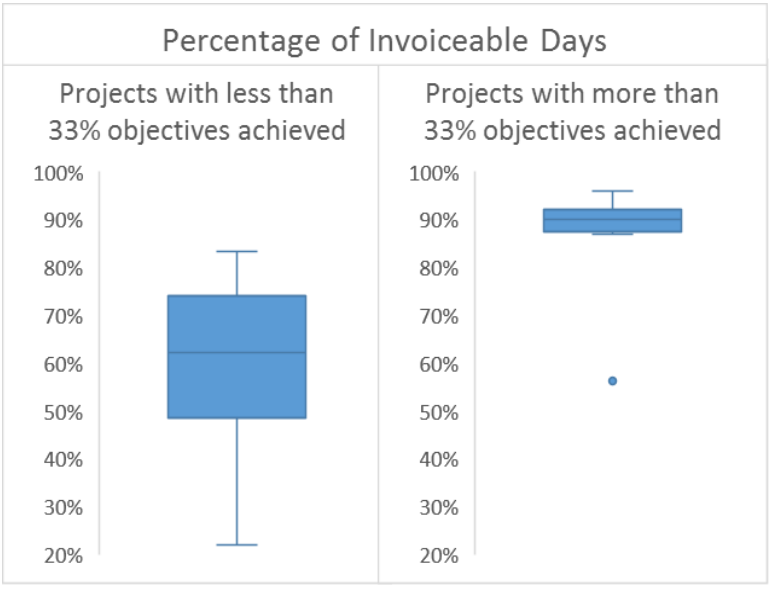

Figure 19 - Relation between quality and cost indicators

Finally, it is concluded that a higher frequency of visit to the client promotes higher OPE, which in turn promotes a higher rate of compliance with objectives and, consequently, better results at the level of the cost indicator. Given that the categories of losses that promote OPE relationships with the other indicators have been defined, there is a possibility of identifying the main opportunities for improvement.

3.4 Chapter synthesis

This chapter summarizes the initial data collection through the shadow and self-assessment methods that allowed the creation of an initial database, whose results were analyzed in detail. This analysis allowed the identification of the main productivity losses of the consultants. At a later stage, the development of a data model that is based on the initial database and allows the continuous collection of data without the need of resource overload is discussed. After referring the various points of validation of the model, its implementation is presented in order to obtain data to analyze the relationships between productivity and the business indicators of quality and cost, as well as a strategic decision variable. This analysis allowed to identify relationships between the various indicators, which should be the based for decision-making regarding productivity improvement.

4 Future vision design

The design of the future vision (TO BE) begins with the identification of the main categories of waste to attack. Following the analysis of the initial situation, the subgroups of losses with impact greater than 5% in total losses were identified. At the same time, each subgroup was characterized in terms of the difficulty of reducing its impact in the short term. Thus, a priority matrix was developed, resulting in Table 7. All subgroups with an impact close to or greater than 5% and low or medium improvement difficulties were selected for the solutions design phase.

Losses Group	Losses Sub Group	Impact	Difficulty
Home Prep	Home Prep	18.1%	Low
Planned Losses	Travelling	36.8%	High
	Attend to a planned training	4.8%	Medium
	Others below 5%	1.7%	
Unplanned Losses	Waiting	5.8%	Medium
	Others below 5%	6.3%	
Performance Losses	Prepare meetings/activities	5.9%	Medium
	Others below 5%	4.9%	
Quality Losses	All below 5%	1.5%	
Other NVA	Not possible no identify causes	14.2%	
	Total	**100%**	

Table 7 - Prioritization of losses' causes

As can be seen, home preparation presents at the same time a great impact on productivity losses and a low difficulty of improvement, so it was selected to be the target of a solution design.

The travel subgroup, although having a great impact on productivity losses, has a very high intervention difficulty, since the nature of the business implies being in the customer, regardless of its location. Taking into account the worldwide acting area of the organization it is expected that this component has high values. As such, the displacements are out of scope for designing solutions.

Still within the group of planned losses, the participation in training sessions assumes an impact near 5% and presents a medium intervention difficulty, reason why it was considered for the study with the perspective of complementarity to home preparation solutions, i.e. it is not intended to reduce losses due to participation in training, but rather to ensure that better training promotes a reduction in the consultants' need for preparation. The remaining planned productivity losses have an individual impact of less than 5.0% and an overall impact of 1.7%, and therefore were not considered for improvement.

Unplanned losses have a subgroup that stands out. Waiting for people, information or materials has an impact of 5.9% on total losses and the potential for improvement is characterized as medium, so solutions to this problem was also studied. The remaining unplanned losses have an individual impact of less than 5.0% and an overall impact of 6.3% and therefore were not considered appealing to the next phase.

In terms of performance losses, the preparation of meetings and activities on the client has an impact of 5.9% and a medium improvement difficulty, so it will also be included in the design of solutions stage. However, this subgroup will be handled together with the home preparation.

Productivity losses due to quality arise with a residual overall impact. The non-characterizable losses, despite having an overall impact of 14.2%, cannot be identified as opportunities for improvement, since the reason for these losses is not known.

Indeed, in the solution design phase, the structured problem-solving methodology will be applied to improve consultant preparation, empower training and reduce waiting times in the customer.

At the same time, to ensure continuous monitoring of the evolution of the OPE and to analyze the impact of the improvements on this indicator and on business indicators, a business intelligence tool was developed for online monitoring of the indicators.

4.1 Vision and organizational goals

Improving resource efficiency usually means reducing the number of resources needed in a given activity. However, when we try to associate resource efficiency with flow efficiency, this reduction in the number of resources may not be as linear. In the case of management consulting, taking into account the main loss typology identified, the relation between productivity increase and FTE reduction is not linear. Firstly, the main component attacked does not take place during normal working hours. As such, even if this component is reduced to zero, it is not fair to introduce a value-added component in this time period. However, a reduction in the consultant's workload after the normal working day or at the weekend will result in a reinforcement of the consultant's motivation. Secondly, with regard to the training component, it is not intended to reduce this time and introduce a new value-added component, but rather to improve the effectiveness of training to reduce the need for additional preparation of the consultant. Finally, the potential improvement in waiting time at the customer is a component that can be directly related to the introduction of value-added in absolute terms, since it is intended to replace losses with value added in the customer.

Thus, the vision for this project is to reduce the opening time of consultants by reducing the preparation outside working hours, ensuring high motivational levels that relate directly to the performance in the client. Simultaneously, there is the goal to optimize the time in the client by reducing the main source of productivity losses when the consultant is present at the client. In this way, the proportion of value-added is increased and the service level and quality to the client is guaranteed by the relation between the productivity in the project and the quality of

the work performed. Figure 20 and Figure 21 show the initial state and vision for the typical consultant's day and the expected weekly impact. The blue and gray present the typical activities at the client, not being 100% value-added. The red shows the preparation activity outside the client. The KIK component includes a planning and reporting component as well as the training period that is intended to be more effective.

