Total Productive Maintenance from a managerial perspective – the value of senior managers' engagement for the success of the methodology

By

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ABSTRACT

Transformations have been impacting on how organizations manage activities, requiring from them capabilities to reinvent themselves and to increase representativeness in the market.

For this purpose, there is a range of methodologies to guide companies to achieve differentiated results. Among them, Total Productive Maintenance (TPM) is an alternative to boost the organizational performance and to develop a differentiated strategy.

The success of the methodology is related to the commitment and engagement of senior management. Although other factors are also considered critical for its implementation, such as full employee involvement, communication, and training, the senior management is perceived as the core component.

To better understand the relevance of the management team, this research focuses on the analysis from points of view of people in management positions and whether they recognize the importance of their decisions to enhance TPM as organizational culture. Furthermore, adopting qualitative research method, the study identifies challenges to develop and strengthen the culture.

The outcomes indicate that there is indeed a consensus on the importance of senior management engagement for the success of the program. The interviewees understand that leadership is one of the main aspects while introducing new ideas and concepts. Because it is a top-down initiative, cases in which there was no commitment from those people failed in developing a TPM-based strategy.

Other findings of the research are related to people management, including assertive communication to keep everyone in the same direction in pursuit of consistent results. Knowledge was also considered essential for culture change because it allows people to have access to information and open mentality.

Based on the discoveries generated by the research and critically analysing the limitations of the study, the researcher gives recommendations for future works to enrich the literature.

Declaration

Submission of Thesis and Dissertation

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Contents

List of Figures

List of Tables

List of Abbreviations

AM	Autonomous Maintenance
CI	Continuous Improvement
JIPM	Japanese Institute of Plant Maintenance
JIT	Just in time
NCI	National College of Ireland
PM	Preventive Maintenance
TPM	Total Productive Maintenance
TQM	Total Quality Management
5S	Japanese methodology composed by 5 senses

1 CHAPTER 1: INTRODUCTION TO THE RESEARCH

1.1 Introduction

The current world requires from organizations know-how to adapt to offer quick responses to the market and to create efficient strategies for the development of competitive advantage, because “an organization that possesses distinctive competencies and exploits them in the strategies it chooses performance” (Griffin, 2013, p.210). Otherwise, they are not able to sustain themselves and tend to fail.

To achieve better performance and stand out, Porter (1985) points out that organizations must have resources and capabilities enough to guide the company to obtain lower costs and enhance the differentiation, in addition to improve the brand reliability among consumers.

Nowadays, there are many ways to develop strategies, and firms need to understand which one fits the best within the organizational context. Methodologies such as Total Productive Maintenance (TPM) are well-known to redesign the management of organizations and ensure spectacular returns, tangible and intangible, and allow corporations to perform outstanding activities among competitors. Overall, Kiran (2017) describes that the TPM mission is to ensure that machines are kept in proper condition so that potential breakdowns are avoided, and there is no intervention during the production process. The author also explains that the methodology seeks to eradicate every loss to increase the efficiency of the machines and maximize their utilization.

The implementation of this philosophy requires teamwork, the involvement of everyone, and, above all, must be a top-down program. In other words, it must be a guideline supported initially by directors and managers, and then it can be disseminated to other levels. Studies emphasize that “the commitment of top management in preparing a suitable environment for TPM’s introduction and in planning and coordinating for its implementation is considered crucial to TPM’s success” (Ahuja and Khamba, 2008, p.127).

Undoubtedly, TPM can be an effective alternative for companies looking for improving results and building a sustainable business. However, such as any other strategy, it requires efforts, especially regarding changing people's mindsets and structuring a strong organizational culture. Furthermore, one of the key elements for the success of the methodology is to have the support and commitment of the senior management, and the lack of this element can cause the failure of the program.

Therefore, this study aims to investigate whether people with leadership roles can perceive the magnitude of their responsibilities when they adopt such a robust program that requires diligence and dedication from everyone.

1.2 Study motivation

In previous experiences, the researcher worked at an organization that implemented TPM. It was an incredible experience: she developed a rich knowledge base and witnessed positive changes, both in people's attitudes and in the company's performance indicators.

However, she identified resistance to the program coming from different areas, both from the operational team and some managers. Therefore, the research is motivated by understanding how people in leadership positions perceive the importance of their actions into the development of the program and whether they comprehend that the success of the methodology depends on their engagement.

1.3 The research outline

This investigation aims to understand how important from a managerial point of view is the involvement and engagement of managers for a successful TPM in organizations seeking better performance. Also, to identify the greatest challenges during the implementation, from planning to the consolidation of the program as organizational culture. Finally, to evaluate if managers perceive that the success or failure of the philosophy is related to their commitment in front of their respective teams.

1.4 Significance of the study

The study was mainly motivated by previous experiences gained by the researcher. Despite the many challenges that the methodology offers, the greatest one was the support of the leadership team to ensure the involvement of everyone, which is often pointed out, by research and cases studies, to be one of the biggest barriers to implement the methodology. The resistance was one of the factors that made the success of the philosophy more difficult.

The general intention of this research is to produce more information and supportive work for the literature about the methodology, approaching the personal experiences of people in leadership positions. It has identified that the literature points out the importance of the management team for the success of TPM, however, none of the papers used as a source of information presented a subjective perspective of managers and leaders about the methodology and changing organizational culture.

Although the study is exclusively focusing on the perspectives of people in managerial positions, it is worth emphasizing that the vision of the operational team is also extremely relevant for the development of the program, which opens opportunities for future research.

1.5 Contribution of the research

This research focuses on offering, through a qualitative approach, experiences from people in managerial positions in organizations adopting TPM, and complementing studies on the subject, tries to show situations that represent the real scenarios about the topic. Its greatest contribution is to confirm what the theory presents through real experiences in organizations that embrace TPM as a channel to achieve better results and create competitive advantage.

2 CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The demand for innovation is significant for the progress of market strategies and associated with this, trends in the consumer segment require the capacity of developing competitive advantage to attend new demands and to reach a position ahead of the competitors.

This complexity within the business chain has made operations and support areas more expensive. On the other hand, organizations do not always use 100% of their productive capacity, therefore it is necessary to find ways to increase productivity, while reducing costs, and ensuring the goods' quality (Blanchard, 1997).

Due to this scenario, many methodologies are being used as allies in the development of new strategies. Among them, the Japanese philosophy called Total Productive Maintenance (TPM) provides the chance to increase machine performance through a mature connection between operators and equipment (Bon and Ping, 2011). It represents an exceptional opportunity for increasing productivity, reducing losses in the production process, reducing operating costs, maintaining the quality of the product, and health and safety in the organizational environment.

Poduval, Pramod and Jagathy Raj (2013) explain that TPM has as the main objective the identification of process losses and consequently the reduction of production costs through the elimination of such waste.

To achieve the goals, TPM goes beyond the management of machinery and equipment. The program requires the involvement of employees, teamwork, and a change of attitude. Therefore, it is necessary to develop a strong organizational culture among employees (Elgharib, 2014). Consequently, the relevance of a committed management team for the success of the methodology is a common denominator among the studies covering this topic.

Chapter 2 will provide an overview of the TPM origin, discussing specific concepts of the program. Besides, some elements that influence the success of the methodology will be explained. Finally, the chapter discusses the importance of a committed team of managers and directors in the process of implementing the organizational culture based on the principles of this philosophy.

2.2 Total Productive Maintenance methodology

Total Productive Maintenance (TPM) focuses on restructuring how the maintenance area was handled in a reactive way in the past. TPM has its origin in Japan during the 1950s (Wireman, 2004) and according to Levitt (2010), the method was improved, when in 1960, Nippondenso, a company belonging to the Toyota Group that produced car components, started implementing some principles of preventive maintenance (PM).

In the PM concept, the maintenance department should only do repairs after a machine breakdown is replaced by corrections anticipating failures, and thus the program permits "you to schedule the work rather than letting the work schedule you" (Gross, 2002, p.6).

In the Nippondenso case, problems arose after automating the production process, and the demand for maintenance technicians grew. Due to this situation, responsibilities had to be reorganized and some activities previously performed by the maintenance staff started belonging to the operators' role (Levitt, 2010).

According to Cooke (2000), through these new activities included in daily routines, the operators acquired the ability to identify abnormalities that eventually could cause stoppages, helping the maintenance team to adopt a proactive posture, once they could focus on scheduling preventative repairs and avoiding significant problems. Then, the traditional maintenance structure was redesigned and, instead of fixing the machines when they failed, the issues were identified in advance.

This shows that the culture of ‘putting out fires’ is replaced by an in-depth analysis of the problems and therefore, the companies become more productive and efficient, strengthening competitiveness (Hooi and Leong, 2017).

The benefits of the Japanese philosophy go beyond reducing machine failures and downtime. TPM also promotes expansion in the expectation of machine operation, which positively affects the efficiency and availability of the equipment (Swanson, 2001). Besides, there is an opportunity of cost reduction, once maintenance costs have a high representation in production costs - Mobley (2002) estimates this number between 15 and 60% depending on the type of industry. Ahuja and Khamba (2008) mention that with the program, it is possible to reduce more than a third of the maintenance costs. Thus, the methodology can be an ally of the organizations to reach higher performance.

Also, TPM helps to solve problems between maintenance and production departments. Droga *et al*. (2011) exemplify that the production area is always reporting that the maintenance team does not keep the machines in good condition, while the maintenance area shows dissatisfaction about the way the production team operates the equipment.

The reduction of downtime, increasing productivity, is achieved when production and maintenance areas start working collectively (Brah and Chong, 2004). It straightaway influences the morale of employees since the fatigue and stress due to machine breakdowns is replaced by continuous improvement and a healthier environment.

Although Hooi and Leong (2017) state that TPM is recognized around the world as a good methodology to focus on increasing manufacturing productivity, Brah and Chong (2004) explain that the advantages are not limited to industry and can reach all sectors within an organization, since TPM also increases the efficiency and performance of administrative processes.

Agustiady and Cudney (2015) describe cases of customer service firms and hospitals that have obtained results in terms of increased satisfaction from both employees and patients because of TPM. There has been reduction in the margins of results errors and customers complaints and an increase in equipment availability, allowing the expansion of consultations.

Despite the philosophy involving employees in the production and maintenance departments, all positions within the organization - from people who hold management roles to operational levels - are essential to structure the methodology (Chan *et al*., 2005).

