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# CONTINUOUS PROCESS IMPROVEMENT IN THE ARMED FORCES[1]

## *MELHORIA CONTÍNUA DE PROCESSOS NAS FORÇAS ARMADAS*

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**Abstract**

This study aims to examine how the Armed Forces have managed change in the face of successive changes and recent personnel cuts, specifically in terms of processes. To do so, the study identifies best practices and improvement projects / events carried out by the branches of the Armed Forces in the areas of Operations, Logistics, and Support, aiming to contribute to a change management philosophy based on continuous process improvement. The study used an inductive and deductive approach combined with a qualitative research strategy to interpret the data collected from interviews and documentary analysis. The analysis of the data and discussion of the results revealed that the Armed Forces use the Plan-Do-Check-Act cycle, which involves making a careful assessment of the current situation, planning the changes required and implementing them to achieve a desired future situation. These change processes increase the efficiency and effectiveness of the Armed Forces through an incremental and participative approach to continuous improvement, improving quality and performance. Finally, the model presented aims to increase continuous process improvement in the military.

**Keywords:** Continuous Improvement, Process, Change Management, Quality.

***Resumo***

*O presente trabalho tem por objetivo estudar a forma como as Forças Armadas têm vindo a gerir a mudança, face às sucessivas transformações e à recente redução de efetivos, em concreto na modificação de processos. Neste âmbito são identificadas as melhores práticas, e os projetos/eventos de melhoria nos Ramos das Forças Armadas nas áreas de Operações, Logística e de Apoio, no sentido de contribuir para uma filosofia de gestão da mudança baseada*

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*na melhoria contínua de processos. Foi adotada uma abordagem indutiva e dedutiva, apoiada numa estratégia de investigação com interpretação de dados através de análise qualitativa, em que a recolha de dados foi efetuada recorrendo à entrevista e análise documental. Da análise dos dados e discussão dos resultados, conclui-se que as Forças Armadas utilizam o ciclo Plan – Do – Check – Act, efetuando uma cuidada avaliação da situação, planeando as mudanças e implementando-as para alcançar uma situação futura desejada. Conclui-se, que os processos de mudança descritos, apresentam ganhos com impacto na respetiva eficiência e eficácia, usando as Forças Armadas uma abordagem incremental e participativa, com melhorias continuadas, elevando os padrões de qualidade e desempenho. Por último, é apresentado um modelo, que permite exponenciar a melhoria contínua de processos na organização militar.*

***Palavras-chave:*** *Melhoria Contínua, Processo, Gestão da Mudança, Qualidade.*

## Introduction

Although nothing lasts forever, organizations that do not evolve run the risk of declining; on the other hand, if they are able to meet the challenges they are faced with, they can improve, as there are always easier and better ways of achieving results and allocating resources.

The structural reform "Defence 2020" provides a new model of National Defence, which "aims to reconfigure the system of forces and rationalise the resources available to the national defence by optimising existing capabilities" (Presidência do Conselho de Ministros, 2013).

The Portuguese Armed Forces (AAFF) have undergone successive genetic, structural, and operational changes in addition to significant personnel cuts. Therefore, more must now be done with less, requiring a constant effort to implement best practices.

For Maquet (2008), the most prevalent reason for the military to implement continuous process improvement is the need to deal with a new reality in which operational demands are increased while reducing resources[2] (such as budget, personnel, and aging equipment).

Therefore, it is necessary to search for ways of optimising existing work processes rather than working more intensely for more hours. Immutability is not an acceptable solution, nor is the usual response: "this is how we've always worked, the way things are done".

Like any other organization, the AAFF must make its processes more streamlined and flexible, faster, more economical, and more efficient, as defined in the structuring document "Defence 2020" (Presidência do Conselho de Ministros, 2013).

The ongoing crisis in Portugal over recent years has driven the search for ways to accomplish the mission of the AAFF using fewer resources. Therefore, now seems a good time to identify how the AAFF have overcome these challenges.

According to Pinto (2009), "continuous improvement is a methodology in which people (process stakeholders who are aware of the constant need for change) work together to

[2] Resources are items that are influenced by an activity that generates them. They can be divided into: human, material, financial, and informational (Author, 2017).

improve process performance, bring performance closer to benchmarks, and monitor and respond to customer needs and expectations".

Kotter (2014) argues that the world is changing at such a speed that the basic systems, structures, and cultures that have been built over the last century cannot keep up with the pressures imposed on them. Something new is needed in this era of turbulent change and mounting uncertainty. The solution for this is to make systems more streamlined while increasing their reliability and efficiency.

With regard to the AAFF's continuous improvement process, Guerra (2012) states that the *Lean* concept has been mainly implemented in areas that relate to equipment and infrastructure maintenance and repair, resulting in significant savings and substantial reductions in budget and resources.

This study aims to understand how the AAFF have used new forms of management to increase efficiency and effectiveness, and how they have done so in an environment of constant and urgent change.

By analysing the way in which the AAFF's best practices are established, lessons can be drawn to achieve a robust continuous improvement process.

This study aims to examine how the AAFF manages change, specifically with regard to its continuous process improvement practices.

The analysis consisted of reviewing the stateoftheart of process management from a perspective of continuous process improvement to infer how it is used by the Portuguese AAFF as well as to contribute to its improvement.

Given the limited time and resources allocated to this study, its scope was delimited to the change processes that occurred in the AAFF over the last decade, which are relevant to the ongoing structural reform "Defence 2020".

The research followed the doctrine, norms, and procedures compiled and used by the Military University Institute (IUM), and the research was developed in three phases: exploratory, analytical, and conclusive.

The work was carried out using an inductive and deductive approach (Quivy & Campenhoudt, 2013).

The analysis model used in the study consisted of exploratory interviews and documentary analysis, in addition to semi-structured interviews with the persons in charge of the branches of the AAFF. Given the type of content addressed, qualitative analysis was used to interpret the data (Quivy & Campenhoudt, 2013).

## 1. State of the art

Organizations focus much of their efforts on managing the change process and on using organizational learning to improve results as they attempt to answer questions such as: How can we ensure successful changes? How can we foster organizational learning and continuous process improvement, change the working environment, improve our performance indicators, and encourage our employees to actively participate in the process? How can we implement

a culture of continuous improvement? Hence, the success of organizations depends on their ability to continuously adapt to the external environment (Justa & Barreiros, 2016).

On the other hand, Senge (2010) states that, in order to succeed organizations must understand the internal and external forces that drive change.

Change has become a part of everyday life and today it is linked with innovation, a critical factor for the success of organizations.

Meyerson (2011) states that organizations change in two ways: through drastic (radical) measures and through evolutionary adaptation. In the first case, change is discontinuous and often forced on the organization by top management as a result of technological innovations, scarcity or abundance of critical resources, or sudden changes in the legal, competitive, or political environment. Under these circumstances, change can occur quickly and involve considerable "pain". On the other hand, evolutionary change is gentle, gradual, decentralised, and produces broad and consistent changes over time.

### 1.1. Change management

According to Schaffer (2017), all management is change management and all change management is management. If sales need to be increased, that is change management. If a new policy must be implemented, that is change management. If a new business model is required, that, too, is change management. Reducing costs? Improving productivity? Developing new products? All of this is change management.

There are four types of change in organizations (Justa & Barreiros, 2016):

– Structural change – the organization is seen as a set of functional parts; top management reconfigures those parts to obtain a better overall performance, changes the organization's structure;

– Strategic change – focuses on eliminating non-essential activities or on ways to reduce operating costs; may change the organization's strategy or mission;

– Process change – aims to change how things are done; usually focuses on making processes more agile, effective, safe, and economical; may require the adoption of new technologies and methods;

– Cultural change – focuses on the human side of the organization; aims to change behaviours, attitudes, or management to improve overall performance.