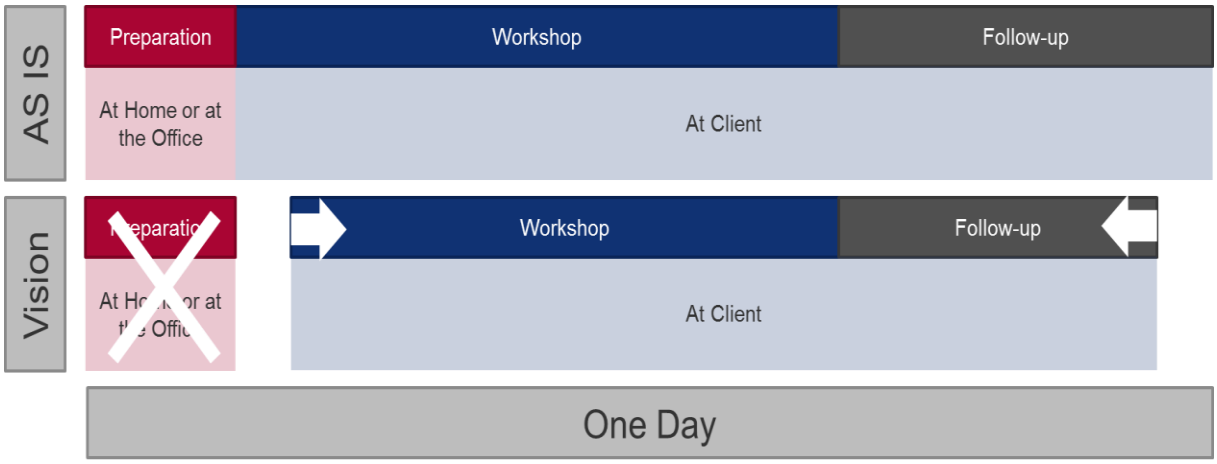

Figure 20 - Consultant's day profile

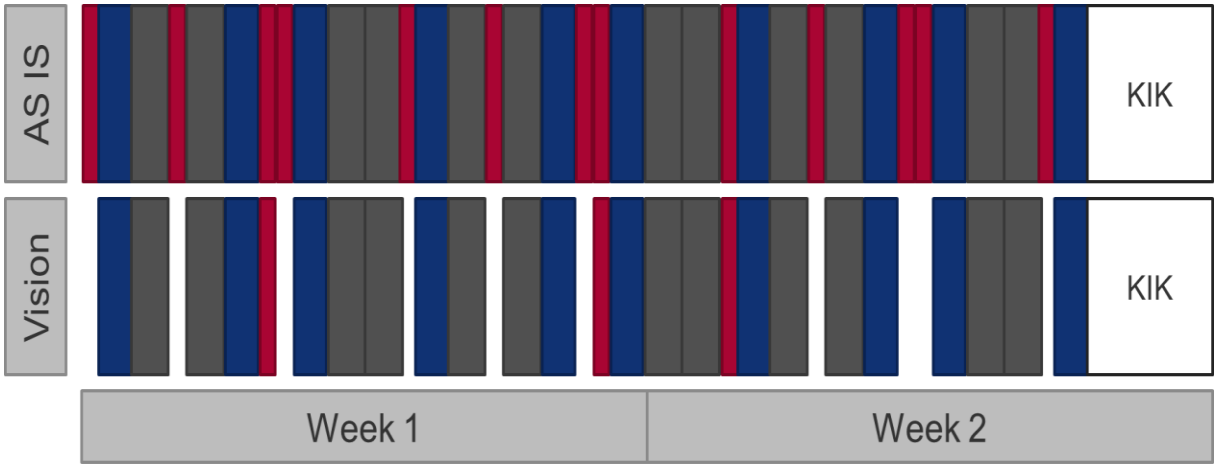

Figure 21 - Consultant's two weeks profile

The vision implementation does not directly aim to reduce FTEs, but given the high growth of the organization, it will be possible to guarantee a higher turnover per consultant through the less need of preparation, greater motivation and optimization of the client's time, guaranteeing a sustainable growth of the organization.

The relation between increased consultant efficiency, increased project quality and reduced operating costs might also have a positive impact on the company's bottom line, based on the best expected operating results.

4.2 Preparation improvement

The consultant preparation tasks for the activities to be carried out at the client account for 24% of the total identified productivity losses. These losses are subdivided into in-house preparation and customer preparation with an impact of 18.1% and 5.9%, respectively. Considering the similar typology of losses, the only difference being the timing and the location in which they occur, both preparation losses were assumed in the application of the 3C methodology for the structured resolution of this problem. After defining and quantifying the problem, Table 8 shows the analysis of causes and definition of countermeasures.

Preparation Ishikawa Analysis		
Type	**Cause**	**Countermeasure**
Men	Ignorance of the methodology.	Training pull planning
Method	Redundancy of planning supports	Integration outlook/last planner
	Lack of visibility on subject experts	Include specialist name on slides
Material	Difficult access to case studies	Knowledge management platform prototype
	Training push planning	
	Multiple information sources	
	Non-translated materials	R&D process normalization
	Non-normalized data collections	Workshop instructions
	Training oriented materials	
Environment	Adaptation to client terminology	Out of scope

Table 8 - Preparation Ishikawa analyze

In the field of labor-related causes, the consultant unawareness of the methodology was the main issue. This cause is typically associated to junior consultants, who apply a particular methodology for the first time, not having specific technical expertise and experience. The countermeasure identified for this cause goes through the training pull planning, i.e. periodically identifying the training needs and training the consultants on the issues they will need to solve in the short term.

In the field of the causes associated with the method, redundancies of planning support and absence of visibility in specialists of the different materials were identified causes. Designing solutions to reduce the number of planning tools went through the integration of Outlook with Last Planner. Figure 22 presents the standard developed for the use of Outlook as a single planning tool, which defines the method of using the calendar and invitations, in order to ensure that all necessary information is included in a more visual way. At the level of the low visibility of the specialists in a given subject, a standard was defined for the identification, in a specific slide, of the person responsible for the development of a given material, to ensure that whoever uses the document can clearly identify the specialist in the subject.