Furthermore, a gradual TPM implementation is recommended to obtain sustainable results, as it involves processes of organizational culture and mindset changing and represents significant challenges. Therefore, Agustiady and Cudney (2015) propose an implementation process structured in four stages as described below:

Table 2.2-1 Stages of TPM Implementation, according to Agustiady and Cudney (2015)

Stage	Definition
Preparatory	**Step 1 - Communication:** First, the management team must develop its knowledge regarding TPM methodology. They also need to commit to the implementation and execution processes. Then they are responsible for a robust communication with everyone. **Step 2 - Initial education and propaganda:** Investment in training since the development of TPM requires knowledge of several concepts. **Step 3 - Setting up TPM and departmental committees:** Definition of the pillars.

Stage	Definition
	Step 4 - TPM working system and target: Determine key performance indicators (KPIs) and define how the system will work. **Step 5 - Master plan for institutionalizing:** Develop strategic plan to transform TPM as an organizational culture.
Introduction	Ceremony for the announcement of the TPM. This moment is fundamental for consciousness, commitment, and support.
Implementation	Each pillar is responsible for developing the activities.
Institutionalizing	When all activities are being executed and TPM reaches a higher level of maturity, new challenges must be proposed for continuous improvement.

It is interesting to point out that TPM does not have a beginning nor an ending: implementing a new culture requires a continuous improvement mindset. When results improve, goals and objectives must be redefined to reach higher levels.

The TPM program is guided by seven pillars, as shown below. They constitute the best policies and procedures to structure TPM methodology and reach new standards of productivity (Adesta, Prabowo and Agusman, 2018).

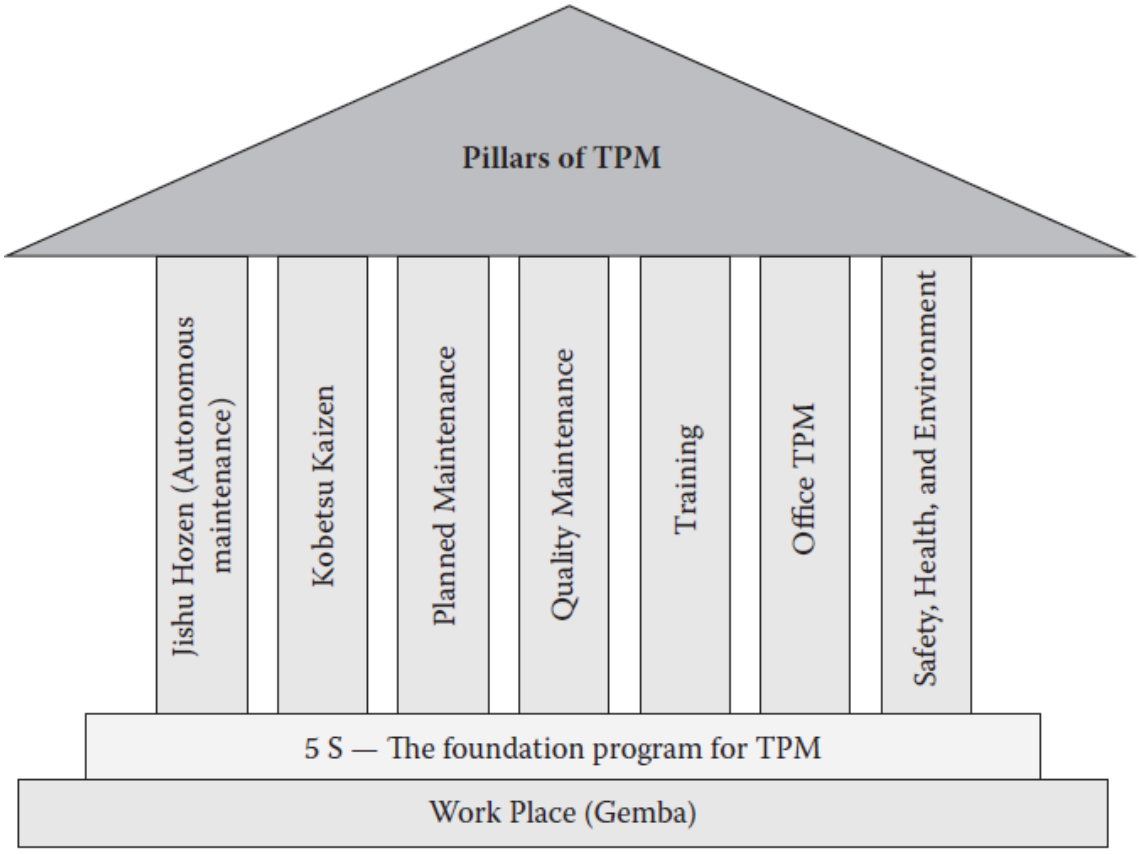

Figure 2.2-1 Pillars of TPM, source: Agustiady and Cudney (2015)

The five senses (5S) is one of the bases for TPM program, which means that before the pillars start any activity, the principles concerning 5S must be consolidated in people's minds and work atmosphere.

The 5S concept has as objectives, defining and maintaining the quality of the working environment (Ho, Cicmil and Fung, 1995). The learnings obtained from the practice goes beyond the work environment and can also be applied to personal projects. 5S helps to prepare a favourable climate for increasing efficiency and improving the quality of goods or services through reducing or eliminating losses and waste and they are (Pheng, 2001):

- Seire (structurize): To separate tools and materials according to the level of usefulness. Materials, documents, and data that are used more frequently should be closer to the users and the less used, more distant, or even rejected.

- Seiton (Systemize): To establish an organized environment defining layouts and determining appropriate places for working tools.

- Seiso (Sanitize): Each employee is responsible for cleaning their workplace.

- Seiketsu (Standardize): Make all that was previously established and agreed upon as a standard of work.

- Shitsuke (Self-discipline): The activities performed in the previous senses must be part of people's routines.

5S changes work atmosphere through the construction of a healthy work environment, enabling people to introduce new behaviours. This transformation is the initial step towards the construction of TPM pillars.

The pillars are the guardians of the methodology and responsible for applying tools that support the Japanese culture in daily activities. They are:

- **Autonomous maintenance**

Traditional maintenance is based on the utilization of a qualified technical workforce for simple maintenance activities. The technicians could focus on activities that add value, such as automation, machine improvements and cost reduction projects.

Studies indicate that among the problems that cause machine stoppage or interfere with product quality, only 17% can be solved through maintenance team interventions. The remaining, 83% are originated by inadequate procedures, deficient design of the machine and lack of components' specification, among other reasons that are not part of maintenance duties (Mobley, 2002).

The autonomous maintenance develops operators to perform simple maintenance activities, releasing maintenance workers to focus on activities that require more technical knowledge (Adesta *et al.*, 2018).

It allows the operators feel as if they are owners of the machines and deliver basic activities, such as inspection, cleaning, and lubrication (Agustiady and Cudney, 2015).

By doing this, operators identify issues that may be responsible for future failures (Borris, 2006), avoiding around 75% of breakdowns (Agustiady and Cudney, 2015), and keeping the equipment in good condition (Adesta *et al.*, 2018).

- **Kobetsu Kaizen**

Also known as Focused Improvement, this pillar identifies equipment and process losses that interfere with the efficiency of activities (Adesta *et al.*, 2018). Through finding losses and wastes (Agustiady and Cudney, 2015), the pillar is responsible for developing improvement projects to eliminate and/or reduce those issues (Borris, 2006).

- **Planned Maintenance**

This pillar focuses on finding the reasons for failures or stoppages of equipment, then solutions are implemented to eliminate the chance of breakdowns for the same reason in the future (Borris, 2006).

It proposes a proactive attitude because, instead of investing resources in machine interventions once they are broken, the pillar builds a maintenance plan to be executed before the issues happen, reducing downtime and affecting the availability of the machines. Moreover, there is more control of the budget allocated to the maintenance department, facilitating the identification of opportunities for cost reduction (Adesta *et al.*, 2018).

This is what differentiates TPM from traditional maintenance since maintenance planning is executed based on the causes of the problems. Eventually, this prevents them from repeating themselves, and consequently avoid breakdowns, once the maintenance plans will include repairs to be executed in advance.

- **Quality Maintenance**

This pillar understands the lack of standardization that causes variations or failure to follow the products' specifications. Modifications or improvement projects are suggested to identify the cause of the deficiency of uniformity (Borris, 2006).

Hence, through the elimination of the deficiency of standardization, the pillar ensures consumers' satisfaction offering products with superior levels of quality (Adesta *et al.*, 2018).

- **Training**

TPM requires awareness and a change of responsibility of everyone. After all, the operators take over some activities that were previously performed by the maintenance team. This process requires skills improvement, and training employees to keep a high level of knowledge.

This pillar identifies training needs, planning, and organizing them to reach as many people as possible. It requires considerable financial investment from the organization (Borris, 2006).

- **Office TPM**

Office TPM seeks to increase performance within administrative departments through the optimization of processes, such as systematization of procedures (Adesta *et al.*, 2018).

It reduces time of execution of activities - such as organization and storage of documents and data - since unnecessary tasks are eliminated. It also increases the accuracy of information through the disposal of unused and needless data and ensures an environment that helps the satisfaction of employees.

- **Safety, Healthy, and Environment**

The main goal of this pillar is to reach zero accidents. It is fundamental to maintain the health and safety of the employees and motivate them to

execute their activities conscientiously, ensuring the protection among them and colleagues. The pillar is responsible for identifying risks within the organization, as well as executing plans to reduce or eliminate events that do not offer safety and well-being to workers (Borris, 2006).

This does not mean that the activities in the organizations offer dangers to the employees. However, depending on the type of industry, processes may require more caution and attention. So, this pillar helps with the identification of potential risks and implement measures to eliminate them, besides monitoring the compliance with health and safety norms.

- **Early management**

Some authors add another pillar, which can be very useful in projects to install equipment in the manufacturing units. It is responsible for "preventing problems occurring during equipment start-up" (Elgharib, 2014, p.20). The author also explains this pillar is important because it helps to reduce the project time to launch the machines.

Although the development of a world-class manufacturer is a response of all pillars acting together (Hooi and Leong, 2017), it is worth mentioning that it is not necessary to implement all the pillars at once as this requires robust structure and sometimes the company does not have enough resources.

Unlike a sudden imposed change that can end up generating demotivation, activities can be performed gradually, always aligning with the strategic plan of the organization. Rodrigues and Hatakeyama (2006) explain that the adoption of the pillars needs to correspond with the internal framework of the company, trying to develop a healthy mixture between the existing culture and the philosophy they want to establish.