In 1940, Kurt Lewin created a simple, intuitive method to effect change through three sequential phases (Marrow, 1969), as represented in Figure 1 and described below:

– Unfreeze – the organization explains why change is needed;

– Change – change is implemented using participatory methods that allow people to see for themselves what change is needed and why, involving them in the process; and

– Refreeze – the new work practices are adopted at the institutional level through new methods, policies, and procedures to solidify the changes and prevent ineffective work practices.

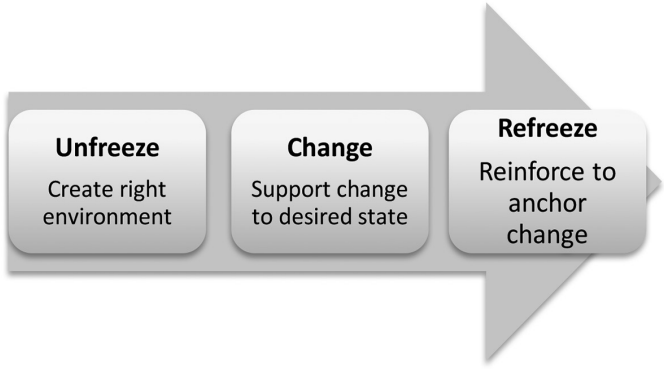


**Figure 1 – Kurt Lewin's change model**
Source: Marrow (1969).

### 1.2. Resistance to change

All change meets with some resistance, not only because new work methods are introduced but because it is what happens whenever there is a discontinuous departure from established behaviours, cultures, and power structures (Chiavenato, 2014).

Thus, the way the change process is managed must fit the new paradigms and provide an effective model which people can use to develop joint improvement initiatives and work in teams to deliver the desired results (Justa & Barreiros, 2016).

Senge (2010) states that resistance to change is neither strange nor arbitrary, rather it is a response to threats to traditional norms and ways of doing things. These norms originate in established power relations, in which authority and power are distributed according to a rigid structure. Rather than fighting people's resistance to change, successful leaders identify the source of the opposition and address the implicit norms and power relations that embody those norms.

During the change process, leaders should create a favourable environment and conditions that allow teams to achieve higher levels of performance and growth.

Managing the change process involves ensuring that changes are carried out in a planned, controlled, and sustainable manner. The basic conditions for this to happen are: believing in the change, a disciplined process, and getting people involved (Justa & Barreiros, 2016).

### 1.3. Continuous improvement

Continuous improvement is a long-term strategic approach used by organizations all over the world. The concept of continuous improvement originated in Japanese firms. It became known as *Kaizen* and was famously adopted by Toyota (Imai, 1986).

Jeffrey Liker has conducted many studies on Toyota and published several books on Toyota's production system. He states that Toyota is globally recognised as the leading firm in terms of continuous improvement, and that Toyota defines improvement as a problem solved (Ahlstrom, 2014).

According to Liker (2004b), Toyota sees a problem as the gap between the current situation and a desired future situation.

Ahlstrom (2014) argues that improvements cannot be made without knowing the current situation and having a clear target. Because the relation between the current situation and the target must always be known, three orienteering questions should be asked regularly:

– To what degree are people aware of the current situation?
– What is the target?
– How can that target be achieved?

Suzaki (2010) conceptualises the improvement process as a three-step cycle (Figure 2). In the first step, employees are provided the necessary tools and orientation in the form of training, visits, workshops, books, and videos, which will allow them to learn basic improvement methods.

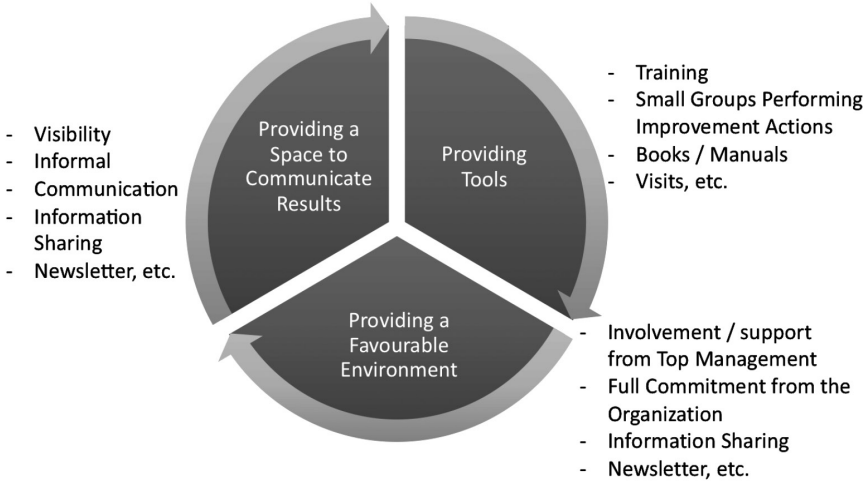


**Figure 2 – Improvement cycle**

Source: Suzaki (2010).

The next phase involves creating a favourable environment that encourages employees to use tools in the most appropriate way, getting people involved.

Finally, the results should be shared with everyone, providing rapid feedback that everyone can access. Once complete, this cycle can be restarted using new tools, so that employees can practice improvement actions in other areas. Repeating these three steps leads to a culture of continuous improvement as a philosophy of life.

Imai (2012) describes *Kaizen* as a way to promote and orient thinking about processes since, in order to improve results, the processes must also be improved.

Therefore, improvement begins with recognising that problems exist, thus creating the opportunity for change (Dias, 2015).

According to Imai (2012), there are two approaches to problem solving. The first involves innovation and applying the latest highcost technology, such as stateoftheart computers

and other tools, which usually entails a considerable investment. The second uses common-sense tools and techniques that are not very costly, and is known as *Kaizen* or continuous improvement. *Kaizen* involves all members of an organization planning and working together for success.

Continuous improvement requires internal energy, which organizations draw from their managers, supervisors, engineers, and employees – it cannot come from top management alone (Liker, 2004a).

A continuous improvement system is a representation of how the work is carried out. It is not an additional or optional activity. It should be part of the organization's culture and all members must believe in it and practice it in their everyday life (Flores et al., 2017).

### 1.4. Continuous process improvement

A process is an interaction of creative ideas, methods, materials, equipment, measurements, and the environment, all of which are necessary to produce a product or service valued by customers. A process can be an individual task or a value chain with a well-defined sequence of tasks. Most processes in an organization involve more than one function or department (King et al., 2014).

Organizations contain many interrelated processes. Processes do not occur in "silos" – they are cross functional to the organization or its subunits.

The most popular method of continuous process improvement is the Plan – Do – Check – Act (PDCA) cycle introduced by W. Edwards Deming (Micklewright, 2010).

The PDCA cycle (Figure 3) is a four-step method, which is repeated over time to generate continuous improvement and learning. Once a problem has been identified and analysed, this allows the organization to plan an action, develop and implement solutions to solve the problem, check if a target has been achieved and if it has had an impact on the respective process, assess the results, and, finally, act on what was learned (Flores et al., 2017).

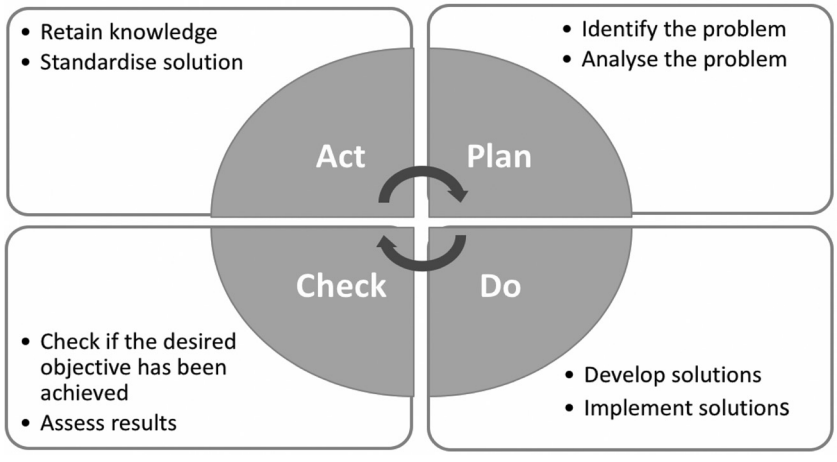


**Figure 3 – PDCA cycle**

Source: Flores (2017).