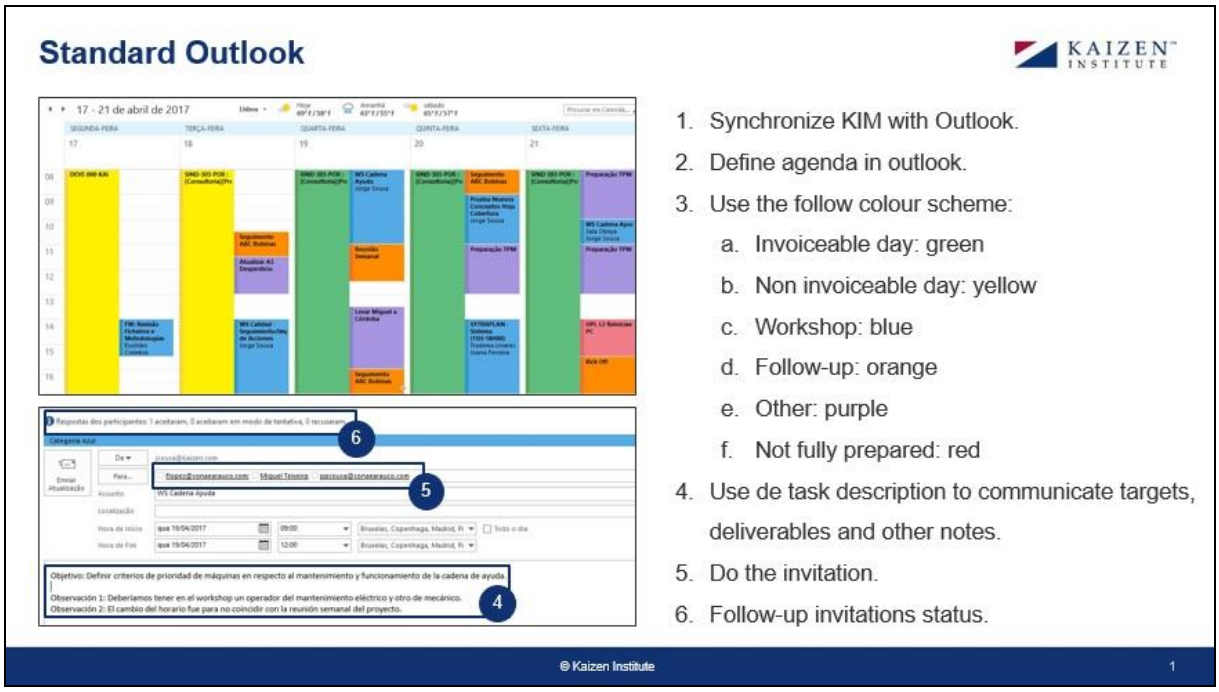

Figure 22 - Standard for Outlook planning tool

In the field of materials-related causes, it was identified the difficulty of accessing case studies, the training push planning and the multiple sources of information, which culminated in the conceptualization of a prototype for a knowledge management platform, which is presented in Figure 23. The objective of this tool is to make available a list of materials related to a specific theme of a specific sector and with special references in catalog that allow the user to filter the materials according to the criteria wanted. This eliminates the exhaustive search in tools such as Dropbox and this evolution can be characterized as an implementation of digital 5S.

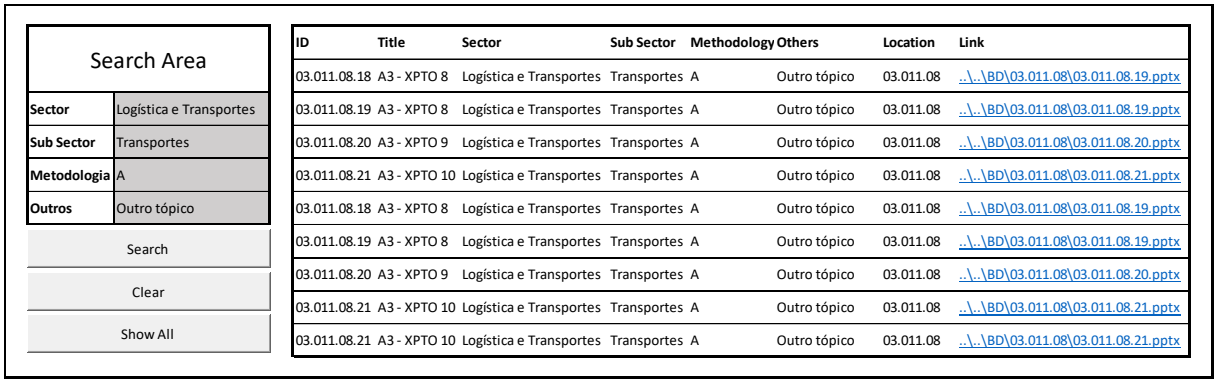

Figure 23 - Knowledge management platform concept

The absence of materials translated into other languages, the lack of data collection standards and the orientation of materials for training use were solved by standardizing the R&D process and creating workshop instructions. The standard for the development cycle is shown in Figure 24, which highlights flow development and reduced lead time, which includes multi-language translations and file design improvement.

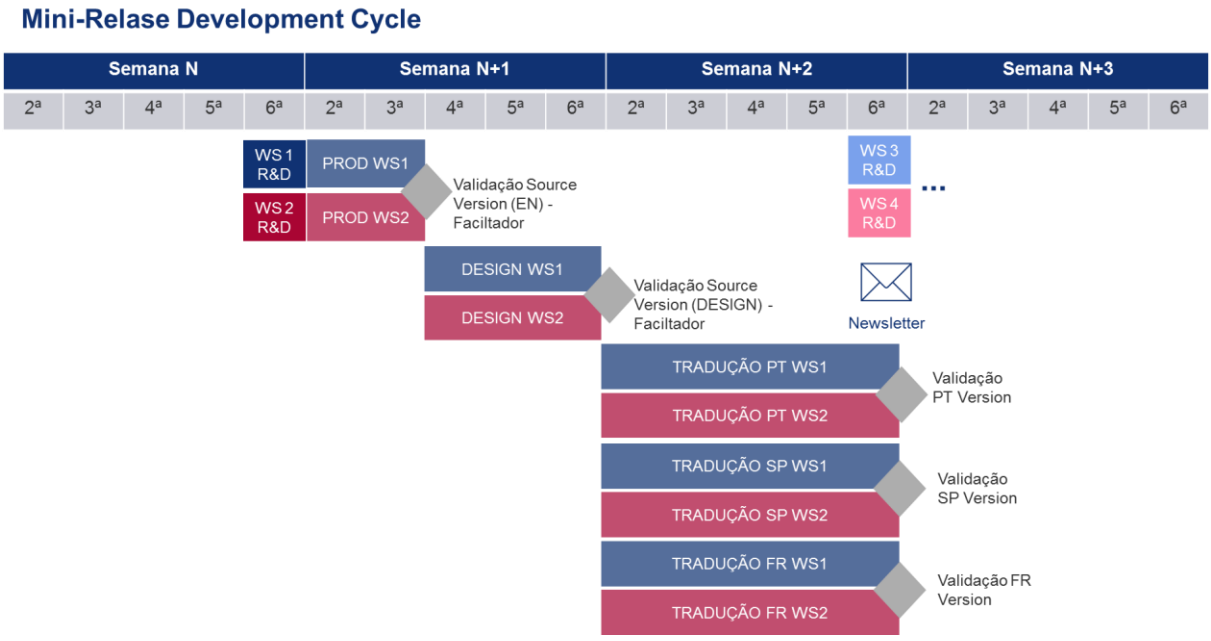

Figure 24 - Development cycle

The absence of standards for data collection and the orientation of the materials for the training use and not for the workshop triggers extra needs for understanding the theme and preparation of files that are intended to be minimized with the creation of workshop instructions. This concept involves the development of materials for the flow of a workshop, which includes a slide with the macro agenda where you can detect a thread for the consultant to base the event. Figure 25 presents the example of the macro agenda for the CI Governance & Communication workshop, which shows the three main phases of the workshop, the respective topics and exercises to be carried out.