Currently, TPM has been recognized as an excellent method to achieve superior results. Through recognition and awards such as the TPM Excellence Awards, offered by the Japan Institute of Plant Maintenance (JIPM), organizations demonstrate that they adopt the pillars, achieving

advancement in performance, quality, and productivity, decreasing costs, reducing accidents, developing a healthier working atmosphere (Brah and Chong, 2004).

2.3 Factors responsible for successful TPM implementation

Despite being a powerful methodology to achieve superior results, TPM is not easily implemented because apart from demanding high investment, it requires the mindset transformation of a whole team.

This topic aims to explain essential elements to sustainably develop the methodology, in other words, to truly embrace the program in the corporate culture. According to Rodrigues and Hatakemaya (2006), some companies often declare to use the program internally. Sometimes, however, the principles are not really incorporated into their strategy or the companies even pretend to use the pillars only to impress TPM auditors. They are responsible for checking whether such processes are complying with what is proposed and give TPM awards and recognition important to a competitive advantage.

- **Alignment of TPM with organizational strategy**

Bamber, Sharp and Hides (1999) use Land Rover as a case study when between 1991 and 1993 they had two failed attempts to implement TPM. Some elements contributed to the failure, such as trying to apply in the entire site at once. By doing this, a lot of effort was demanded in areas that were not so strategic. After understanding what went wrong, the company considered TPM as part of its strategic plan, which ensured the success of the third attempt.

The case exemplifies that TPM is susceptible to failure if there is no implementation planning related to the organization's strategy. Ahuja and Khamba (2008) state that it is essential to ensure that the deployment of TPM, including its targets and aims, needs to be connected with the strategies of the organization because the methodology is not restricted to the productive sector or maintenance; it impacts the entire company. When

companies decide to encompass all areas and departments at one time, there may be an overload of activities, and employees may not be able to give the needed attention to build a sustainable culture.

Thus, before implementing TPM, the organization must define the priority areas where the resources must be primarily managed. Therefore, it is necessary to understand that TPM and strategic planning should be working together, which is cited by Brah and Chong (2004) as one of the success factors of TPM implementation.

- **Dedicate time and effort in TPM activities**

TPM also needs to focus on creating awareness about the objectives and benefits proposed by the methodology among people so that they feel encouraged to embrace changes.

A big challenge provided by TPM as organizational culture is how to integrate what is planned with the daily activities and the employees, who surely need to be completely engaged in the process of developing new policies (Agustiady and Cudney, 2015).

Thus, daily routine management can pose a threat to the success of TPM, especially when there are not enough resources invested, as well as time dedicated to routine activities. Therefore, Poduval *et al*. (2013) point out these factors increase the complexity to tailor the methodology correctly, since a series of phases is recommended, requiring more time and dedication.

Organizations may experience frustrations when they develop a TPM plan without considering each step or when they skip some stages to achieve results immediately. Ahuja and Khamba (2008) explain that plans which do not reflect reality, or propose extremely ambitious goals, tend to deliver unsatisfactory results, and even cause demotivation among employees, who start questioning the effectiveness of the program. The authors also say that companies need to invest time to engage everyone and strengthen the efforts. With this, it is possible to develop proactive

measures to fight against the barriers that may impact the progress of the program.

- **Human resources management**

Lazim *et al*. (2013) exemplify that the program proposes strong changes in the way of thinking since it requires operators to expand their activities to work with the maintenance team. Therefore, as Rodrigues and Hatakeyama (2006) suggest, one of the success factors is related to the administration of human resources since they are the most fundamental components of the program.

Another element concerning the workforce is related to situations when the production plan changes because of market demand fluctuation. In response to the pressure of market changes, Poduval *et al*. (2013) cite that organizations have increasingly prioritized cost reduction and focus on extricating from the workforce as much as they can, using production demand as the only factor to hire or fire people.

Thus, sometimes it is most profitable when companies outsource when the demand increases and reduce back to the original workforce when demand returns to normal. Many organizations using TPM and an outsourcing system may face challenges to spread the TPM culture because they do not include TPM knowledge as a requirement for recruitment. It causes lack of awareness of the program values and it may become a barrier.

Another factor is the necessity of understanding the benefits of the program. Ahuja and Khamba (2008) cite that some operators assume that autonomous maintenance will provide an increment in work since the activities previously carried out by maintenance will be added to their roles, whereas the maintenance technicians feel threatened of losing their jobs because they will not be demanded as before.

Also, Kocher *et al.* (2012) point out that the requirement for a mindset change leads to a lack of acceptance by employees, which again shows the need for a management team that can motivate them.

Levitt (2010) complements that the change of posture can be reached through knowledge transfer. Thus, training is the basis for success because new ideas are discovered, and in-depth discussions about important elements to the strategy are explored such as motivation, support, competence, and environment.

If culture of knowledge is not solidified, then it impacts the reliability among managers and subordinates. This scenario represents a threat to the development of autonomous maintenance since managers think that the operators can damage the machines when trying to execute simple maintenance tasks (Patterson, Kennedy and Fredendall, 1995). In such cases, managers prefer not to risk training the employees, discouraging them from developing new skills, and demotivating them in the educational process about the methodology.

Brah and Chong (2004) highlight the importance between a robust management team capable of transmitting the ideals of continuous improvement and the organizational policies to promote staff commitment.

From all the elements discussed, it is unquestionable that they are related to decisions made by people on strategic levels, as well as certain attitudes and behaviours of managers, who have huge responsibility to transmit the values and motivate teams to achieve goals.

2.4 The importance of a committed management team in the process of organizational culture change

To implement TPM is not simple and requires a lot of unity, persistence, and, most of all, commitment. Hence, it is unquestionable the significance of top managers to motivate teams and guide people towards building organizational culture based on the principles developed by total productive maintenance.

Organizational culture can be explained as the set of views, expectations, and values that shape and constitute the patterns of conduct followed by employees in a corporate environment to accomplish the objectives defined for the company (Hill and Jones, 2008). Griffin (2013) considers that corporate culture can be a potent ally in the construction of efficient enterprise scenarios, supporting the achievement of long-term positive results.

While developing a stable corporate culture is important to establish the identity that shapes the strategies of an organization, it is essential to understand that companies need to reinvent themselves due to such a dynamic market. Consequently, Griffin (2013) believes that managers represent a significant role in recognizing whether the current culture can support the organization in achieving goals or whether there is a necessity to change or expand new values.

Therefore, the leadership team has a powerful role in creating an organizational culture so that distinctive competencies are developed and, consequently, competitive advantage assists companies to conquer leading positions. The management team, with the directors and owners of the organizations, need to be able to understand the external scenarios and, consider the resources and capabilities of the organization. Griffin (2013) states that they must be prepared to identify whether it is necessary to maintain or adopt new cultures to adapt to market demands.

When implementing TPM, managers need to consider several factors, such as understanding the program in detail, defining whether it is the most

appropriate for the current scenario and whether it is aligned with the strategic objectives. Also, they must understand if the company has enough resources and capabilities to structure all necessary changes, thinking about how to involve and motivate people.

Therefore, Hill, Jones and Schilling (2015) highlight that managers need to be qualified to handle challenging conditions because they are regularly transforming. The market requires dynamism and promptness in responding to potential changes, which means that it would be a misconception considering that good results can be reached if the culture remains the same.

Most companies with TPM have in their organizational structure a person to manage the program. In this case, this person would be responsible for assisting in the training of managers, who should ensure the dissemination of knowledge within their respective sectors. Hooi and Leong (2017) emphasize that the methodology requires from people who hold top management roles not only basic knowledge of maintenance duties but also how to apply the theory on the daily basis. This allows them to understand how their decisions impact organizational efficiency and the employees.

Also, the TPM manager serves as a specialist and is responsible for supporting the areas with the methodology knowledge (Brah and Chong, 2004). However, it is important to understand that this person is not 100% responsible for the results. As previously discussed, TPM requires the most all-embracing involvement of everyone, and that is why the whole management team influences and determines the success or failure of TPM.

Hence, people in management positions are fundamental to influence and convince employees that TPM brings exceptional results, not only for the company but also in the individual performance of each employee (Brah and Chong, 2004).

When changes are necessary in the environment in which someone is used to, it is reasonable to find resistance. Ivancevich, Konopaske and

Matteson (2014) explain that even in scenarios where changes are the best alternative, it is still possible to recognize a mixture of fear, anxiety, and opposition. These feelings act as a defence mechanism for people because the resistance is caused by uncertainty and doubts about the future. Also, the authors highlight the perception between situations of change and emotions, where the more significant the change, the more intensely these feelings exist.

For instance, when maintenance workers do not have expertise about TPM, there is a concern about the reduction of manpower. Because of that, many think they will lose their jobs because their activities will be transferred to the production team (Maggard and Rhyne, 1992). Consequently, the explanation of the real benefits of the methodology through education is necessary so that uncertainties will not cause resistance to change.

On the other hand, it is worth noting that when managers lead teams that buy into the idea of change, they will hold on to that idea (Willmot and McCarthy, 2001), reducing the impact of negative feelings.

Therefore, within the entire process of creating an organizational culture, it is essential to define some tools and techniques, aiming to reduce any potential resistance to change, encouraging employees to support the unknown (Dent and Goldberg, 1999).

For Bateh, Castaneda and Farah (2013), an understanding of why employees refuse to embrace change is essential to empower managers to avoid conflicts and encourage everyone to contribute. Furthermore, leaders must be prepared to deal with resistance and, above all, learn how it can be overcome. Otherwise, significant difficulties can be detected, which will be susceptible to failure.

Some initiatives can be adopted, by managers, to reduce the impact of the resistance. For Ivancevich *et al.* (2014), the first step would be to ensure assertive communication, promoting an adequate awareness of everyone. It is important to emphasize that when changes are forced, there is a higher possibility of failure since it becomes more painful to accept them.

Transparent and effective communication becomes an excellent ally in reducing this sense of imposition and preparing the team for coming changes.

Moreover, it is important to identify other people who distinguish themselves and who are influential among the company's employees. These people should be used as a channel to spread the knowledge and benefits of the program, thus facilitating adherence and openness for changing (Ivancevich *et al.,* 2014). The authors also highlight the necessity to create an organizational environment which is called "learning organization" where people feel comfortable and free to express their opinions, share ideas, and participate in change.

Motivation is another key component: it is responsible for stimulating, triggering the willingness to achieve goals, and building an atmosphere where teams are open to working together in pursuit of shared objectives (Peterson, 2007).

The motivation of qualified and enthusiastic leaders generates a new attitude among employees, who often refuse to join TPM because they think that new activities will be introduced in their routines. Instead, when the management approach on methodology goes through the right paths, they agree that this is not an extension of work, but a process to support them to reduce future problems (Maggard and Rhyne, 1992).