The PDCA is a significantly simpler way for organizations to develop a continuous improvement system, and implementing it is the first step.

Imai (2012) states that in the beginning, all processes are unstable. Therefore, before initiating the PDCA, existing processes must be stabilised using a process called Standard – Do – Check – Act (SDCA).

The SDCA cycle normalises and stabilises existing processes, while the PDCA cycle improves them. The SDCA deals with sustainability, the PDCA with improvement.

Figure 4 shows how improvements occur between the SDCA and PDCA cycles. Improvements are introduced through the implementation of new standards or updates to the old ones, followed by actions to stabilise the new procedures, initiating a new stage that must be sustained (Imai, 2012).

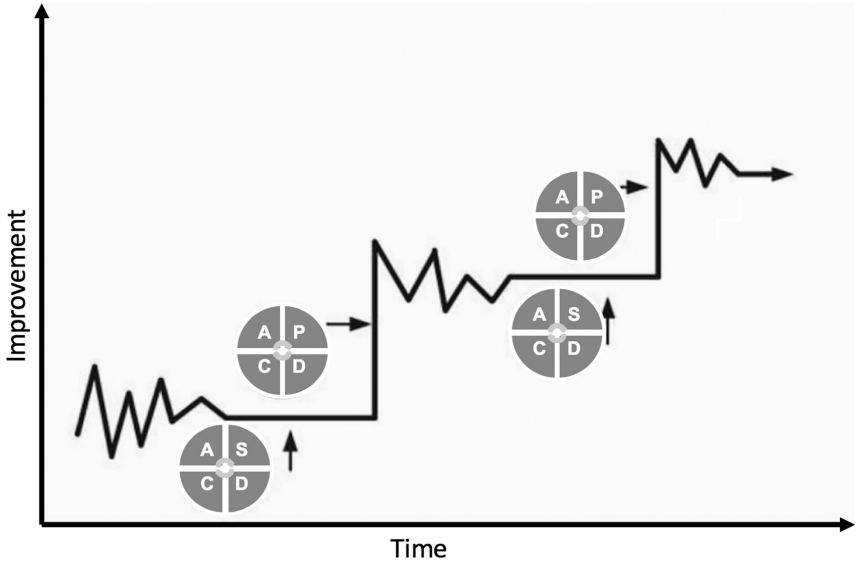


**Figure 4 – Institutional improvements between the SDCA cycle and the PDCA cycle**

Source: Imai (2012).

Toyota is a reference in the field of continuous improvement. Rother (2010) states that the improvement model known as Toyota *Kata* provides a basic approach to introduce continuous improvement in organizations (Figure 5). It consists of a routine that helps organizations move from where they are to where they want to be in a creative and oriented way using a four-phase model:

– Understand the vision or direction;
– Grasp the current condition;
– Establish the next target condition;
– Iterate towards the target condition using PDCA cycles. During the PDCA cycle, the five questions in Figure 5 should be asked to create a mental routine or model for approaching any process or situation.

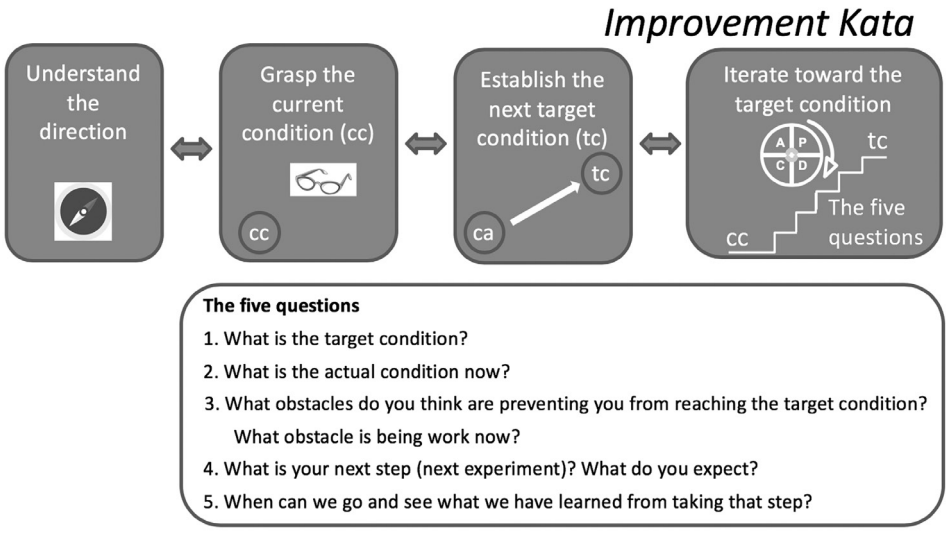


**Figure 5 – Improvement *Kata***

Source: Rother (2010, p.159).

Unlike approaches that attempt to predict a path and focus on implementation, the improvement *Kata* is based on discoveries that occur along the way. Teams that use the *Kata* for improvement learn as they strive to achieve a target condition and adapt based on what learn along the way.

### 1.5. Continuous improvement tools – Lean, Six Sigma, and Theory of Constraints

The Six Sigma, Lean, and the Theory of Constraints (TOC) methodologies provide a set of techniques that can be extremely useful when implementing Continuous Process Improvement (CPI).

The Six Sigma methodology aims to reduce variation through five steps: define; measure; analyse; improve, and control.

Lean Thinking, also known as Lean Manufacturing or Lean Management, focuses on eliminating waste and increasing the value of products or services. It includes five steps: identify value from the perspective of the final customer; map the task sequence or value stream; establish product flow; allow customers to pull the product or service; and seek perfection in the process.

The Theory of Constraints aims to improve systems by managing constraints. It consists of five steps: identify the constraint; determine how to exploit the constraint; subordinate other processes to the constraint; elevate the constraint; repeat the cycle.

These useful techniques can be used to improve processes, alone or combining their methodologies and terminologies. According to Maquet (2008) none of these techniques contains all the tools and principles required to obtain the best possible gains. Although using

them separately leads to improvements, the best results are achieved when the techniques are combined.

Any improvement effort must include the four basic actions listed below, using tools from any of the above methodologies (Maquet, 2008):

– Identify the current situation. The data collection and prioritisation tools included in Six Sigma and Lean can be used to map the value chain, an extremely useful tool for identifying waste and visualising processes;

– Identify the change that needs to occur. The ToC concepts can be used to identify constraints; Six Sigma provides information on process lead time and identifies where defects occur; several Lean techniques, such as the "5 whys" analysis or working groups formed to design the ideal state, help determine the causes of the problems and visualise processes as a whole rather than look for small, easy improvements;

– Identify the desired situation. The Lean method provides a map of the desired situation, mapping the new process stepbystep in a logical way, and the ToC can be used to review the map of the ideal situation to any identify constraints;

– Implement the change plan. Lean implementation forms are easy to visualise and distribute; Six Sigma facilitates monitoring by identifying Specific – Measurable – Attainable – Resultsoriented – Timely (SMART[3]) metrics and providing control charts. This is the step where change has an impact on organizational culture.

Maquet (2008) believes that there are no processes that CPI cannot improve. Typical improvements are approximately 50% of cycle times. Some examples of improvements are listed below:

– Medical. Reduced dental care time by 58%;

– Administrative Support. Reduced contracting time for equipment acquisition contracts (military) from 225 days to 90 days (60%);

– C-130 flight operations. Reduced flight times from 4 hours to 1.5 hours (63%);

– Operations scheduling process. Reduced weekly scheduling cycle time from 72 hours to 42 hours (43%);

– Wheel and tire repair process. Reduced personnel required from 14 to 5 (30%), reduced steps from seven to four (43%), and reduced the time required to repair a wheel by 67%;

– Maintenance. Reduced C-130 inspection cycle time from 20 to 10 days (50%).