Macro Agenda - SK 1 CI Governance & Communication

KAIZEN INSTITUTE

TIME PERIOD	TOPICS	EXERCISES
PREPARATION WORK	Preparation Work	Identify existing communication means and formats Workshop Agenda & Participation Sheet Define CI Mission Control room
WORKSHOP DAYS 2 DAYS	Support Kaizen Introduction	Support Kaizen mission and roles review
	Mission Control	CI Programme & Daily Management Elements CI Mission Control Room Layout Detailed Mockup of CI Mission Control Room elements
	CI Governance Meetings	CI Governance Meeting Structure Design Meetings Standards
	CI Communication	Video Presentation & Case Studies Design CI communication means Define communication plan
FOLLOW UP WORK 1 to 2 DAYS	Follow Up Work	Action Plan Review CI Mission Control Room final design KPO meetings follow up

Figure 25 - Workshop instructions example

Finally, as environmental causes, the adaptation of the materials to the specific terminology of the client was identified, which, due to issues associated with the business, were not included in the scope of countermeasures definition

Appendix B contains the 3C visual presentation for the problem of productivity losses due to preparation. The quantification of gains and verification of the solution will be discussed in chapter 5.

4.3 Training improvement

Consultant training activities represent 4.8% of the total productivity losses identified, being these activities concentrated on the planning and training day. Although the great impact these days have by reducing the number of days available to add value in the client, training activities are fundamental to guarantee the high-quality of the work performed by the consultants. As such, it is not intended to reduce the training load, but rather to increase the effectiveness of these training sessions in order to reduce the extra preparation needs. After defining and quantifying the problem, Table 9 shows the causes analysis and definition of countermeasures.

Training Ishikawa Analysis		
Type	**Cause**	**Countermeasure**
Men	Unavailability of theme specialists	Previous allocation of specialists
Method	Excess of people per training session	Definition of training sessions based on real time training needs with specialists participation
	Training push planning	
	Different training methods	
	No visibility on training needs	
Material	Training oriented materials	Workshop instructions
Environment	Office logistics limitations	Out of scope

Table 9 - Training Ishikawa analyze

In the area of labor-related causes that promote low effectiveness of training, the unavailability of specialists of the subject in the training sessions promotes less transference of knowledge to more junior consultants. This absence of specialists promotes the existence of doubts throughout the trainings that cannot be correctly explained to the group. To solve this problem, a prior allocation of specialists was assured according to the training needs raised.

At the level of the causes associated to the method, it was detected an excess of people per training session, training push planning, different training methods and no visibility on real training needs. The proposed solution involves the identification of themes for every training sessions in a real-time basis, i.e. pull planning training, with the presence of specialists in the theme. The implementation of this solution was based on a survey sent to all the consultants before the training days, in which the training needs for the next four weeks are questioned, in order of priority. Subsequently, it will be possible to satisfy as many consultants as possible

with the allocation of specialists to the groups of consultants who participate in each of the sessions.

In the field of material causes, it was identified that the fact that the materials were training-oriented did not allow the training to be effective in terms of preparing the consultant for the workshop, i.e. the consultant was knowledgeable about the subject, but does not know how to properly perform a workshop on that theme. As such, it was defined that the existence of workshop instruction allowed the training to be already given in a workshop simulation way, closing the session to the reality in the client. This proposed solution is common to that addressed in the topic of improvement of the preparation.

Lastly, in environmental causes, it was analyzed the logistical limitation of the office associated with the lack of space for the various training courses that take place simultaneously with almost all the consultants of the organization. This cause was out of scope, given its infrastructural nature not solvable with the present project.

Appendix C contains the 3C visual presentation for the training improvement problem. The quantification of gains and verification of the solution will be discussed in chapter 5.

4.4 Waiting reduction

The impact of the consultant's waiting for people, information or materials on the client is 5.8% of the total productivity losses identified. These waiting times are divided into various timeframes throughout the work day in the client. After the definition and quantification of the problem, the analysis of causes and definition of countermeasures is presented in Table 10.

Waiting Ishikawa Analysis		
Type	**Cause**	**Countermeasure**
Men	Client devaluation of meeting importance	Normalization of invitation
	Client forgetting a meeting	Invitation follow up
Method	Consultant anticipation	Out of scope
	Difficulty to track invitation confirmation	Weekly checklist
	Invitation not sent formally	One month workshop planning
Material	Logistic failure	Out of scope
Environment	Non-punctuality culture	Out of scope

Table 10 - Waiting Ishikawa analyze

In the section on labor-related causes, the customer's devaluation of the importance of the meeting and the forgetting of the meeting were identified causes. As countermeasures, it is proposed the normalization of the description of the invitation where the role to be played by each of the invited elements and the follow-up of the state of the convocations should be highlighted.

In the section of causes associated to the method, a normal anticipation of the consultant was detected in relation to the defined time, which causes waiting. However, this anticipation is positive since punctuality is fundamental as a professional attitude. The difficulty of following the confirmations of many invitations, leads the consultant to lose track of the people who have already accepted or not each meeting. At the same time, it may be the case that the meetings requests are not formally held. As a countermeasure for these problems a checklist of constraint checks was elaborated, which allows monitoring, among other aspects, the status of the invitations. The tool presented in Table 11 for client meeting planning was developed, which serves as a management tool for the allocation of team members in the client, allowing greater compliance with the various events. For each day in the client the number of hours required for the project of each of the elements of the teams is defined. The color code used is intended to represent several workshops that are running concurrently. In the lower part of the table it is possible to visualize the weekly load, in hours, of each of the elements of the teams, in which case the color code intends to demonstrate which elements are more overloaded in each of the weeks, in order to avoid overloading team members'.

Date/Person	A	B	C	D	E	F	G	H	I	J	N	R	S
11/abr	6			6	6		6	6		6			6
12/abr	2									2			2
18/abr	1.5		1.5			3			1.5	1.5	1.5		
19/abr	3	3	1									3	
20/abr	3			3			6			6	6		6
21/abr			2								0.3		
02/mai										3			3
03/mai	3		2									3	
04/mai	2.5						2.5						
05/mai	2											2	
08/mai													
09/mai													
10/mai			2										

Week/Person	A	B	C	D	E	F	G	H	I	J	N	R	S
15	8	0	0	6	6	0	6	6	0	8	0	0	8
16	7.5	3	4.5	3	0	3	6	0	1.5	7.5	7.8	3	6
17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	7.5	0	2	0	0	0	2.5	0	0	3	0	5	3
19	0	0	2	0	0	0	0	0	0	0	0	0	0

Table 11 - One month planning tool

In what concerns causes associated with the material and the environment, problems such as logistic failures and organizational cultures with a tendency towards non-punctuality were identified, but they were outside the scope of solution design. Logistical failures can translate room unavailability, computer malfunction, flight delay, among others, while the culture of non-punctuality intends to represent the natural tendency in some organizations or people not to comply with the previously established schedules.

Appendix D contains the 3C visual presentation for the problem waiting losses at the client. The quantification of gains and verification of the solution will be discussed in chapter 5.

4.5 On-line data monitoring

The data model developed for project productivity measurement has allowed for more frequent productivity monitoring and can be performed on all projects simultaneously without the need for extra features. In addition to the data collection allowed by the model, it is fundamental to ensure continuous monitoring and analysis of the evolution of the different indicators together. Taking into account the proposed relationship between the operational indicators of quality and cost and the project productivity indicator, a business intelligence dashboard was developed for online monitoring of all the indicators in an intuitive and visual way, allowing numerous possibilities of analysis. The application was developed through Microsoft PowerBi software. The developed dashboard is presented in Figure 26.