From a managerial point of view, although motivation itself is not a sufficient factor to determine the performance of a team, it is responsible for different behaviours that may impact the process of implementing an organizational culture (Ivancevich *et al.*, 2014).

2.5 Summary and conclusion

The chapter discusses the importance of people in leadership positions to the process of changing organizational culture once companies choose TPM to develop competitive advantage.

It presented an overview of the Japanese Total Productive Maintenance (TPM) model, addressing its origin, ideas, and benefits. The methodology is known as an option to seek operational excellence by reducing waste, increasing productivity and performance, affecting the satisfaction of employees and product quality (Singh *et al*., 2013). The chapter also exposes the commitment of the management team as a critical driver to guide the process of organizational culture change.

Aiming to facilitate the comprehension, concepts considered more technical were not mentioned. However, it did not represent any impact on the development of the research.

Even though a robust and committed team of managers is repeatedly cited in the literature as one of the crucial elements responsible for the success of the methodology, the researcher identified that studies conducting adopting a more subjective approach and from a managerial perspective on the subject has been deficient, which justifies the importance of this research.

3 CHAPTER 3: METHODOLOGY

3.1 Introduction

The idea of research embraces a range of characteristics, and diverse scenarios, however in general, for Kothari (2004), research can be described as an academic work that will be carried out in the exploration about a specific theme to encourage the enlargement of knowledge through a defined methodology. It also includes activities to determine solutions to problems and questions that may arise, after a process of investigation and analysis of elements that are connected (Sekaran and Bougie, 2009).

In contradiction to what many people believe, the research goes beyond gathering information or contrasting data. For Leedy and Ormrod (2015), it consists of the process of compiling data, investigating, translating, and understanding information to comprehend events that are relevant and offer advantages to the study area.

Hence, enriching academic research requires critical analysis of the researcher and discernment to adopt the appropriate methodology to achieve results that add value to future researches.

Chapter 3 analyses different methods of research processes and combined with the researcher critical analysis, define the most convenient to conduct the study to answer the research questions.

3.2 The research questions

The study is motivated by the desire to cover the knowledge about management acquired during the master's degree course in Entrepreneurship and to connect with the professional experiences lived by the author in the TPM environment.

The author faced challenges while being responsible for ensuring the application of TPM in an organization, especially with the involvement of everyone in pursuing common goals.

Throughout this experience, there were opportunities for improvement regarding the commitment of the managers. On some occasions, TPM had not been fully incorporated into their routine, and sometimes they performed activities required by the program not because they genuinely understood the benefits, but simply because the superiors demanded it. This represented a significant obstacle to the dissemination of culture, as eventually, the employees did not feel inspired to cooperate if even the managers did not actively participate in the process.

Hence, the research aims at understanding if managers realize that their attitudes and behaviours directly influence the implementation of TPM.

The main objectives to be achieved through this research are:

Overall research objective: How important is it, from a managerial point of view, the involvement and engagement of managers to a successful implementation of TPM in organizations seeking better performance?

Research objective 2: To investigate whether people who hold managerial roles in organizations with TPM have an in-depth understanding of the methodology and the most difficult challenges faced by them?

Research objective 3: To evaluate if managers perceive that the success or failure of the philosophy is directly related to their engagement and commitment.

Scientific research is categorized according to some guidelines suggested by different authors. To answer the questions above, the criteria involved will be research design, data collection, research philosophy, and research methodology.

3.3 Research design

Some definitions for research design are:

"Blueprint or plan for the collection, measurement, and analysis of data, created to answer your research questions" (Sekaran and Bougie, 2016, p.95).

"Decisions regarding what, where, when, how much, by what means concerning an inquiry or a research study" (Kothari, 2004, p.31).

The research design is, hence, the act of determining how the research will be conducted, which methods will be used to gather information, how the data will be compiled and analysed to address the research questions.

Although Cash (2020) points out some controversies and lack of clarity regarding the different frameworks on research design, Kothari (2004) recommends that the research design should be chosen according to the aspirations and issues to be answered through the most appropriate academic methodology for the study.

Whilst there are many different types and classifications of research design, three will be addressed in this study: exploratory, descriptive, and explanatory.

3.3.1 Exploratory

Usually, an exploratory design should be conducted in scenarios offering difficulties for obtaining satisfactory information for the progress of the research. Sekaran and Bougie (2016) assume that this may happen in cases where there is no in-depth comprehension of the problem, when studies are not transparent or show insufficient results or demonstrate limitations and complexity, and when there are not enough frameworks available supporting the research.

This type of study is also characterized by guiding researchers to develop comprehension "about a new or under-researched topic or

approach the topic from a different perspective to generate new and emerging insights" (Leavy, 2017, p.5).

3.3.2 Descriptive

This category analyses a scenario based on what already exists, and there is no intention to propose any change or confrontation on what is being studied (Leedy and Ormrod, 2015). As its name implies, this nature of research characterizes a specific situation in a specific time (Kothari, 2004).

There are also approaches denominating correlational studies, in which researchers wish to understand and discuss the connection between two different variables (Sekaran and Bougie, 2016).

So, descriptive design is pointed out as a suitable alternative when there is the pursuit of understanding characteristics under specific conditions and provide information and data to serve as a basis for other studies.

3.3.3 Explanatory

When researchers wish to study the cause and effect of an event, the explanatory study may be the most pertinent (Leavy, 2017), since it seeks to explain the reasons and in what way some elements are related in a specific event (Kumar, 2011).

The main difference between descriptive and explanatory research is that while the first one is focused on exposure of a detailed presentation of a phenomenon; the explanatory study has an extensive proposal and looks beyond describing tasks. Explanatory research attempts to examine and explain the origins of an event and "confronts head-on the challenges and difficulties of establishing casual order and connections" (Ruane, 2005, p.13).

From the research design perspective, this study is conducted through an explanatory approach, since "the emphasis here is on studying a situation or a problem in order to explain the relationship between

variables" (Saunders, Lewis and Thornhill, 2009, p.140). Although the commitment of top management is widely acknowledged as one of the most influential factors for a well-structured implementation of TPM, the author intends to investigate whether managers are conscious about the correlation between their engagement and the success of the methodology.

Nevertheless, the research can also introduce some elements of exploratory design, as it tries to explore the TPM challenges and to understand the importance of the involvement of managers to promote the change of organizational culture.

3.4 Data collection

The researcher also needed to plan how the project was carried out and, to do so, it was necessary to understand the background to expand the knowledge and then, to identify other studies that may encourage the development of the research (Dawson, 2002).

3.4.1 Primary data

Primary data collection refers to the data used for research that come directly from original sources that will serve to help the achievement of the proposals of specific studies (Sekaran and Bougie, 2016).

Dawson (2002) illustrates that these data can be obtained from the experiments and observations from the researcher or information provided by other people. Several methods enable the collection of this data, such as observation, interviews, questionnaires, among others (Kothari, 2004).

Thence, primary data are collected by those responsible for the project, to answer the research questions and consequently serve as sources for conclusions and future work.

Normally, primary data are “the most valid, the most illuminating, the most truth-manifesting” (Leedy and Ormrod, 2015, p.94).

3.4.2 Secondary data

Secondary data encompasses information taken from other work, and before being used for any purpose, its veracity needs to be carefully analysed (Sekaran and Bougie, 2016). The more different sources reproduce the same type of information, the more likely it is that these data portray reality (Kothari, 2004).

Although using secondary data reduces the time to gather information, using them may not be the best option when they do not provide answers to the research questions, once the variables and conditions analysed are generally not the same (Boslaugh, 2007).

Both types of data were used on this paper, the primary data being the most representative to achieve the responses to the problems that motivated this research. On the other hand, secondary data were used to support the literature review and methodology, being very useful to present the overview of the themes and to define the most suitable research process.

3.5 Research philosophy

Saunders *et al*. (2009) articulate that research philosophy expresses the format in which knowledge will be built within a specific area since they present different presumptions about how researchers perceive their surroundings. The authors also declare that these different perspectives will sustain the research strategies chosen by the researcher.

Several parameters contribute to structure the research philosophy and they work as guidelines such as “beliefs about nature of social work, what can be known about social life, how research should proceed, who can be a knower, what kind of knowledge is valued, and how we come to know” (Leavy, 2017, p.11).

It is important to emphasize that there is no better or worse philosophy. What exists is the most adequate to reflect on each type of

research question, and that will bring better benefits to the study (Saunders *et al.*, 2009).

Although those concepts are important to guide the studies, Mkansi and Acheampong (2012) discuss that the existence of many classifications for research philosophy does not mean that they are the opposite. They present similarities when compared, however, the results of these assumptions are different, and they can generate doubts and indecisiveness in conducting research.

3.5.1 Ontology

Ontology refers to studies that consider the beliefs about the environment in which we surround ourselves as motivating possible findings (Sekaran and Bougie, 2016). For Saunders *et al*. (2009), the studies within this category raise questions about the functioning of the elements that are within the reality of the researcher.

Ontology covers two categories called objectivism and subjectivism. Whereas objectivism encompasses “the position that social entities exist in reality external to social actors concerned with their existence” (Saunders *et al*., 2009, p.109); subjectivism “holds that social phenomena are created from the perceptions and consequent actions of those social actors concerned with their existence” (Saunders *et al*., 2009, p.109).

3.5.2 Epistemology

Epistemology comprises questions about the origins and motivation of knowledge or how people perceive this knowledge (Sekaran and Bougie, 2016). In other words, it is “the issue of how we know the world around us or what makes a claim about it true” and “includes what we need to do to produce knowledge and what scientific knowledge looks like once we have produce it” (Neuman, 2014, p.95). That is, when this approach is applied, researchers are interested in understanding how the knowledge was produced.

This philosophy is divided into subcategories, such as positivism, realism, and interpretivism. A research is defined as positivist when is conducted as a way to find the truth and only through it, it is possible to understand reality in detail (Sekaran and Bougie, 2016). Realism is similar to positivism due to the need to develop scientific research to elaborate the knowledge, although it considers the senses as a way to demonstrate what is true (Saunders *et al.*, 2009). Finally, interpretivism includes that "it is necessary for the researcher to understand differences between humans in our role as social actors," that is, in this category researchers need to adopt a more empathic posture and visualize reality under the perception of other elements (Saunders *et al.*, 2009).

From a broad perspective, the research presents characteristics referring to the interpretivism paradigm, because the study investigates the subjective experiences and thoughts of the participants to understand their perspectives and how they impact on the phenomenon being studied.