CPIbased cultures have been expanding successfully and will continue to do so in the future. The key to success is to make CPI a part of the organization's culture and ensure that all members actively participate in it. As a cultural change, it requires a longterm effort and the involvement of everyone in the new culture, especially top management, to ensure organizational success (Maquet, 2008).

According to Pascal Dennis (2002), firms spend 95% of their time on non value adding tasks.

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[3] Acronym used to define the goal setting process in CPI actions. Each letter of the acronym corresponds to an objective (Maquet, 2008).

After decades of striving to remove waste from their processes, some firms were able to increase the add-value time of their processes by more than 30%, which indicates that there is much potential for improvement.

### 1.6. Methodology

The study used the research methodology and research design presented in the introduction.

The data were collected using documentary and literature analysis, which served to contextualise the topic. The analysis model is based on the methodological and conceptual frameworks presented in Figure 6 and Table 1.

The analysis model is based on the assumption that there are four types of change: structural change, strategic change, process change, and cultural change.

This study aims to examine change management from the perspective of process change, which aims to change the way things are done to achieve optimisation.

Thus, for each analysed process, it is crucial to know the current situation, the desired situation, the action plan devised to achieve it, and to what extent continuous improvement is applied using the SDCA and PDCA cycles.

The conceptual framework described in Table 1 depicts change management as a concept, the process change and continuous improvement dimensions, and their respective components.

The model helped guide the research, during which exploratory and semi-structured interviews were conducted with persons who perform functions relevant to the object of study.

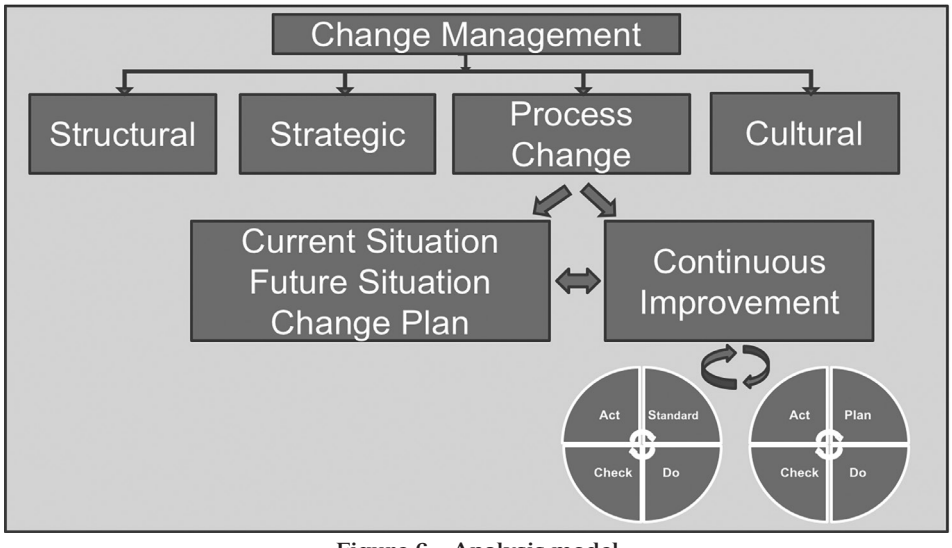



**Figure 6 – Analysis model**

**Table 1 – Conceptual framework**

| Concept | Dimension | Components |
|---|---|---|
| Change Management | Process Change | Projects / Events at the AAFF |
| | | Change (Evolutionary / Disruptive) |
| | Continuous Improvement | Methodologies |
| | | Degree of awareness |
| | | Impact (execution time, costs, quality, human resources) |
| | | Gains (efficiency, effectiveness) |

## 2. Process improvement in the Armed Forces

This chapter analyses change management in the different AAFF branches to ascertain the degree of awareness about CPI, how it has been implemented, and in which areas.

In order to identify CPI events that occurred in the AAFF, semi-structured interviews were conducted with the auditors of the IUM's 2017 / 2018 General / Flag Officers Course / (CPOG) and Joint Staff Course (CEMC), and students of the Field Grade Officers Course (CPOS) from the three branches of the AAFF. Additionally, a documentary review was carried out to provide a framework for some of the identified processes.

The interviews served to collect change events that were classified as CPI. The process, area, and the situation before and after the event were identified for each event.

### 2.1. Navy

The following are the Navy's CPI events, divided by area, as shown in Figure 7.

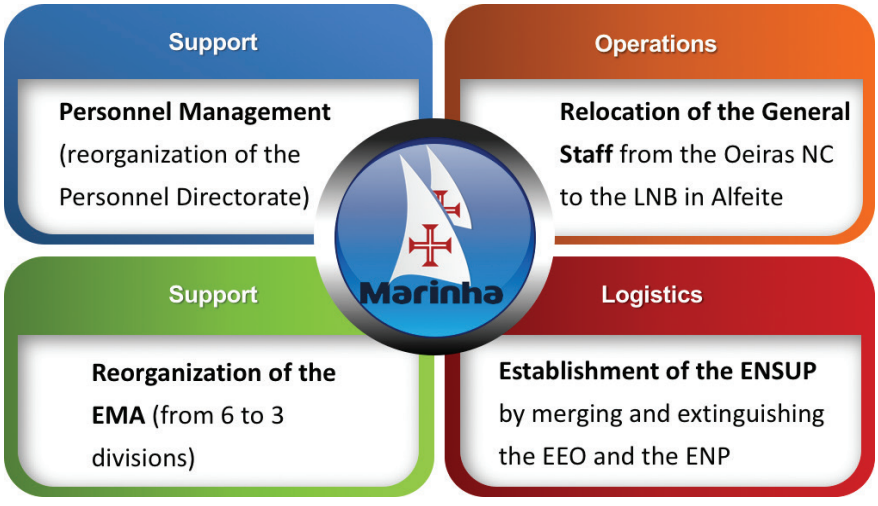



**Figure 7 – Navy CPI events**

### 2.1.1. Personnel management

The Navy's personnel management process was changed in 2013 and the changes were consolidated over the following years. The process was conducted in accordance with the internal regulations of the Navy's Personnel Directorate (PD) (EMA, 2016).

The previous model separated the personnel management processes and their admission, appointments, assignments, promotions, training, and qualification processes according to category: Officers' Division and Sergeants and Other Ranks Division.

In 2013, the way processes were managed was changed to include all categories and is now concentrated in two departments: Appointments and Assignments Division and Active Duty Staff Status Division (Figueiredo, 2018).

In 2012, the PD had 311 staff. After the 2014 reform, those numbers reached 245, corresponding to a reduction of 22%.

The Navy has continuously improved the process by optimising resources and adjusting the Navy's needs and objectives to those of its staff.

These initiatives have improved the relationship between management and staff, simplifying processes and eliminating the need for travel, as summarised in Figure 8. For example, the "My Page" initiative (available from the PD sub-portal), which links the PD to the Navy's military and civilian personnel, provides services and information in a secure, remote way, thus helping to dematerialise the Navy's processes.