In addition to the cost / quality operational indicators and project productivity indicator, the revenue short/medium term indicators and consultants' geographical dispersion indicators are also included in the dashboard. At the level of revenue indicators, it is possible to monitor daily revenue against target and maximum capacity, deviations from the target for the last seven days and annual revenue against annual targets and total annual capacity. These indicators are subdivided into the different natural teams, making possible a comparative analysis. This analysis can be combined with the analysis of the operational indicators by each of the natural teams, by drilling them down by projects, i.e. by detecting constant deviations from the objectives of a given team, we can analyze the operational indicators of the team and go into greater detail to see if this deviation is being caused by a particular consultant / project or if it is a cross-cutting cause for the whole team. The geographic dispersion analysis against the productivity indicator allows to compare the project productivity in different geographies, besides allowing the monitoring of the dispersion of consultants worldwide.

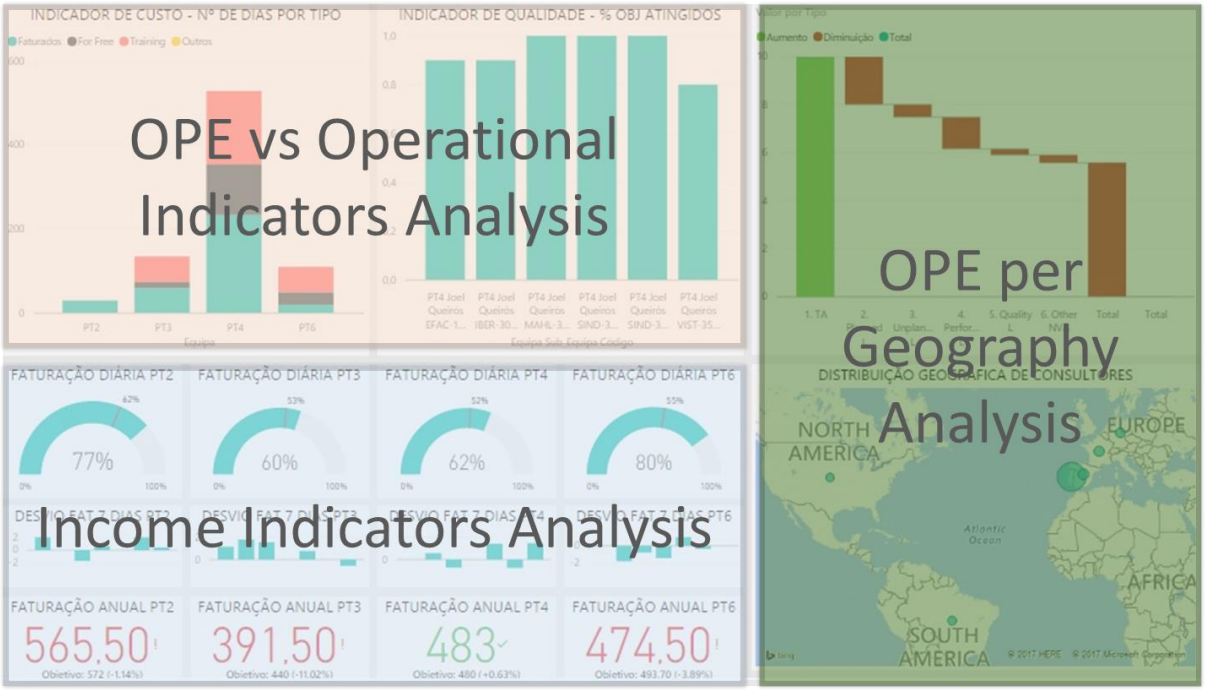

Figure 26 - On-line data monitoring dashboard

Given the data presented in Figure 27, the analysis of the revenue indicators allows identifying the positive positioning of the PT4 team against the year-to-date objective. For the same team, in the last seven days there were mostly positive deviations from the daily targets, including the actual day of analysis on which the revenue target was 52% and reached 62%.

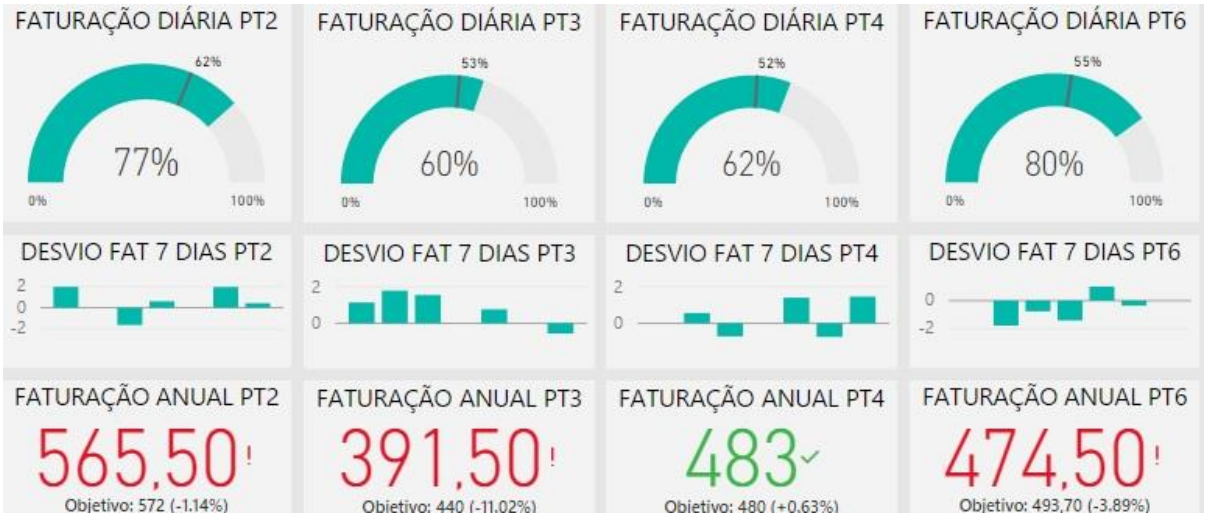

Figure 27 - Revenue dashboard

In order to understand the causes of better results for PT4 team, a comparative analysis of the cost and quality indicators for the sub-teams of the PT4 team can be carried out. With this analysis, it is possible to identify if the behavior within the same team is homogeneous or if there are sub teams with heterogeneous results. In Figure 28 it can be seen that at the level of the total days in the client are at a similar level for both sub teams, however, the sub team with greater percentage of days invoiced also has a greater percentage of goals reached in all projects.