3.6 Research methodology

Methodology can be defined as “the way which we approach problems and seek answers” (Taylor, Bodgan and DeVault, 2016, p.3). Therefore, applying this definition to the scientific research context, methodology comprehends elements that guide research. Due to the correlation between data and methodology, Leedy and Ormrod (2015) recommend that the methodology selected should always reflect on the origin of the data used to create a study able to answer the research questions.

The literature suggests two different methodology approaches to conduct scientific research: qualitative and quantitative. As analysed by Leedy and Ormrod (2015), although both have similar processes, such as the definition of the research question, literature review, collection, and analysis of information, they present particularities regarding the data.

3.6.1 Qualitative

This methodology configures the analysis of “descriptive data” (Taylor *et al.*, 2016, p.4) or “data in the form of words” (Sekaran and Bougie, 2016,

p.2) and “is about immersing oneself in a scene and trying to make sense of it” (Tracy, 2013, p.3).

Generally, the qualitative approach is used in studies that focus on understanding events that represent reality, and often they concentrate on explaining the complexity of these scenarios (Leedy and Ormrod, 2015).

Therefore, this methodology is motivated by the need to translate different thoughts and perceptions that people have on a given subject.

3.6.2 Quantitative

Quantitative methodology, meanwhile, focuses on investigating the elements of various scenarios by correlating them with quantitative factors (Novikov and Novikov, 2013) and uses mathematical and statistical theories to convert data into numerical information (Tracy, 2013), which means that "measurement is a distinct step in research process that occurs prior to data collection" (Neuman, 2014, p.203).

As this methodology is supported by statistical tools, it is recommended the use of techniques that allow a more extensive sample to achieve a larger representation (Taylor *et al.*, 2016).

Compared to qualitative, quantitative research tends to be “specific, well structured, have been tested for their validity and reliability, and can be explicitly defined and recognised”, whereas qualitative has a less accurate structure (Kumar, 2011, p. 117).

3.6.3 Mixed

Scientific research is not limited and can adopt qualitative and quantitative in the same study to find more complete results (Biggam, 2008). The union of the positive points of both methodologies (Williams, 2007) provides an enrichment of the quality of the research, especially when they complement each other by reaffirming the analyses found (Cooper and Schindler, 2014).

Mixed methodology is increasingly being used among academic papers. Cameron and Molina-Azorin (2011) show which methodology is mostly used in different areas of study and, although the quantitative method is the most representative, data indicates that mixed methods have been performing an important role in the development of studies.

Although it adds more value, this methodology requires more time and resources from the researcher. Therefore, there must be a deep reflection before adopting this strategy.

3.7 Choice of the methodology to be adopted

The issues to be investigated focus on understanding the link between the level of managerial engagement and the effectiveness of TPM as organizational culture; verifying whether managers have knowledge about the philosophy and the biggest challenges that TPM offers; identifying whether managers feel responsible for the success/failure of the methodology and if they attribute the results to other factors. It is worth noting that all questions take into consideration the managerial point of view.

The qualitative methodology was considered the most suitable for this research, as it requires deeper and subjective access through the perceptions and insights of people in leadership positions. Furthermore, there is a contextualization of personal experiences, thoughts, and feelings, and the qualitative approach proves to be more harmonious for the analysis of this data. This research methodology assured that the research questioning is not being explored from one perspective only, but from multiple points of view, which allows the phenomenon to be analysed in depth.

Quantitative methodology was not considered because the data collected would not represent the best alternative to answer the research questions. Also, it "usually requires a large sample size sometimes several thousand households" (Choy, 2014, p.102). As the profile of participants for data capture is restricted, it would be difficult to reach a representative sample size.

The data collection method was through interviews, as they offer “in-depth information pertaining to participants’ experiences and viewpoints of a particular topic” (Turner, 2010, p.754). It was decided to use semi structured interview with questions based on previous works with similar approaches. This sort of interview is “guided by a list of questions or issues to be explored, and neither the exact wording nor the order of the questions is determined ahead of time” (Merriam, 2009, p.90). This structure was considered the most appropriate to gather the information, to compare the participants' answers, but at the same time, to allow approaching new subjects in case it was necessary.

By adopting the semi-structured interview, the researcher included new points if she thought they would be convenient to clarify some aspects, as well as discarding others if they already had been answered throughout the conversation. It avoided repetition of topics, giving the interviewees opportunities to explore the subject further.

Also, the access to potential interviewees was hampered by the COVID-19 pandemic scenario when many people were not working, making it difficult to conduct in-person interviews. Therefore, the collection of information was carried out remotely, using electronic channels.

To conduct the interviews, the participants were selected based on some characteristics. They needed to have held management positions, such as directors, managers, coordinators, and pillar members, and to have participated in TPM-related practices.

The research did not have a limited scenario, which means that all the information gathered was considered, regardless of country, type, and size of the industry. It was not considered for how long the company applies TPM and there was also no restriction on gender, age, ethnicity, qualification, or background.

The sampling method adopted was nonprobability, which “the probability of selecting population elements is unknown” (Cooper and Schindler, 2014, p.358). The use of the judgment sampling technique

allowed the researcher to apply her discernment and common sense (Saunders, et al., 2009) to choose the sample based on previously defined factors (Cooper and Schindler, 2014). The sample size was five people, and although the participants were not identified by names, letters were used to reference them.

A pilot test was conducted before the interviews. Cooper and Schindler (2014) declare that a pilot test should take place to identify the fragilities of the research process by simulating the scenario to apply the chosen method. The pilot is a powerful strategy to build an interview that adds value to the research, because it is through tests that potential deficiencies are identified, for instance, if the question is clear or if it provides information that will be useful, also the recommendations given by respondents (Merriam, 2009).

The main objective of pilot testing is not limited to checking whether there is clarity about the questions but also to identify the potential problems, and actions were executed to reduce the impact and probability of any issues during the interviews.

A problem identified during the pilot was the recording of the interview. However, the researcher managed that situation with a voice recorder app as an alternative and ensured that the same issue could not repeat for the next interviews.

Regarding the questions, the interviewee was able to understand all the questions satisfactorily. Only one question was excluded from the interviews to avoid repetition, since it had already been covered in previous answers.

3.8 Data collection process

The questions were previously structured (see Appendix C) and followed a pre-defined script, discussing the points considered necessary. The most appropriate format was the semi-structured interview, and, from

the researcher perspective, it allowed the interview to be conducted more logically since questions could be added or deleted any time.

It also allowed a flexible, dynamic, and relaxed moment, providing an enjoyable environment where the researcher could “slowly build confidence and trust with the interviewee” (Jacob and Furgerson, 2012, p.4). Also, it is significant “building rapport and establishing comfortable interactions in the qualitative interview situation” (McGrath *et al*., 2019, p.1003), so that the participants could express their impression about the subject.

The process of capturing potential participants was carried out through LinkedIn. The choice of respondents was based on two criteria: professionals who have experience with the TPM and perform leadership roles.

They were contacted by message and, upon demonstrating interest, the researcher sent an invitation email (see Appendix A) explaining the purpose of the research with the consent form (see Appendix B) containing details about data confidentiality. After the interviewee answered the form with his/her authorization, the interview was scheduled according to the participant's availability.

Before starting the interview, the researcher ensured that the information in the consent form was briefly repeated and only after the validation of the participant, the interview started. After finishing the questions, the interviewer ended the recording appreciating the participation of the interviewee.

Although the interviews were conducted online, the interaction between researcher and interviewee was casual, and all participants were comfortable with the questions. None of them refused to provide any information, offering detailed and better-quality data, further enriching the data collected.

The dialogues were transcribed and stored with the recorded file and the signed consent form, each folder referring to each participant. In some

cases, when the participant's native language was Portuguese or Spanish, they had to be translated to English, being the original transcribed file also preserved.

3.9 Limitations and potential problems

Even though scientific research is essential to understand specific phenomena, it is not possible to contemplate all the likely scenarios and elements, no matter how in-depth the study may be, and therefore has limitations that may compromise the results. Thus, the researcher must be aware of the restricted points and present them “with complete frankness” (Cooper and Schindler, 2014, p.17) before any reader can question the authenticity of the research (Vanderstoep and Johnston, 2009).

The first point to be considered is about the subjects approached in the literature review. Because the issues about the management role, leadership, and organizational culture are extensive and can be addressed in various ways, due to time and length constraints, the author thought it would be prudent to merge these themes into a single topic in the literature review.

Another element regards to the qualitative method. Being more flexible, the veracity of the data obtained with this format is constantly questioned by the scientific community because it is evaluated “as biased, small scale, anecdotal, and/or lacking rigor” (Anderson, 2010, p.2).

Although it is still possible to find many papers contesting its validity, the qualitative method can present strengths and an ideal format for "intuitive understandings of a culture" (Tracy, 2013, p.5). Also, it offers opportunities to study data in a way that is not approached with the quantitative method, through research or experiments (Tracy, 2013).

The use of interviews also presents some disadvantages, as pointed out by Taylor *et al*. (2016); the fact is, it cannot be ensured that what the interviewees report is necessarily what they truly believe, because

“participants do not always state the truth and may say what they think the interviewer wishes to hear” (Anderson, 2010, p.5).

The sample is also considered a limitation, which, according to Trotter (2012), is a subject that is still widely discussed, since there is no evident definition for the ideal sample size in studies applying qualitative design, because “it always depends on the questions being asked, the data being gathered, the analysis in progress, the resources you have to support the study” (Merriam, 2009, p.80).

The sample is restricted due to the narrow profile of the participants. Moreover, the time constraint is another factor that contributes to the sample size not being so expressive, since interviews consume more time of data analysis.

The cultural element and the industry in which the participants work are also factors that may impact the results. As highlighted by Sekaran and Bougie (2016, p.103), “individuals do not have the same characteristics as groups and there are variations in the perceptions, attitudes, and behaviours of people in different cultures”. Therefore, cultural differences, both country and organizational cultures can influence how people develop activities, daily routines, ways of thinking, and acting.

There is no requirement for age as well as the time of professional experience, which may represent a limitation since there is a likelihood that people who have more contact with TPM have more knowledge of the methodology and therefore have more mature views.

Although the elements described above may represent limitations, the researcher recognized them and made them clear to the readers, “so that the audience is not misled” (Sekaran and Bougie, 2016, p.365) and do not underestimate their importance.

Apart from discussing potential problems, the researcher sees them as opportunities for future works and considers the data contained in this paper as sources that will help to enrich future scientific research.