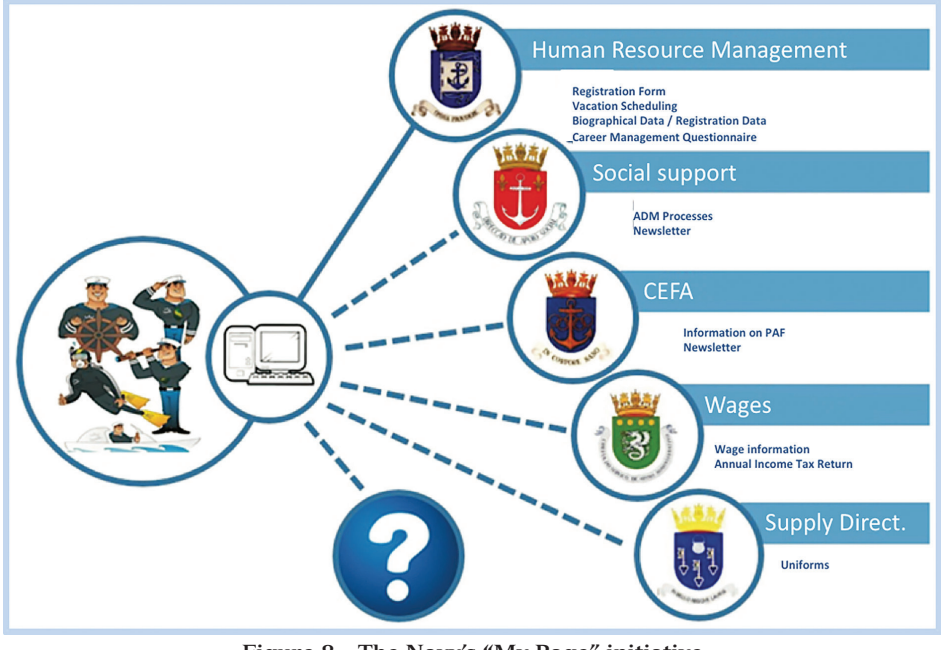



**Figure 8 – The Navy's "My Page" initiative**

Source: Silva (2014).

### 2.1.2. Relocation of the Naval Command General Staff

Similarly, the Naval Command General Staff (NC) was relocated from Oeiras to Alfeite through small but constant incremental changes to existing processes.

The NC General Staff had been headquartered in Oeiras and the 2nd Naval Commander and Ship Flotilla (squadron administrative command), at the Lisbon Naval Base (LNB) in Alfeite.

In the reorganization, the NC was transferred to the LNB in Alfeite and its General Staff acquired the Flotilla's administrative competencies, resulting in the extinction of the latter.

The physical move was accomplished quickly, whereas the processes and physical and technological links were transferred over a longer period to avoid interfering with regular operations.

According to Ribeiro (2018), extensive preparations were carried out to plan the move, such as establishing the desired end state in relation to the current situation, training the change team and the personnel that will be transferred, identifying the processes and changes required to improve performance and the end state, and prioritising the actions that must be taken before the move. This resulted in gains, especially in terms of efficiency. There was no loss of effectiveness.

### 2.1.3. Establishment of the Surface Ships Squadron

The establishment of the Navy Surface Ships Squadron (ENSUP) involved the centralisation of all logistical support to surface vessels in a single squadron, merging and extinguishing the Ocean Escorts Squadron (EEO) and the Patrol Ships Squadron (ENP).

The new ENSUP has the same mission the former EEO and ENP, with the difference that all surface naval assets are now under a single command (Arroteia, 2018).

The benefits of this merge are: optimising human, material, and financial resources, improving preparedness and the support provided to the surface squadron, and standardised "processes for all surface assets […] improving management processes, which are common to all ships [with] efficiency gains [stemming from] the aggregation of various structures" (Silva, 2015).

### 2.1.4. Navy General Staff reorganization

The reorganization of the Navy General Staff (EMA) involved the merger of six divisions (personnel and organization, operations, logistics, planning, communications, and information systems) into three divisions: resources, planning, and external relations (Pinto, 2018).

This reorganization was based on a study carried out by the General Staff to assess the appropriateness, feasibility, and acceptability of the restructuring, which aimed to improve the support provided by the EMA to the decision-making process of the Navy Chief of Staff (CEMA) and the National Maritime Authority (AMN), in addition to enhancing the qualifications of the human resources, rationalising processes, and optimising the physical space allocated to the services. The new structure is more streamlined and more adjusted

to the current reality, and it was possible to reduce human resources by about 20%, which indicates that management efficiency has improved and confirms the effectiveness of the action (EMA, 2011).

### 2.2. Army

Figure 9 summarises the Army's CPI events divided by area.

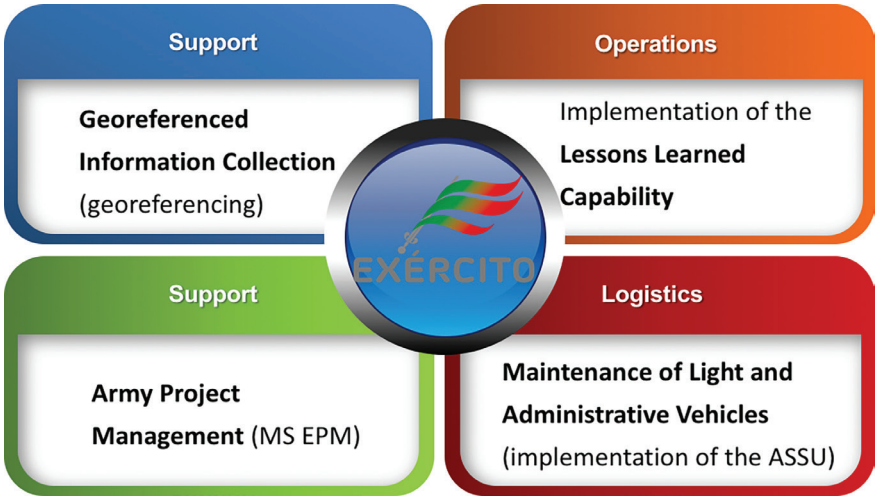



**Figure 9 – Army CPI events**

#### 2.2.1. Implementation of the Lessons Learned capability

In order to become more flexible, modern, and to foster a culture of excellence, the army identified that interoperability and efficiency are critical to continuous process improve (Santos, 2016).

In 2012, the Portuguese Army implemented a Lessons Learned (LL) capability, which consists of a process, a structure, and tools, through which it will become a learning organization (Santos, 2016).

Before that, the organization's knowledge was scattered, especially with regards to personnel who participated in situations (such as Operations, Exercises, and organization of events). Tacit knowledge[4] was the norm and explicit knowledge was scant and unstructured. For example, the reports on and experiences acquired during the engagements of the National Deployed Forces (NDF) or in major international exercises (TRIDENT JUNCTURE), as well as other tactical-operational aspect, used to be scattered across several departments and commands.

[4] According to Choo (2006), 80% of the knowledge of organizations resides in their people (tacit knowledge) and only 20% in the organization (explicit knowledge), but only one fifth of those 20% is structured.

The Army Lessons Learned Process is an open system with an input phase (observations, including problems or best practices), an analysis phase (facts without value judgments), an Identified Lessons list (IL), an implementation and validation phase and, finally, a dissemination phase. A LL (the output) only exists if there is an improved or changed capability within the organization. According to Campos (2018), organizations can only sustain an environment of permanent and urgent change through a Lessons Learned capacity or similar.

The Army now has an Identified Lessons database, which includes information on training for NDF, experiences acquired during the organization of the TRIDENT JUNCTURE exercise, and tactical and operational IL acquired ontheground in NDF. Once validated, these IL can become LL (Campos, 2018).

### 2.2.2. Georeferenced information collection

From a more technical perspective, Portuguese Military Cartography (which traditionally used a 1:25,000 scale) has evolved over time to keep up with the data collection process (Figure 10) (Afonso, 2010; Dias, 2018).

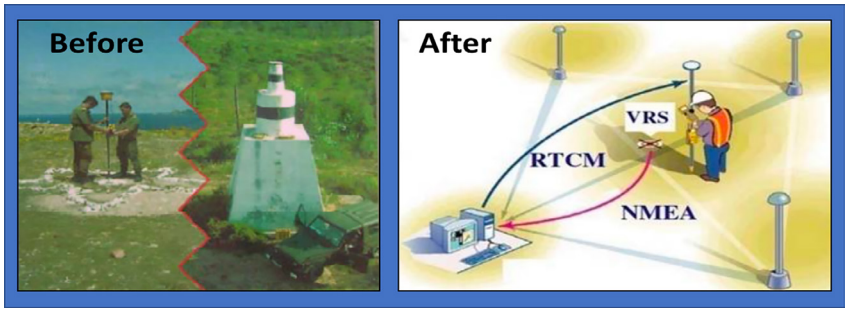



**Figure 10 – Evolution of the georeferencing concept**

Source: Afonso (2010).