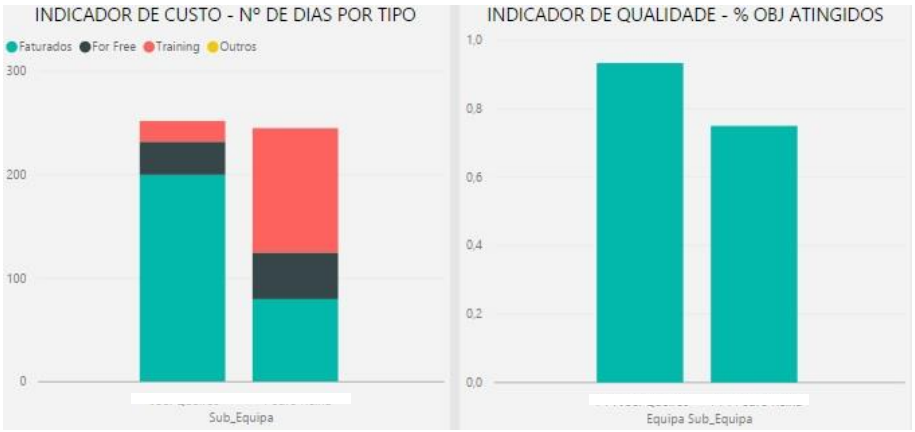

Figure 28 - Cost vs quality level 1 dashboard

The developed business intelligence system allows to further explore the behavior of the various projects within the sub teams. Figure 29 shows the project drill down for a given sub team. Through this functionality it is possible to compare projects with different dimensions and with different percentages of days invoiced in parallel with the quality component of these same projects.

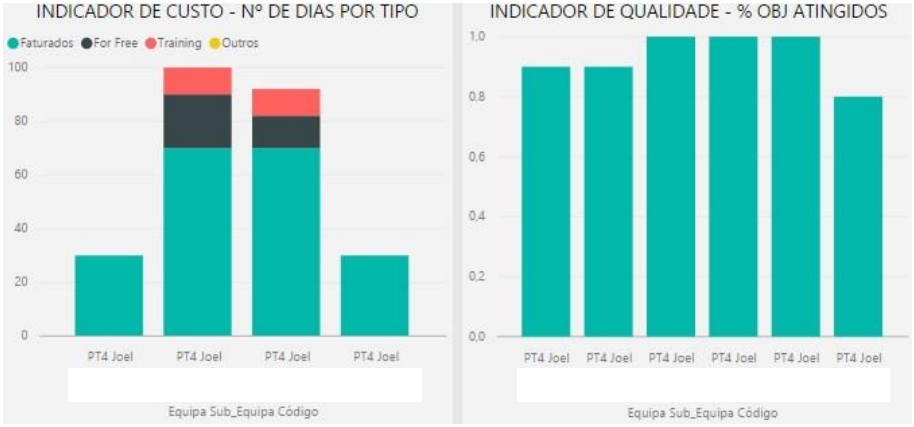

Figure 29 - Cost vs quality level 2 dashboard

Finally, by selecting one of the projects it is possible to analyze the productivity in the project. In Figure 30 we can see one of the selected projects and the distribution of productivity losses in the project, as well as the time of value-added versus the opening time.

Figure 30 - Quality vs OPE dashboard

4.6 Chapter synthesis

This chapter summarizes the organization's vision for improving the productivity of consultants by framing the project in an optimization perspective with a view to reducing opening time rather than reducing the resources required. Subsequently, the 3C methodology is applied to the main problems identified using a priority matrix. For each of the identified problems the causes are defined by category and the proposed countermeasures are presented. Finally, the online monitoring platform of the indicators addressed in the analysis of the initial situation is presented, with the aim of guaranteeing continuous monitoring of all indicators at stake.

5 Pilot project and implementation plan

The pilot project implementation of some of the proposed solutions aims to ensure the validation of the concepts and results before their implementation throughout the organization. For the pilot project phase, a group of 8 consultants was selected who implemented and / or tested some of the solutions proposed in the current project. The timeframe required to execute some solutions and / or the investment needed to implement solutions meant that not all actions were tested in the pilot phase. The implementation of the pilot project lasted approximately six weeks and precedes the phase of deployment and transversal implementation of the proposed solutions to the organization.

5.1 Actions implemented in pilot team

Table 12 presents the actions implemented in pilot and the actions in which only the concept was developed due to its greater complexity and / or cost. In the case of one-month workshop planning, since it is a solution that can only be implemented after the standardization and follow up of the invitations, it could not be implemented in the pilot phase. The concept of knowledge management platform was developed, however, given that it is a proposal that involves the conceptualization and specification of a new system and large investment, was also not implemented in the pilot phase.

Solution	Pilot	
	Concept	Final Solution
Training pull planning		
Integration outlook/last planner		
Standardization of Invitation and follow up		
Weekly constraints checklist		
One month workshop planning		
R&D process standaridzation		
Workshop instructions		
Knowledge management platform		

Table 12 - Actions implemented in pilot group (concepts and final solutions)

5.2 Results

Due to the short duration of the pilot project it could only be assessed the evolution of the preparation component, since the component of losses in the client requires a monitoring with duration equivalent to the duration of a project. As for the training improvement, since it was intended to increase the effectiveness of these moments instead of reduce their duration in order to have an impact on the reduction of the preparation, it was considered a way to achieve the aim of reducing the number of hours of preparation.

Figure 31 presents the average values for the number of hours of preparation per week and the average opening time before and after the implementation of the proposed solutions. The need for preparation outside the client and therefore outside the normal working hours of the consultant reduced from 6.97 hours a week to 2.80 hours a week, representing a 60% reduction. Quality of projects is expected to remain high once the improvement was in the elimination of non-value-added activities. Given that part of this preparation is carried out over the weekend, the reduction achieved translates into one more morning / afternoon free of work for the consultant during the weekend, which is completely in line with the objective of the organization to invest in the pillar of motivation as support for the pillars of quality, cost and customer service.

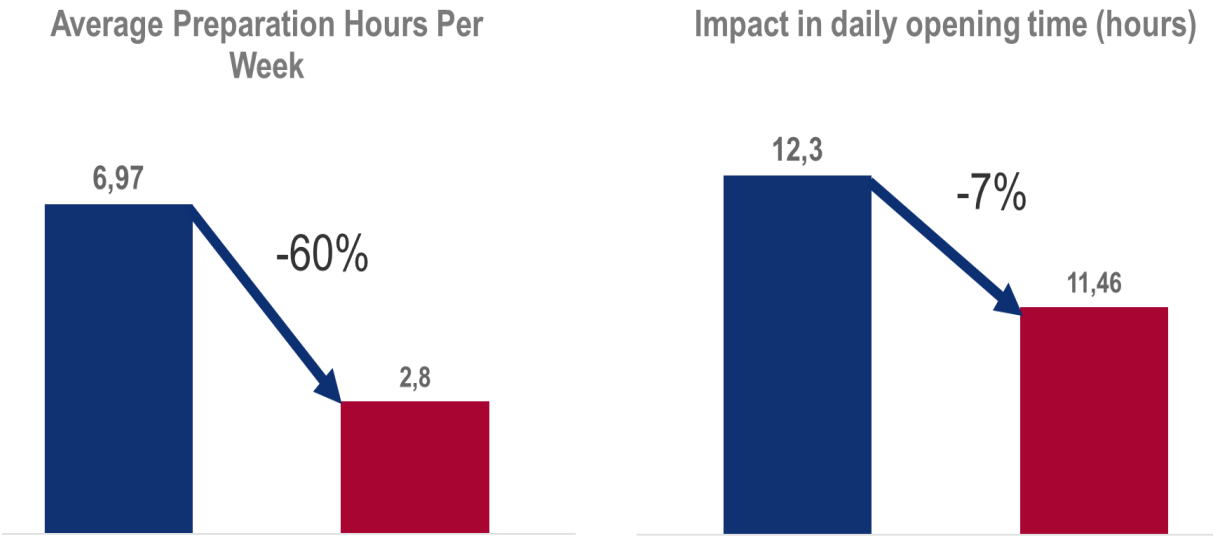

Figure 31 - Evolution of preparation time and impact in opening time

The reduction of the average preparation time has a significant impact on the average opening time, since this component represented about 24% of the total losses identified. Thus, with the improvement obtained, the average opening time is reduced by approximately 7%, going from 12.30 hours to 11.46 hours per day. It is necessary to take into account that the largest loss component identified is related to the consultants' travels, which was not addressed due to the implication it has in the business, but increases the difficulty to obtain significant results in the opening time.