3.10 Ethical considerations

Researchers need to be aware of issues that may compromise any study ethically and responsibly. Therefore, it is necessary to define the ethical considerations that were taken into account during the research.

For Brown (2006), the questions to be used as a data collection should be structured as not representing a hazard or intimidation to the respondents or breaching their beliefs or integrity. Although there is a variety of factors to be ethically considered during the research process, such as "attention to human rights, data collection, data analysis and interpretation, respect for the research site, writing and disseminating the research" (Roberts, 2010, p.31), the variables to be analysed depend on the researcher and the institution.

Important topics to be addressed in any study are the agreement of people who have participated in sharing information, regardless of the method chosen to conduct the research, and the approval of the study proposal by the review board of the institution to which the researcher belongs (Connelly, 2014).

National College of Ireland - NCI provides the Ethical Guidelines and Procedures for Research involving Human Participants, a document that describes the principles required by the institution and orients researchers in conducting research that does not represent risks or affect human rights.

For this study, the participants are not vulnerable as described by NCI (2017), which includes children, older people or those with any kind of special need, people who have any connection with the researcher, or people who are not able to understand the research.

Also, no risks that could compromise the well-being, integrity, or present any sort of inconvenience to the participants, either physically or emotionally, were identified. The ethics form was filled out and submitted with the dissertation proposal for the approval of the Ethics Committee of the institution.

Besides, a consent form based on the document of The University of Edinburgh - School of GeoSiences (2013) was sent to all participants to get their authorization to use their information. This form (see Appendix B) explains the objectives of the study, clarifies doubts, and informs them that the data provided by them would be approached anonymously.

Therefore, the points described above were adopted to avoid any issues that eventually might affect the integrity of the participants and ensure that the principles required by NCI were complied with, such as respect for people, protection for the welfare of participants and a sense of ethics and justice (National College of Ireland, 2017).

3.11 Chapter summary

Chapter 3 has explained the reasons for choosing the most appropriate methodology. Furthermore, the data collection process is detailed, alongside the limitations and potential problems found during the study. It also explains the procedures to ensure that the research was elaborated ethically, following the principles required by the institution to which the researcher belongs.

4 CHAPTER 4: ANALYSIS, FINDINGS, AND DISCUSSIONS

4.1 Introduction

Chapter 4 explores the data analysis process. It presents the data obtained through interviews and is divided into subtopics corresponding to the themes defined through the coding of qualitative data. Then, the results are discussed to answer the research questions and correlate them with the literature review presented at the start of the paper.

4.2 Data analysis process

The data analysis process means "to organize, integrate, and examine" (Neuman, 2014, p.477), and the main objective is to assess whether there are standards in the data found and correlations between particular elements. It requires focused work and “it is the most complex and mysterious of all the phases of a qualitative project” (Thorne, 2000, p.68). It is perhaps the most crucial stage of the research because there is no purpose in collecting diverse information if it will not be properly analysed.

Currently there are several software alternatives that support the analysis of qualitative data. Although they are useful to assist in organizing and classifying, Thorne (2000) makes it clear that they are not intellectually effective in replacing the role of the researcher, who is responsible for developing new knowledge by understanding this data.

The first stage of analysis was to transcribe the interviews. It is important to note that "whether it is done manually or electronically, data screening is an essential process in ensuring that data are accurate and complete" (Marczyk *et al*., 2005, p.201).

Even though a specific software was used for this purpose, it was an activity that took considerable time. Also, some interviews had to be translated into English, and great attention was required so that the thoughts expressed in the native language of the interviewee were consistently retained in English.

Aiming to narrow down and detail the analysis, the author decided to adopt the coding process, which "involves taking text data or pictures gathered during data collection, segmenting sentences or images into categories, and labelling those categories with a term" (Creswell, 2009, p.186).

Even though the author searched software programs for coding qualitative data and considered using them to aid in the analysis process, she realized that learning how the software operates would require more time and due to its limitation, it was more convenient to adopt a simplified method, by using Microsoft Excel.

After coding, the author divided the most repeated information and grouped them into themes, which will be used to organize the findings. The themes are:

- Background and work environment
- TPM implementation
- Organizational culture
- Results of TPM
- People management
- Support from senior management

4.3 Background and work environment

This topic explored a general view of the interviewee's background, such as position and responsibilities, type of industry, amount of experience with TPM, and issues related to the work environment. The idea was to provide him/her with an opportunity to introduce their experience.

There is a large variation of the time working with TPM, varying between 4 and 25 years, it means that some have more experience than others.

"*My position is as maintenance manager […] I've been working with the company for 35 years […] We're in the dairy food manufacturing industry*

and we're probably the biggest in Ireland. […] TPM has been here on different forms and different initiatives since 1995". (Interviewee A)

"*I am site manager […] I've been working for 21 years. […] The industry is a chemical industry. […] The factory is currently located in Santiago, Chile. […] The company started working with TPM in 1997"*. (Interviewee B)

"*I'm holding manufacturing manager position […] I've been working for 12 years and it's a soft drink company. […] The site I am working at today is in Fortaleza, Brazil […] TPM has been applied for about 4 or 5 years now inside the industrial area."* (Interviewee C)

"*I am the manager of one of productive cells. […] I've been working there for 13 years and I've been connected directly to TPM for 4 years. […] The company is located in the south of Minas Gerais, Brazil and it is a food industry. Nowadays it is leader in the dairy market."* (Interviewee D)

"*I am director of Company X, […] producing the whole portfolio of soft drinks, water, and juices. […] I have experience of 13 years with TPM."* (Interviewee E)

4.4 TPM implementation

The participants' understanding of TPM is, in general, quite detailed. They think that the methodology allows 'new ways' of managing activities and requires a great 'flexibility to adapt', especially the idea that it is a 'process of continuous improvement', which means that there is not a beginning nor an ending but a change in the routine of the industry.

"TPM is the way to manage the factory. […] I think, as the definition explains, a process of continuous improvement. […] It's an elementary program for industries to improve their production processes […] And the good thing about TPM is that you can implement it in a small, medium or large company. There is that flexibility to adapt to the type of industry and the size of the industry." (Interviewee B)

"It's a methodology that helps to build standards to be followed, to make optimizations, and especially to change people." (Interviewee D)

Most respondents consider that the implementation of TPM is a success in their companies and it has brought both measurable and immeasurable results for the organization. However, some interviewees claim that there were failures in the past, especially because 'senior management didn't really buy into it' and 'top management did not give value' or 'because our culture is really difficult'. But after understanding what was done wrong, the process was redone and achieved good results.

"But unfortunately, because it was a craft initiative at the time, senior management didn't really buy into it. […] So that's where the problem really. So as a result of that, as you can imagine, it's just never going to work. So it fizzled out for a while. […] it is very difficult second time around because I only mentioned TPM again. You can imagine frustration people felt […] So that's we overcame that through communication and through a proper communication and this was a new way of doing our business." (Interviewee A)

"*The question that the operator always ask is: 'what are we going to do this time? What will it be different?' We have to show that the operators are the main point to the TPM to the company keep strong within the market. […] Today we are experiencing a wave of success, but we have failed twice before. But again, because our culture is difficult and because top management did not give value that should have given."* (Interviewee D)

It is important to note that in both cases described above, the lack of commitment and support from the senior management team is pointed as one of the reasons for the frustrated attempts of implementation.

The program structure was an element that presented different opinions. While some participants stated that the methodology is 'simple' and it was important that they 'followed the methodology according the books', others understand that sometimes the theory is 'very bureaucratic' and needs to be adapted and simplified.

"I think if you can follow the methodology according to what they say in the books and you have discipline, because as a Japanese program, you have to have discipline. If you have this, you'll get the results very quickly." (Interviewee B)

"*I like how the program goes, I just don't follow it very strictly, the Japanese, you know? […] I guess the secret of TPM is being simple. […] I think it's a methodology that is sometimes very closed, you know? […] I don't think it can have this barrier, of wanting to do just by the book. I think it is a weakness if everything has to be black and white."* (Interviewee C)

"[…] *the challenge for the manager and for the operator is to understand that if you follow the steps in maturation time, the result will come."* (Interviewee D)

"*I think the main weakness that's not from TPM, but it is the way it is used, it can be very bureaucratic and instead of helping, it can get in the way a lot […] for each reality, you have to apply methodology, I believe a lot in that, it cannot be a linear and standardized thing."* (Interviewee E)

4.5 Organizational culture

Themes approaching behaviour changes, culture, ways of thinking, and transformation of people were widely cited during the interviews.

"*I would say a development of attitude, a change of attitude, a change of mindset. A complete turnaround from just waiting for things to happen. […] That's you can never take that away. And the culture shift has been through TPM."* (Interviewee A)

"*I believe that in the beginning it is a very drastic change of culture"* (Interviewee D)

"*It is something that involves change of culture, a change in the way you do things."* (Interviewee E)

Also, as any process of change, all the participants expressed how challenging TPM is, especially concerning the 'resistance of people' towards the adherence of the new routines and activities suggested by the program.

"[…] you'll have groups who are totally against change. In that environment, the leadership within that group is most important." (Interviewee A)

"The human being by nature is resistant to change. So you have to know how, it is one of the skills of managers, how you can fight that resistance.[…] It needs work, to demonstrate that the program is good, that you will see the results. It's a step-by-step path." (Interviewee B)

4.6 Results of TPM

Many benefits offered by TPM were cited in all interviews, confirming that the Japanese methodology is, indeed, a good strategy for achieving competitive advantage. The various strengths are associated with the process of seeking 'continuous improvement' and, through the development of 'standards', processes are optimized, and consequently, organizations achieve better results.

"*And an interesting way to achieve greater results, much greater results than you would ever dream of. […] TPM is achieving a set of goals through small team activity, the cross functional, to adapt to new ways, new methods of solving problems and using new techniques to solve issues."* (Interviewee A)

"*My vision of TPM is, I think, as the definition explains, a process of continuous improvement. […] I remember the average operational efficiency in our pilot line was between 40 and 45%. Today our lines are all over 70%, 80%, the same line."* (Interviewee B)

"It's a methodology that helps to build standards to be followed, to make optimizations, and especially to change people. Because when you change people, you change the environment and you change results. […] We had an average of 40 breakdowns per month. Nowadays we can work

with a scenario between 3 and 10 breakdowns, that's money that we can convert in improvements. […] And certainly, if I've had a breakdown, I'll increase the price of the product. Because I will have to replace something in the machine, I have to clean, so I put more cost on that product. Soon this product will become more expensive in the market. So every time we start to work in a preventive way effectively giving emphasis to TPM, mainly autonomous maintenance, we start to have cheaper cost of the product produced, soon the profit margin of the company will increase." (Interviewee D)

"[…] for each $1 invested, we have $12 return. That's what I want to show, that we can make money, develop people, have a methodological environment that we work systematically, not randomly or by demands, but in an organized way and that it is profitable and sustainable." (Interviewee E)

A highlighted aspect among all interviewees was the 'communication of the results' as a crucial practice to generate a sense of belonging. That means it is essential that employees feel they are owners in the program. Thus, everyone needs to be in alignment with the results and achievement of goals during the TPM implementation.