According to Afonso (2010), in addition to the high cost of maintaining two Global Positioning System (GPS) receivers, the previous georeferencing method required two field teams (one to handle the base and the other to handle the mobile radio) with a radius of action between them of 5 to 10 km (for centimetre coordinates), which meant that the signal degraded as the distance between the base and the mobile radio increased.

Improving this process increased productivity by more than 200%, reducing the need for on-the-ground assets, significantly increasing asset flexibility, and ensuring the accuracy of the data required. In light of these "gains", this process was adopted by the civilian sector and is currently a standard of reference in topography (Afonso, 2010).

### 2.2.3. Project management

In order to improve the Army's project management process and optimise the implementation of the Military Programming Law (MPL), the Army Chief of Staff (CEME)

approved the "Project Management Standards for the Army" in 2013. The document, which was reviewed in 2015, defines procedures, orientations, concepts, and processes for the Army's Project Management process (APM), in addition to defining the responsibilities of the various Commands, Units, Establishments, and Corps within the framework of the Military Defence Planning Cycle (Fonseca, 2018).

Until that moment, the Force Planning Division (FPD) of the Army General Staff was responsible for project coordination. This was neither practical nor straightforward, as it largely depended on the project manager's proactiveness, and top management found it difficult to ascertain the status of projects due to lack of standardisation and communication difficulties.

When a new type of project management was implemented, a matrix structure was set up to link the various stakeholders using several monitoring and control instruments, such as: the APM standards; process mapping; Microsoft Enterprise Project Management[5] (MS EPM) software; and the Collaborative Portal of the Army General Staff (EME), where the project's page and various control indicators can be accessed. Furthermore, the best practices implemented make it possible to check on the project status at any given moment and include: the project manager and the project team, the Project Management Office (PMO) organization, the monitoring reports (semi-annual), and the meetings of the Synchronization Groups (Fonseca, 2018).

#### 2.2.4. Vehicle Maintenance

In the logistics area, the process of maintaining the Army's light and administrative vehicles was improved. The maintenance of these vehicles was previously managed directly by the Equipment and Transport Department (ETD) of the Logistics Command, which made the process complex and time-consuming, requiring a bloated structure with high staff numbers (Ribeiro, 2018).

According to Ribeiro (2018), the implementation of the Area Services Support Unit (ASSU) in 2009 streamlined and simplified the administrative and vehicle repair processes, streamlining the process and limiting the number of stakeholders involved with the ETD, facilitating the activity of this directorate.

### 2.3. Air Force

Figure 11 – Air Force CPI Events shows the Air Force's CPI events divided by area.

[5] Project management software for organizations.

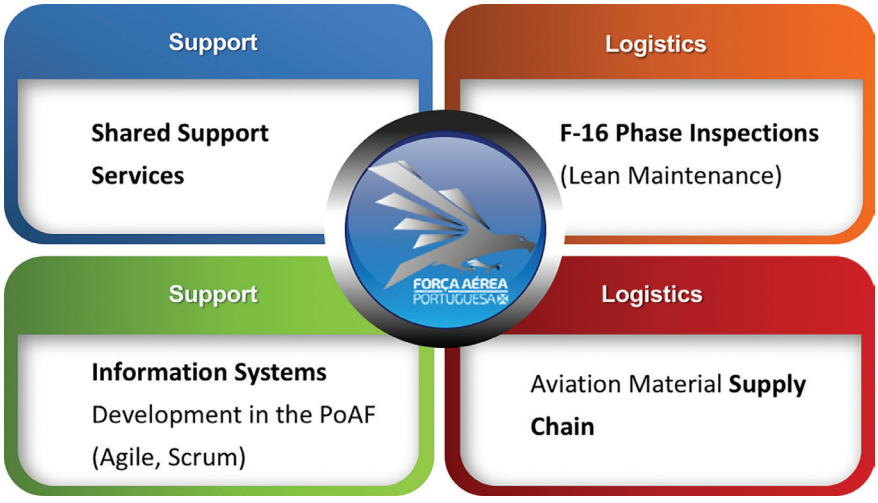



**Figure 11 – Air Force CPI Events**

### 2.3.1. F-16 phase inspections

When conducting the F-16 Mid Life Upgrade (F-16 / MLU) aircraft modification programme, the Air Force (PoAF) implemented and used the Lean methodology as a CPI approach, with outstanding results (Cortez et al., 2010).

Later, the PoAF extended the same practices to other fleets, such as the Epsilon TB 30, C-130, and AL III aircraft fleets. These improvement processes were described by Carneiro (2013).

One of the recurring problems in the maintenance of F-16 aircraft (phase inspections[6]) was the high variability of downtime, as well as the difficulties managing the allocation of resources for the execution of maintenance tasks. Aircraft maintenance work was performed in a fixed dock and the number of aircraft undergoing maintenance simultaneously varied between two and five due to the scarcity of human and material resources. The average downtime was 74 days, although this varied greatly.

After implementing the lean management philosophy in the scheduled maintenance actions through fast improvement events, a new way of working was implemented, which involved the allocation of a dedicated hangar and the division of the work space into four cells, which allowed the aircraft to be moved after each inspection phase; the entire working space was reorganized, and visual management and control tools were installed, a dedicated kit was created to allow the replacement materials to be prepared in advance, and the work charts were standardised and optimised. Only two to three aircraft now undergo maintenance simultaneously, reducing the average time of aircraft downtime by 50% to around 36 days (Carneiro, 2013).

[6] Scheduled maintenance of F-16 aircraft after each 300-hour flight cycle.

### 2.3.2. Information systems development

The Information Systems Division (ISD) of the Directorate of Communications and Information Systems implemented improvements in its Information Systems (IS) programming methods, significantly changing the process, especially regarding the way programmers work. The PoAF's IS development process adopted the Agile / Scrum[7] methodology, which involves minimal contact with the users, using a tool known as Scrum Master to link the programmers and stakeholders responsible for IS (Coimbra, 2018).

### 2.3.3. Shared support services

The traditional staff support model was characterised by support services that were scattered across the various units, processes that involved a large number of stakeholders, low dematerialisation, and excessive levels of approval.

The shared support services that were implemented are based on the concept of concentration and entail using the Intranet / Internet autonomously, in a form of "self-service" (Online Shop) which includes a virtual helpdesk. A contact centre was created to help clarify any doubts that may arise during the navigation in self-service; finally, a Military Lodge was created for face-to-face service, a concept represented schematically in Figure 12.

Because this was a significant cultural change, the Lean methodology was also used to get all levels of the organization involved and ensure that all stakeholders in the staff support processes contribute to the continuous improvement process (Casadinho, 2016).

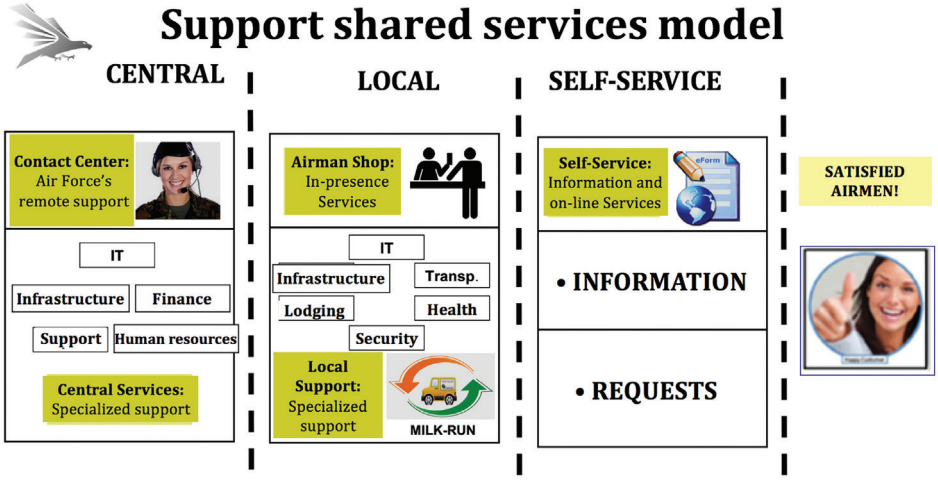



**Figure 12 – Shared service model**

Source: Salvada & Silva (2016).