5.3 Implementation plan

The deployment phase of the actions implemented in the pilot throughout the organization and the execution of the other solutions will be carried out according to the implementation plan presented in Table 13. After the pilot phase, lasting approximately six weeks, it follows the sequential unfolding of the actions associated with the consultants and, simultaneously, the actions associated to the R & D team are developed. The estimate for the conclusion of the implementation plan is approximately six months.

Solution	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21	W22	W23	W24
Pilot implementation																								
Training pull planning																								
Integration outlook/last planner																								
Normalization of Invitation and follow up																								
Weekly checklist																								
One month workshop planning																								
R&D process normalization																								
Workshop instructions																								
Knowledge management platform																								

Table 13 - Implementation plan

5.4 Chapter synthesis

This chapter addresses the execution of the pilot project, in which some of the solutions proposed in the solution design were implemented. The importance of the validation of the developed concepts is highlighted. Some solutions were not tested due to the need for medium-term investment and the complexity of its development. After the characterization of the pilot project, the results obtained are presented and an analysis is carried out that seeks to validate the project taking into account the previously defined organizational objectives. Finally, a plan for deploying the solutions to the whole organization was established.

6 Conclusions and future work

The study of productivity in consulting activities is a very complex topic because of the typology of the elements involved and the great intellectual component inherent to the business. Evaluating the productivity of a consultant by the OPE method implies the definition and characterization of the concept of value-added. This characterization should be simplified and summarized to the activities for which the customer is willing to pay. Based on this metric and this concept for value-added, the basic elements for the development of this study, an intensive and diversified data collection was elaborated.

The creation of a robust database allowed for an exhaustive characterization of the initial situation, in which an overall value of the consultants' OPE of the organization of 37% was identified. With this result, the potential of improvement in the productivity of the consultants of the organization stood out immediately. The main productivity losses identified are related to the preparation work for the activities to be performed at the client and the planned losses due to travelling. In the group of productivity losses due to preparation activities a detailed analysis was conducted regarding the relationship of this component with the consultant seniority. This analysis resulted in functions that reflect the evolution of productivity losses due to preparation needs for each level of the organization's consultants. The planned productivity losses, which translate the travels to the clients, are an inherent subject of the consulting business due to the geographical dispersion of the clients and the need for the consultants to carry out most of the work in the customer's locations. Taking into account the worldwide presence of the organization under study, this component of losses proved to be significant, but was out of scope. For the remaining categories of productivity losses, such as unplanned unavailability, performance and quality losses, the main causes were studied and residual loss elements were excluded, as well as the uncharacterized losses component.

The different typology of the activities of the consultants promoted a study regarding the distribution of the OPE according to the days of the workshop and the days of follow up. This analysis demonstrated that the workshop days are tendentially more productive than the follow up days. This feature indicates a greater potential for improvement for follow up days, but does not reveal the effect of the preparation that is typically more present on workshop days.

The database obtained and the analysis of all the variables identified allowed the development of a data model that significantly reduced the effort required to collect data on the productivity of the consultants. The initial data collected required the follow-up of the consultants of the study group by a second consultant who developed time writing activities or required the assessed consultant to spend part of their working day filling out their time-writing grid. This methodology of data collection would not be sustainable in a perspective of continuous monitoring of the productivity of the consultants, reason why the data model developed proved extremely useful in the industrialization of the measurement of the productivity in project. This model is based on a 19-question survey and includes adjustment parameters that are based on the data history to fit each of the new entries in the model. The defined questions are intended to cover all types of losses within the scope of the OPE metric,

as well as the impact of each one of the losses. One of the variables included in the model is the perception of value-added by the consultant, since it is considered important to capture the point of view of the executor. In order to approve the reliability of the model, the results obtained were extensively studied through macro comparative analysis with the initial database and detailed comparisons with a specific project. Although globally reliable, the model presented a weakness in the scope of productivity losses by team performance. In comparison with the initial database, this component was much higher in the data model. This change comes from the greater penalization of the team's performance on the part of the consultant regarding the low speed of conceptualization and execution. From the consultant point of view, the time required to perform a task is lower than the real time required for a team to perform the same task.

The implementation of the data model was accompanied by a comparative analysis with the cost indicator associated with the percentage of days invoiced, the quality indicator that reflects the percentage of objectives reached and a strategic business variable that represents the weekly frequency of the consultant's visit to the client. This analysis demonstrated the existence of several relationships between the OPE and the others indicators under analysis. The indicator of percentage of objectives reached relates to the OPE through the components of performance losses and unplanned unavailability, proving that projects with less productivity losses in these components translate into projects with a higher percentage of goals achieved. The percentage of invoiceable days relates to the OPE through the component of planned availability losses, i.e. traveling time, emphasizing that projects with greater need of displacement are related to projects with greater percentage of days invoiced. The customer visit frequency was related to the OPE through unplanned and performance losses, demonstrating a relationship between projects with a higher frequency of visits and projects with lower productivity losses for unplanned unavailability and performance. The relationship between the cost and quality indicators was also analyzed, and it was possible to establish a strong connection between projects with a higher percentage of days invoiced and a higher percentage of objectives achieved, i.e. projects without budget overruns are more likely to achieve more objectives. Through these four relationships, it is possible to conclude that the cost and quality indicators can be influenced positively by increasing the weekly frequency of customer visits, which promotes the reduction of performance losses and unplanned downtime. At the same time, solutions should be designed to reduce the remaining productivity losses in order to increase the impact of the OPE in the business indicators.

The design of solutions to enhance productivity results was based on the organization's vision for a decrease in the average opening time by focusing on larger losses of productivity and improvement of project activities efficiency. The main problems addressed were the preparation, which represented 24% of total productivity losses, training effectiveness and customer waiting times, which represented 4.8% and 5.8% of total losses, respectively.

For each of the problems under study, the 3C methodology was applied and a set of solutions was defined, including the pull planning training, the integration of the outlook with the last planner, the standardization of invitations and follow up, the creation of a constraint checklist, one-month workshop planning, R & D process standardization, workshop instructions and a knowledge management platform. Given the strong component of data analysis and the need to continuously monitor productivity, a business intelligence application has been developed that incorporates all the necessary data in a visual and interactive way, so that management teams and consultants are able to daily monitor their productivity, project results and overall results of the organization.