"[…] we overcame that through communication and through a proper communication and this was a new way of doing our business. […] You have to communicate; you have to constantly remind people that this is the way to go." (Interviewee A)

"*[…] we show the result of the line to the rest of the factory. Whoever gets the best efficiencies, whoever gets the most kaizen in the line, that's very cool. Basically, showing the result and doing some recognition."* (Interviewee B)

"*We gather all the people from all shifts at the start of the shift and we inform them the status of this progression of the process."* (Interviewee D)

Moreover, about results, antagonistic opinions were identified regarding the time needed to see the first results. While some participants consider that the benefits are quickly encountered, others think that one of the weaknesses of the methodology is the slowness to achieve the benefits.

"*If you have this, you'll get the results very quickly. In 1 year, 2 years, you can already see results in terms of factory efficiency. That converts to productivity and you have more product available within the market. So it is a quick result."* (Interviewee B)

"[…] *culture naturally takes 3 to 5 years to be changed. He won't get the result they expect a month later. And the operator has to have patience in seeing the results happening, because it's not like that, I started to follow the methodology, the result comes? No."* (Interviewee D)

4.7 People management

People management factor was cited in many ways. The participants affirmed that TPM is, indeed, a philosophy that requires the involvement and 'engagement of people' for the development of a work environment where there is strong unity and 'teamwork' in search of better results. For this, the management team must have skills to motivate people to participate in the process of continuous improvement.

"If you look at the work environment and look at team working, to me, TPM is team working." (Interviewee A)

"The main challenge is the engagement of people and to convince everyone to do TPM. […] So the challenge is to engage all people and it is not easy. It's not in only one day that I'm going to implement TPM and have everything working perfectly. It needs work, to demonstrate that the program is good, that you will see the results. It's a step-by-step path." (Interviewee B)

"[…] *the manager has to influence his team and encourage them to be part of any pillar and to be engaged on the process."* (Interviewee C)

"*This is the main tool of TPM, it's people engaged […] We can replace the equipment, however when people are not engaged, we do not have another alternative."* (Interviewee D)

"[…] *you have to motivate, recognize people and it's not just about prizes, it is listening and being enchanted by what the operator is talking about and doing"* (Interviewee E)

Another element that was mentioned was the education and dissemination of knowledge that TPM methodology requires. It is through training that people have access to the right information of the program and understand how they can help to mature the organizational culture. Some respondents also stated that 'TPM transforms people', and the knowledge acquired is not only limited to the professional scenario but can also bring personal gains.

"T*hat's all about information, that's the key to keeping a go on making it roll along nicely. […] you need to have the knowledge of the local people who operate machinery, who operate plant because their voice is critical to the process."* (Interviewee A)

"Another strength for me is the training of people, the development of people. It can do something that you never thought you could do. When you give the tools, the training, the knowledge, you stimulate more creativity and they can do incredible things with the machines. […] And then you have to convince him that you are going to teach him, you have to train him about more technical knowledge and then, with this knowledge, he will not only be able to work at this machine, but he will also be able to work in another area, in other lines of the plant, in another process. Or if he wants to leave the company, he will be trained to have another skilled job at another company." (Interviewee B)

"[…] it is a methodology that when well applied, it's transformative. It develops people, indeed. People change and grow up with the methodology. […] it brings a transformative personal and professional development in people." (Interviewee E)

4.8 Support from senior management

The support and engagement of the management team and board of directors was a common opinion as an essential factor for the success of TPM. Also, participants emphasized the importance of being a 'top-down program', which means that the decision to implement the methodology must come from people at higher organizational levels and then spread to other levels. Some respondents also stated the lack of commitment from those people as one of the reasons for the previous failures of implementation of the methodology.

"So there was a massive buy in from senior management. They wanted. They knew and the information was there from of all that. […] it has to be top-down. They have to buy into it and seriously" (Interviewee A)

"*I think it's a top-down program. For all this to happen, it has to have a strong commitment from the front line of the organization. In order to get resources and support for implementation on the factory."* (Interviewee B)

"*They must participate in the whole process. The commitment of directors is essential for the success of the program. If he doesn't believe, the operational team won't, so he is essential."* (Interviewee C)

"*I believe that managers and directors are the examples. If the guy can't promote this idea in the company and he doesn't take it seriously, it won't really happen. […] So the engagement and the sponsorship in this situation has to be total, they have to believe that it really works and when the operator have asked for improvement or help, they can't put barriers, they have to try to build bridges and not barriers.*" (Interviewee D)

"*First, you have to have a high-management commitment. If the director, if the area manager does not believe, the thing will not happen.* […] *for all the experience I have, I tell you with all certainty that if TPM does not come as a policy from the high corporation, if it does not come as a very strong guideline and with the very strong support of the senior management*

of the company, it will have a very large possibility of failure." (Interviewee E)

Interviewees also gave managers and directors the responsibility for implementing the TPM. Although activities are performed at the operational level, TPM must be part of the routine of all employees. It is the responsibility of the directors, managers, and leaders to educate, to motivate, to support, to 'sponsor', to offer investments whenever necessary, and to ensure that the methodology is being effectively accomplished.

"*From the conceptual point of view the responsible is the number 1 of the organization, he is responsible for implementing the TPM. It has to be the plant manager, he has to be responsible for giving the resource, support, everything for the implementation, so the thing can happen. […] Many people say that the TPM manager or the TPM coordinator is the person in charge of the TPM. No. He is responsible for organizing the implementation, but the person responsible for making it happen is the number 1 of the plant."* (Interviewee B)

"[…] *the cell managers are responsible. The most focused management, micro-management, is the cell owner and the support team. The director of the plant is the sponsor, the guy who sometimes makes the money available or helps to solve issues that are not in our hands. But the basic part, methodology and engagement, that manager of the cells." (Interviewee D)*

"I am the responsible and the guardian of the methodology. […] here the methodology has the support from senior management, but the responsibility of implementation, as industrial director, is mine." (Interviewee E)

4.9 Limitations of findings

As mentioned before, the sample size used for the research is small and represents a potential source of bias. Eventually, if there were more participants, the reliability would be higher. Nevertheless, although this is

considered a limitation, it can be said that, fortunately, all the interviews were longer than expected. It allowed the collection of data full of details, and therefore, data were generated for the study in considerable depth, as can be seen through the quotes presented.

4.10 Chapter summary

Chapter four provides the data collected through the interviews conducted. After analysing the qualitative data through coding, the author identified the main themes and grouped them into six categories to organize the presentation of the data. It is important to note that due to the limited size of the study, some themes had to be disregarded.

5 CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Chapter 5 will discuss the results presented in the previous section, making a comparative analysis between the data collected in the interviews and the literature. Also, the chapter contains recommendations for future research, and the author will discuss her opinions and lessons learned throughout the study process.

5.2 Discussion of findings

5.2.1 Background and work environment

The beginning of the interviews was based on general questions about the background of the interviewees. Although they are not critical information for the investigation, they were essential for two main reasons.

First, to understand the participants' positions. Since the research is focused on a managerial perspective, the respondents must be part of a specific group of people of leadership positions. Among the five interviewees, four of them are managers, and one is director. Besides, these questions brought an overview of their professional experiences with TPM. It was identified that all participants have a good background, which guaranteed rich interviews.

Secondly, being the first contact between interviewer and interviewee, the opening questions created a relaxed environment so that both felt free to conduct the interview, because "the romantic view sees research interviews as a human encounter, encouraging the interviewees to reveal their authentic experiences by establishing rapport, trust and commitment between the interviewer and interviewee" (Qu and Dumay, 2011, p.242).

5.2.2 TPM implementation

When discussing TPM, most of the interviewees referred to the methodology as a process of continuous improvement which allows the management of the business in new forms, in addition to provide flexibility,

so that the activities can be optimized according to the reality of each organization. As described by Digalwar and Nayagam (2014), it is a continuous improvement practice that develops through the operators and leadership of the production lines the feeling of belonging, in such a way that the human resources become more qualified by working closely together.

The change proposed by the methodology allows the achievement of better results, bringing companies to higher levels, representing a differential within the market. Indeed, Gisi (2018) affirms that continuous improvement is within the mentality of the people, and it is fundamental to increase productivity and to build a more efficient team.

Some situations were also reported of companies that tried to implement the TPM, but mainly due to lack of support from the management team, the methodology did not obtain the expected results and failed. The experiences described by the participants confirm that they understand the importance of engagement and commitment of the senior management team from the beginning making decisions of adopting a new organizational culture, through implementation and daily supporting and recognizing the results. Protzman *et al.* (2019) emphasize that TPM should be a policy that reaches all organizational levels and although it involves all employees, it must be on the responsibility of the senior leadership members, including directors.

The participants also explained that in situations like these it is even more difficult to have the support of people in case they try to implement TPM again and one of the biggest challenges faced by them is to define the new way of approaching employees and try to convince them TPM really brings results and, even though it failed in the past, it is worth try to implement again. Therefore, large communication and an open posture are needed, besides the skills that the management team use to motivate their workers.

5.2.3 Organizational Culture

TPM makes people change some perceptions, especially concerning how to solve problems and knowledge dissemination. Basically, TPM preaches that the operator must, through cleaning and inspection activities, identify possible failures, and notify the maintenance team in advance of the equipment breakdown. With this, operational efficiency is increased, and the operator is no longer a slave to the machine and has more available time to implement improvements and new ideas.

However, TPM goes far beyond and involves changing behaviour and consequently changing culture and mentality. Therefore, “the main challenge for an organisation is to be able to make radical transformation to its culture for ensuring overall employee participation towards maintenance performance improvement through TPM initiatives” (Elgharib, 2014, p.34).

The interviewees discussed culture change as a fundamental element for the success of TPM and, consequently, the challenge faced due to resistance. All of them reported difficulties with people who do not believe in the benefits of the methodology or do not engage enough to implement the program.