[7] Agile / Scrum is a simple framework that enables effective team collaboration on complex products (Schwaber, 2018).

### 2.3.4. Aviation Material Supply Chain

According to Varandas (2018), with regards to the logistic area, the aviation material Supply Chain process was changed using Lean techniques, eliminating all tasks or procedures that did not add value. It was a highly bureaucratic process with unnecessary procedures that created a number of obstacles in the flow of the aviation material supply chain, especially regarding the materials repaired abroad.

By implementing the Lean techniques / management it was possible to streamline and simplify the supply chain and significantly reduce the delivery times of items to repair aviation articles / equipment, especially due to the reduction of the stakeholders involved in the process. The process has improved substantially (Salvada, 2011).

## 3. Impacts and contributions to the implementation of continuous process improvement

The previous chapter presented change and CPI events in the AAFF. The present chapter analyses the main success factors, CPI gains of the cases analysed in the Navy, Army, and Air Force, as well as the impacts of those gains on efficiency and efficacy.

In order to manage the AAFF processes, it is crucial to do better today than yesterday and tomorrow better than today.

The previous chapter presented several AAFF projects / events divided by branch, which are synthesized by area as follows:

- Six for Support;
- Two for Operations;
- Four for Logistics.

### 3.1. Impact analysis

The analysis carried out showed that the projects of the AAFF mentioned in chapter two can be considered successful cases of improvement, which focused on problem solving, were implemented gradually, and aimed to optimise resources.

The Navy culture includes a practice based on the strategic management of the organization, which follows a process that includes the analysis, identification, and planning of courses of action, followed by implementation control using targets and performance indicators (Marques, 2018).

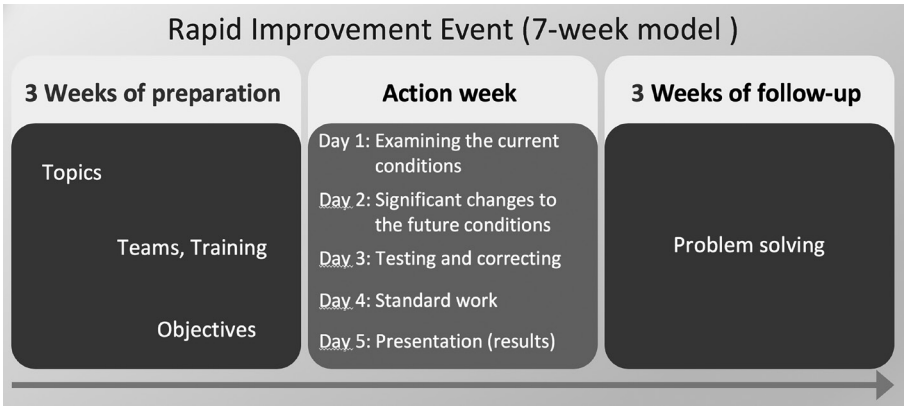
According to Fonseca (2018), since the implementation of the Directive issued by the Army Chief of Staff for 2016/2017, a clear and aligned organization cycle was created to facilitate change, driven by the goals that must be achieved. Furthermore, the creation of project management norms made those projects easier to carry out.

With regard to the PoAF's improvement processes, the Lean methodology has helped those involved in the processes to identify waste and accept change more easily. They were integrated in multifunctional teams to discover and implement the most efficient solutions to achieve the objectives. Tools are used to map the current situation of the value chains, an

ideal situation is visualised, after which the future situation is implemented through rapid improvement events. The chain of command monitors the progress of the situation using the A3 methodology[8] (Ferreira, 2018).

The change or transition from the previous to the future situation is achieved by accomplishing several rapid improvement events (Table 2), which are one of the Lean solutions to create a mechanism for radical or evolutionary process change (Salvada et al., 2015, p.71).

**Table 2 – Rapid improvement event**




Source: Salvada et al. (2015).

In the areas of the branches that underwent changes and improvements, there were several impacts in terms of execution time, costs, quality, and human resources.

In general, the execution times were reduced after the change, as several redundancies were eliminated, resulting in shorter execution cycles.

As for the costs indicator, the financial resources were also reduced and this budget reduction was a catalyst for rethinking and optimising the processes. This led to more quality of service, which was facilitated by the introduction of technology.

The interviews and documentary analysis carried out revealed that the general perception is that, after the implementation of the defined improvements, all processes began to operate with fewer resources, while at the same time managing to relieve the overload of some military personnel in certain areas.

As for lessons learned, these include the presence of resistance to change and the need to take this into account when implementing the change process, as well as the need for effective communication that ensures that everyone is involved in the process.

[8] The designation A3 report originated in the use of an A3 sheet to collect information. This report is based on the Deming cycle, or PDCA method, which serves as a basis to systematise problem solving and possible solutions. This tool is based on eight steps (Ribeiro, 2011).

### 3.2. Contributions for the application of continuous process improvement

In terms of methodologies, each Branch has its own culture, with some similarities. Change management is framed by objectives defined by the top hierarchy, based on careful planning, assessing the various possible solutions, selecting the best form of implementation, and monitoring success through indicators and targets.

From the analysis and assessment of several CPI events in the branches of the AAFF Forces, a model was drawn for use in the AAFF, divided into five steps, as a contribution to a CPI-based change management philosophy (Figure 13).

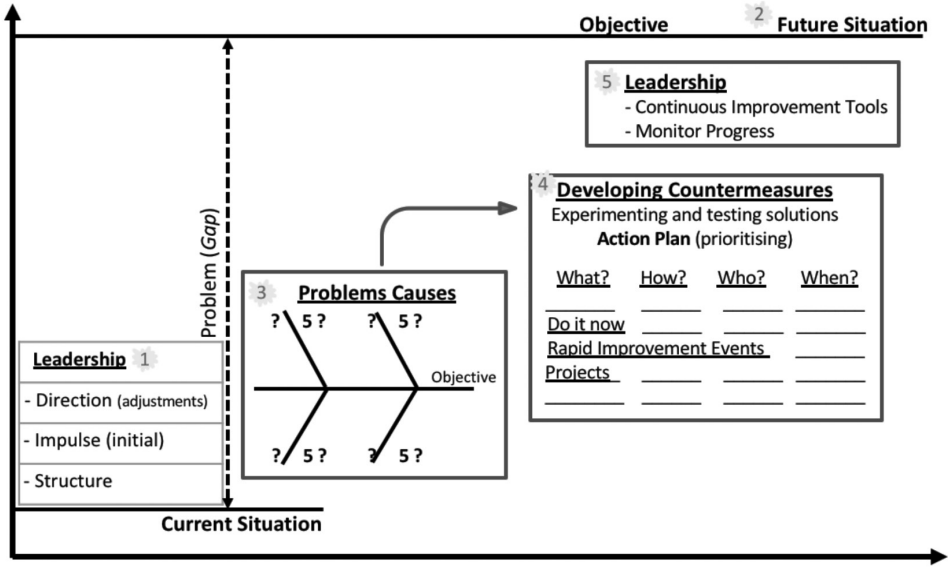



**Figure 13 – AAFF continuous process improvement model**

The first step involves the role played by leaders, who should create an environment conducive to CPI, intervening in the following aspects:

– Direction. Establish and identify the goal to be achieved, making the necessary adjustments to maintain focus on the objective;

– Impulse. Create the initial catalyst for action by identifying the reason for action in a clear, rational, and objective way;

– Structure. Develop a structure and environment that can accommodate change.