The implementation of the defined actions took place in a pilot team, with the exception of the actions with greater lead time of execution or need of investment, in which only the concepts were developed. The results obtained in the pilot team translated a reduction of 60% of the preparation time, which resulted in a reduction of 7% in the average opening time. It is

anticipated that deploying the actions to all elements of the organization and implementing the actions with greater lead time of execution will potentiate these results and increase the efficiency of the work in the client, further reducing the opening time.

In terms of future work, although the subject of displacement is outside the scope of this study due to the inevitability of its existence, an enormous impact of this competent was detected in productivity losses. Although it is not possible to eliminate such losses, it would be advantageous to develop an algorithm that would define the best way for a consultant to move to their projects, taking into account their location, customer location, means of transportation available, associated costs and the convenience of the consultant. At the same time, it would be advantageous to develop a methodology that allow the organization to minimize the trips made by the consultants, by creating clusters of consultants by regions and optimizing the organization of the days of the week in order to minimize the distances traveled.

Another area of future study is the possible development of a technological mobile tool that allows managing the consultant's agenda and is integrated with the indicator monitoring platform so that the data feed becomes even faster, more complete and more reliable.

In order to confirm that quality of projects and the percentage of invoiceable days might be positively affected by the solutions presented, it should be also monitored the evolution of these indicators in a long-term perspective, which can be based on the developed dashboard.

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APPENDIX A: Time writing grid

Type	Activity	Status	06:00	06:15	06:30	06:45	07:00	07:15	07:30	07:45	08:00	…
Availability, Planned	Empty Planner - Nothing to do -	0										
	Reporting to supervisor	0										
	Prepare a report to the supervisor	0										
	Attend to a planned training	0										
	Give a planned training	0										
	Prepare the training	0										
	Travelling	0										
Availability, Unplanned	Interruptions (questions, requests for help, etc.)	0										
	Waiting (people, pc, information etc.)	0										
	Walking between meetings	0										
	Switch between activity	0										
	Setup - reread / review to start over the activity	0										
	Search for information / people / materials	0										
	Sorting out (information, e-mails, spam etc.)	0										
Performance	System failures (computer, printer, copiers, etc.)	0										
	Lack of software / No permission	0										
	descriptions, data transfer errors, duplicate input, manual data import or export)	0										
	Task took long than planned (standard)	0										
	Passing information / work	0										
	Prepare meetings / activities	0										
	Follow up on meetings / activities	0										
	Coaching a colleague	0										
Quality	Check a document	0										
	Relearning	0										
	Rework	0										
	Respond more than once to the same subject	0										
Added/ Non Added Value Tasks	Produce a information that will never be used	0										
	Attend a meeting with out added value / results	0										
	Administrative phone calls / email without added value	0										
	Other Non Added Value Work	0										
	Content-related work (in the planned duration)	0										
	Content-related meetings / calls / emails (in the planned duratic	0										

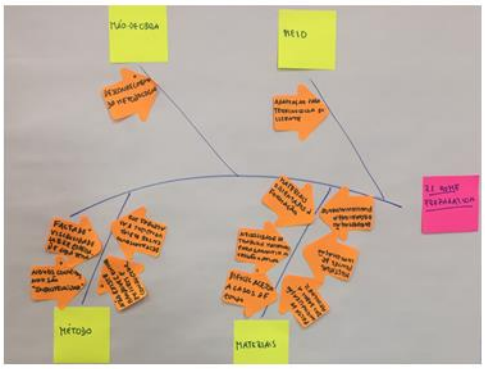
APPENDIX B: 3C for preparation improvement

1. Case

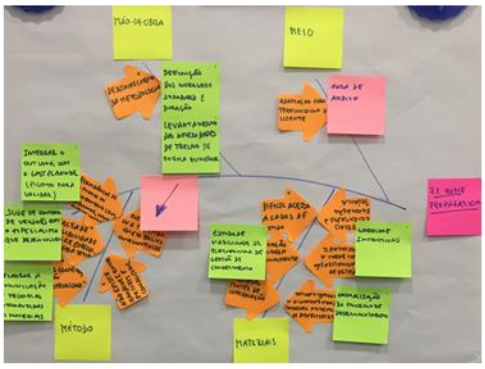
Preparation losses of 24%

- **Out of normal work schedule – 18%**
- **At the customer – 6%**

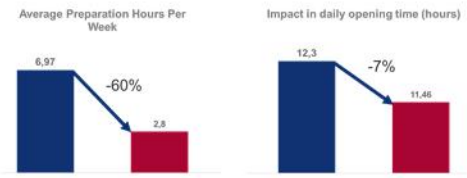
2. Causes



3. Countermeasures



4. Verify Solutions



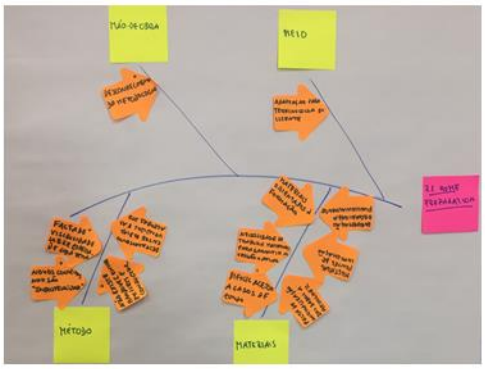
APPENDIX C: 3C for training improvement

1. Case

Training losses of 4.8%

- Ineffective training that leads to extra preparation needs

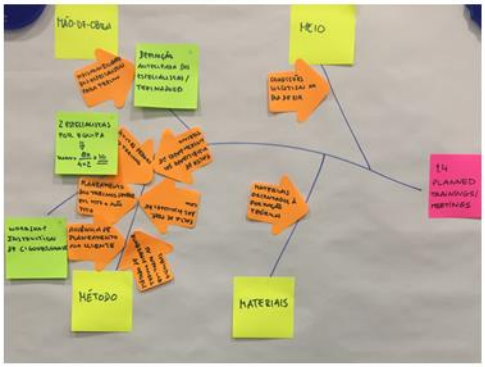
2. Causes



4. Verify Solutions

Impacted should be noted in preparation time. Not analyzed in particular due to time constraints

3. Countermeasures



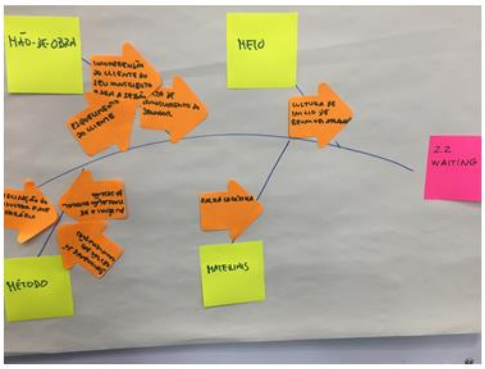
APPENDIX D: 3C for waiting reduction

1. Case

Preparation losses of 24%

- **Out of normal work schedule – 18%**
- **At the customer – 6%**

2. Causes



4. Verify Solutions

Not analyzed in particular due to time constraints

3. Countermeasures