5.2.4 Results of TPM

Participants reported that the TPM results go far beyond increasing the efficiency of equipment. Indeed, the methodology can be a great strategy to overcome financial, technological, and organizational climate problems, since it can enhance “productivity, quality cost, operation technique, moral of employee and operation safety” (Habidin *et al*., 2018, p.1855).

Another finding was the communication between the leadership and the operational teams. The interviewees commented on the importance of maintaining an efficient communication channel, always informing the results achieved, and sharing knowledge to make everyone feel that they are part of the process and that they are the focus of the work. Andersson *et al.* (2015) confirm that the absence of communication can be considered

a potential barrier to motivate employees and that meetings are fundamental to spread awareness and expertise on the philosophy.

The time needed for seeing the first result of TPM was a contradictory point among the interviewees. While some stated that the methodology brings results quickly, others reported that one of the weaknesses of TPM is that it takes a long time, between 3 and 5 years to change the culture, which can represent a barrier, since organizations need faster responses to problems. The different points of view about time are intriguing results, although, it is essential to highlight that “any cultural change which takes pace is an option of long-term improvement” (Pospecu *et al*., 2013, p.135).

5.2.5 People management

Engaging people was pointed out as one of the biggest challenges faced in the TPM implementation because this requires strong leaders with specific attributes to be able to, at the same time, motivate and educate employees to avoid resistance to change and to embrace the process of culture change. As presented by Elgharib (2014, p.61), “the top management has to make concerted efforts to enhance motivation within the organisation by creating awareness about the true potential of the TPM philosophy”.

Still, on the development of people, training was mentioned as the main point of dissemination of knowledge, and they play a fundamental role in the process of changing people's mentality. Munir *et al.* (2019) also point out that the positive result of TPM is linked to the performance of productive employees and training, not only technical education but also behavioural knowledge, is a powerful tool for transformation and the best method to develop skilled employees.

5.2.6 Support from senior management

Finally, the support of the management team was a factor widely referred throughout the interviews and all participants recognized it as the most important element for the success of the methodology, many stating

that the lack of a committed leadership certainly results in a program that cannot be sustained for a long time.

In most of the studies used as a basis for this research, senior management support is predominantly mentioned, which further reinforces the importance of these roles for the program survival.

Hence, this theme encompasses the main motivator of the study and clearly answers the overall research question, which seeks to understand, how important the commitment and engagement of the senior management team is for the successful implementation of TPM. The participants understand that they are responsible for the success or failure of the program, which should be top down and therefore be aligned with the entire organizational strategy.

5.3 Research Findings

The findings were presented in themes to facilitate the presentation of the results. Evidence shows that people in leadership positions recognize that the commitment and engagement of senior management are indeed one of the most important elements for the success of TPM.

Furthermore, it was identified that these people have in-depth knowledge of the methodology and face daily challenges in the implementation process, especially concerning motivation, consciousness, and people management.

Finally, the findings confirm that the respondents consider themselves responsible for the success or failure of the TPM, which is directly related to engagement during the change process.

Therefore, it is possible to identify evidence supporting the research questions outlined in this study.

5.4 Further research

Overall, the limitations detected in this study can be used as drivers for future research. Also, some topics were covered in the interviews but

could not be presented due to length constraint, and they can be used as data for subsequent investigations. For instance, the cultural dimension, in which some participants claimed that some cultures can be more disciplined than others and facilitate the success of the program. It could be interesting to investigate if this could be an element that impacts the development of the methodology.

Also, it could be recommended to understand the perspectives of people working in operational roles. It would be useful to listen to and analyse personal experiences from the standpoint of people who are part of the maintenance team or equipment operators.

The author believes that TPM methodology is a tool that represents a differential in the corporative strategies, creating competitive advantage in the market and highlighting companies that have greater capacity to adapt. For this reason, the topic is very important nowadays and potential investigations on TPM will be enriching for the literature.

5.5 Personal learnings

At the same time, as it was extremely challenging, this research was also proof that I am more capable than I think I am. There were countless challenges, starting from the language. Since I am not a native English speaker, the investigation required a robust vocabulary, and writing this thesis required a lot of preparation and patience. Besides, we had a pandemic during all this process, and I can assure that it was not easy.

I chose this theme because of my background and previous experiences in which I had direct contact with TPM methodology, and I believe it brought me immeasurable lessons. The research questions were mainly motivated by the challenges I faced during this period, and I trust that the dissertation was the opportunity to combine TPM with some subjects I acquired during the master's degree.

I must confess that the literature review was the stage that required the most dedication. The search for potential respondents to the interviews

was also very frustrating, as many people were not interested in participating. Nevertheless, interviewing people, no matter how small the sample was, was a very enriching moment, with exchanges of knowledge and, above all, opened potential doors for future projects.

Regardless of whether the issue is TPM or not, in any change process, people in leadership positions or people who have influential power need to be aware of their roles before their teams and motivate them to seek better opportunities, better working conditions, and life.

Therefore, my learning goes far beyond methodology and technical knowledge. I do not doubt that the experience of finishing a Masters' course abroad will generate many fruits, both in future professional and personal projects.

5.6 Concluding thoughts and summary

The research objectives were to investigate whether the engagement of managers and directors influences the success of the TPM methodology, to identify the main challenges faced in the development of the program and to verify whether there is an agreement that its success depends on the commitment of the leadership team. It is important to point out that all these objectives were explored from the perspective of people in management positions.

All the data collected in the interviews are supported by elements identified in the literature review. The commitment and engagement of directors and senior managers are fundamental for the implementation of TPM to be a success and bring the results that the methodology preaches, a point agreed upon by all participants.

Although TPM is considered a brilliant way to achieve better results, there are lots of challenges while implementing it, especially when it comes to people. Since it is a process of organizational culture change, it is common to find resistance to change since this is the natural reaction of the

human being towards an unknown scenario. Therefore, managers must know the methodology and have enough skills to motivate their teams.

Therefore, in general, the literature supports all the results found throughout this investigation and reaffirms the importance of the commitment of people in leadership positions in the process of construction and transformation of the corporate environment.

To conclude, all research questions were successfully answered with this investigation and provides the foundation for future research in the area.

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APPENDIX A: INVITATION TO POTENTIAL INTERVIEWEES

Dear,

I am currently writing my thesis for concluding my Master of Science in Entrepreneurship for National College of Ireland – NCI.

The focal point of the research is understanding the management perspective about the Total Productive Maintenance methodology – TPM.

As part of the research process, I will need to conduct some interviews and I would appreciate it if you would accept being a participant in the study. The time taken for the interview is between 20-40 minutes, and it will be conducted through Microsoft Teams. We can schedule it for whenever is best for you.

It is important to note that the interviews will be recorded, however, your identification and personal data will be confidential. Therefore, before that, I will send you a consent form, so that you know the details of the scientific research, as well as additional information on how the data gathered through the interviews will be stored.

Please let me know if you are interested in being part of the project, I am sure that your participation will be essential to enrich the research. If yes, send me back the consent form with your signature so we can schedule the interview.

If you need further information, please do not hesitate to contact me.

Kind regards,

Juliana Matos Monteiro Vieira

Telephone: + 353 89 967 4585

E-mail: julianammonteirov@gmail.com

APPENDIX B: INTERVIEW CONSENT FORM

Welcome! Thank you for your participation in the research project for the course Master of Science in Entrepreneurship submitted to the National College of Ireland.

The study is motivated by investigating and analysing, from a managerial point of view, the correlation between the engagement and commitment of managers, directors, and people in leadership positions and the success in implementing the Total Productive Maintenance - TPM program in organizations.

The method used for the data collection will be through interviews, which will last between 20 and 40 minutes, conducted through the Microsoft Teams software.

No risks that could impact human rights or harm the values or integrity of the respective participants were identified. However, the consent form is a tool for compliance with the ethical considerations required by the institution to conduct research. This document assures that respondents agree the conditions to answer the questions and explains how the information gathered will be used for the research.

Please read the topics below and sign at the designated area, showing that you are aware of and agree with all the conditions described.

1. The interview will be recorded, and a transcription will be produced
2. The transcriptions can be required by you and if you wish, you will be able to amend any eventual mistake.
3. The transcriptions will be analysed by the researcher, Juliana Matos Monteiro Vieira, to investigate the topics addressed in the study.
4. To protect your privacy, there will be no individual identification of the interviewee since all content or direct quotations will be addressed anonymously using pseudonyms.

5. Direct quotations will be used in the study if the researcher considers it to be valuable and future works may make reference to these quotations.
6. The transcriptions, records and notes will be destroyed after the researcher's thesis has been accepted by the institution.
7. Any changes to the above will only be made with the authorization of the interviewee.
8. The participation of the interviewee is optional and can be refused if you wish, without any penalization.

By signing this consent form, I understand that:

- Some direct quotations might be used for the research purpose.
- My participation is voluntary, and I have not received any funds or remuneration for it.
- I can contact the researcher in case I have further questions.
- I have read this form and understood all the points.

Interviewee name:

Interviewee signature: _____ Date: ____/____/____

Researcher signature: _____ Date: ____/____/____

APPENDIX C: INTERVIEW QUESTIONS

1. How long have you worked for the company?
2. What is the type of the industry and where is it located?
3. How many employees?
4. What is your role?
5. How long have you been in this position?
6. How long has the company decided to use TPM as culture organisational?
7. How is the strategy communication to inform people about the program?
8. When did you first hear about TPM?
9. What do you understand about the methodology?
10. Have you done any courses or training that would address the philosophy in more depth?
11. If yes, was this course provided by the company?
12. How would you evaluate your knowledge about TPM?
13. What do you think about the TPM program?
14. Do you participate in any pillars?
15. What do you think are the strengths of the TPM methodology?
16. What do you think are the weaknesses of the methodology?
17. Do you see TPM as a good or bad strategy to gain competitive advantage?
18. Would you classify TPM as a success in the company?
19. Why?
20. In your opinion, what would be the most important element to reach TPM success?
21. And what would be a potential barrier?
22. For you, who is responsible for TPM implementation?
23. Do you think TPM has to be part of managers and directors routine or it only requires additional demands?
24. How would you evaluate the importance of the commitment of managers to TPM?

25. Would you agree or disagree with the statement: “the success of TPM is completed influenced by the commitment and engagement of the managers.”?

26. What about your employees? Were they properly informed of the benefits of the program?

27. How do you encourage your team to support TPM?

28. What is the biggest challenge required by TPM?

29. Were there any problems in relation to resistance to change?

30. How do you manage resistance to change?

31. Did you create any incentives?

32. Were there any punishment measures in place for not obeying the program requirements?

33. Did you notice different departments having different reactions to change?

34. If yes, why do you think this happened?