The second step involves making the whole organization aware of the future situation, which is aligned with the objective, can realistically be achieved in the short term (six months to a year), and is broken down into small targets.

The third step involves identifying the causes any problems or deviations that occur between the current situation and the future situation, usually using an Ishikawa diagram[9] and the 5 Whys[10].

In the fourth step, appropriate countermeasures are developed to address the causes of the identified problems. These countermeasures should be tested and validated, after which they should be integrated into a properly prioritised action plan, which may include improvement actions in three categories:

– Do it now, small, simple process improvements, that can achieved locally;

– Rapid improvement events, short-term events (3 to 5 days, using the model shown in Table 2) include the use of continuous improvement tools, waste elimination, with clearly established improvement objectives, which are recognised as drivers of change. These events involve leaders and multifunctional teams, have a well-defined scope, an implementation plan, and use monitoring metrics;

– Projects, more complex processes that are common to the whole organization and involve several functional areas, lasting six to nine months.

In the fifth and final step, leaders once again play an important role, as they provide the appropriate means to develop CPI, namely training and continuous improvement tools, as well as constantly monitoring the progress of the process, and be available to remove any obstacles for the teams.

The following are some examples of continuous improvement tools (Salvada et al., 2015):

– Value chain mapping can be used to map process flow, and consists of three phases: identifying the current situation; envisioning the ideal situation; building the future situation based on the analysis of the current situation and on a set of ideas / inputs taken from the idealised scenario. This leads to the creation of a plan of action to implement the future scenario and improve the processes;

– Rapid improvement events enable the creation of rapid mechanisms for radical change in an organization's existing activities and processes, generating fast and significant results, creating an environment of optimism, trust, enthusiasm, and satisfaction among participants, while building the desired scenario in incremental steps;

– The A3 methodology, based on the PDCA cycle, focuses on solving problems by identifying their root causes in order to find the best solution;

– The 6S is a widely accepted and easily implemented management method for workplace organization, with quick, visible results that are easily understood by everyone, which represent the visible side of the ongoing organizational transformation;

– Visual management is a communication tool that enables realtime decision making, analysis, and control of performance metrics, increasing the transparency of the process and,

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[9] The Ishikawa Diagram, also known as a fishbone, is a causeandeffect diagram that provides a visualisation of relationship between the effect and the causes that contribute to an occurrence.

[10] The 5 Whys is a technique to find the root cause of a defect or problem. It is based on the assumption that that by asking why a problem occurs 5 times or more it will be possible to determine the root cause of the problem.

therefore, fostering trust among levels of management, mitigating resistance to change, and encouraging the whole team to achieve the proposed objectives;

– Standardisation / harmonisation ensures that all tasks are performed in the same way by all participants, following the same task sequence, using the same tools, and knowing how to intervene in unexpected situations, increasing the efficiency of the process through repetition.

Continuous process improvement can become the management standard in the AAFF, ensuring that the search for innovation and more efficient ways of using material and human resources is ongoing and daily, thus contributing to achieve the AAFF mission in a more effective way.

## Conclusions

This study aimed to identify, from the perspective of change management, how the AAFF have used new forms of management to increase efficiency and effectiveness, and how they have done so in an environment of permanent and urgent change.

Thus, it aimed to identify how the AAFF manage change, specifically process change, by describing best practices and the impact of continuous process improvement in the management of the AAFF.

The study identified CPI projects / events that occurred in the AAFF, which were examined to identify contributions to a CPI-based change management philosophy.

Chapter 1 provided the stateoftheart and analysed change management, which can be divided into four types: structural change; strategic change; process change; and cultural change. Next, the study focused on process change through continuous improvement.

It was found that in any change process there is resistance to change, which cannot be overlooked and must be properly managed. Instead of fighting it, leaders should identify the source of the opposition and create the conditions and foster the right environment for teams to carry out their work in a planned, controlled, and sustainable manner by ensuring discipline and getting people involved in the process.

The improvement process is developed in three steps: understanding the existing situation, establishing the target to be reached, and designing the implementation plan to reach it.

CPI is based on the PDCA cycle, which is always preceded by the SDCA cycle. Improvements are achieved when there is a balance between the two cycles, which are repeated in an iterative manner.

CPI has been increasingly used successfully by organizations, providing a "strategic weapon" for their development and growth.

Chapter 2, *Process improvement in the Armed Forces*, describes the analysis carried out in the branches of the Armed Forces (Navy, Army, and Air Force) to establish whether change management processes such as CPI exist and in what areas they have been implemented.

In the Navy, several reorganization projects were identified in the areas of Operations, Logistics, and Support. The area providing support to Personnel Management and the restructuring of EMA are especially noteworthy, as there was a visible concern with streamlining processes to require fewer human resources and using technology to dematerialise those processes, especially personnel management processes.

With regard to Operations, the chapter addressed the relocation of the NC General Staff, which was accomplished through incremental changes to existing processes, and was preceded by extensive preparation and planning. The resources (human and material) were optimised and a large number of processes were improved, making them simpler and more productive.

In the Logistics area, the creation of the Surface Ships Squadron centralised all logistic support to surface ships in a single squadron, optimising the human, material, and financial resources, improving preparedness and support to the surface squadron and standardising processes for all surface assets.

As for the Army, projects were also identified in three areas. In the case of Operations, the Lessons Learned capability was implemented to enable the Army to become a learning organization.

In the Support area, the georeferencing concept has evolved to keep up with technological advances, and Project Management was implemented by setting up a matrix structure between the various stakeholders to facilitate the management and procurement processes, in order to achieve the defined objectives.

In the Logistics area, the Army has been implementing Area Services Support Units since 2009, which have enabled streamlining and simplifying vehicle administration and repair processes, removing bureaucracy from the process and reducing the number of personnel involved.

In the Air Force, processes that use the Lean methodology were identified in the Logistics and Support areas.

In the Logistics area, the F-16 aircraft maintenance times were reduced, making it easier to allocate resources to carry out maintenance tasks, as well as streamlining the aviation material supply chain and eliminating non value adding activities or procedures.

In the PoAF Support services, IS programming improvements were implemented using the Agile / Scrum methodology, and various procedures were changed both in internal development and in the relationship between the programmers and the entities responsible for IS. There were also significant changes to the administrative support area, with the implementation of the concept of shared services, which has streamlined, simplified, and increased the use of information and communication platforms, providing online support and much faster services. This has also helped reduce the number of the entities and staff involved in these processes.

The cases identified in the AAFF branches revealed that all three branches use the PDCA cycle, which involves making a careful assessment of the situation, planning the changes, and implementing them to achieve a desired future scenario.

Chapter 3 consisted of an analysis of the *Impacts and contributions to the implementation of continuous process improvement*, which was based on the projects / events described in the second chapter and on the semi-structured interviews with the persons responsible for the Armed Forces General Staff.

The efficiency and effectiveness of these change processes has been improved through the use of CPI. Furthermore, the branches use an incremental and participative approach that ensures continuous improvements and higher quality and performance standards.

As for the methodologies used, although each branch has its own culture, there are common points regarding the definition and approval of objectives by top management, such as rigorous planning and careful identification of solutions, followed by rapid implementation to achieve higher standards of performance.

The continuous process improvement model (Figure 13) is a management model that can facilitate change management in the AAFF. It is based on the following assumptions: the important role that leaders have in achieving the objectives; understanding the current situation and the desired future situation; identifying the causes of problems or deviations; developing countermeasures and an action plan to achieve the desired situation, and, finally; leaders must provide constant follow-up and monitoring. This model can contribute to CPIbased change management that is applicable, appropriate, feasible, and acceptable and that can be integrated into the daily work of the AAFF.

Traditional management models have difficulty operating in today's unpredictable world. Therefore, the forms of management that worked in the past are no longer viable. Today, successful organizations have a constant focus on improvement. The best results are achieved by firms that use continuous improvement as the basis for their management practices, involving people in the process by having them practice successive improvement cycles and learn in the process.

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