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THE DIGITAL ORGANISATION IN THE PORTUGUESE AIR FORCE

A ORGANIZAÇÃO DIGITAL NA FORÇA AÉREA PORTUGUESA

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Abstract

The commitments and obligations which Portugal has undertaken (and, by extension, the Air Force), which reflect the growing concerns about the environment and the problem of Dematerialisation, and the need for near-real-time awareness has led to the development of computer applications with cockpits that enable the management of multiple application domains. The Organisation is the element that links military institutions to military capabilities and to their operational product. This study aims to optimise the way in which the organisation is managed by comparing planning to execution, aligning organisational concepts and establishing relationships between individual competencies and organisational competencies and functions. Design Science Research methodology was used to analyse and design the Air Force's Digital Organisation. This was achieved by creating and establishing relationships between organisational concepts and building a computer-based artifact. The study contributes to science because it provides a representation of the organisational contexts, the competencies of organisational agents, the informational concepts that were developed and the traceability of the actions carried out during the study. The findings confirm that the Digital Organisation concept will make the Air Force's management process more effective and efficient.

Keywords: Organizational Entities, Portuguese Air Force, Digital Organization, Organizational Positions, Digital Transformation

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Resumo

A crescente preocupação com o Ambiente e com a Desmaterialização, presente nos compromissos e obrigações assumidos por Portugal, e consequentemente pela Força Aérea, aliados à necessidade de direção em quase tempo real, cada vez mais premente, concorrem para o desenvolvimento de aplicações informáticas, com cockpits que permitam a gestão de múltiplos domínios de aplicação. A Organização, constitui-se como um elemento base que alicerça as instituições militares às capacidades militares e ao seu produto operacional. Esta investigação tem como objetivo a otimização da gestão da organização comparando o planeamento com a realidade, alinhando os conceitos organizacionais e potenciando a ligação entre as competências individuais e as competências e funções organizacionais. Utiliza a metodologia Design Science Research na pesquisa e no desenho da Organização Digital da Força Aérea, materializada na criação e ligação entre si de conceitos organizacionais e na construção de um artefacto informático. Os contributos científicos focam-se na representação de contextos, nas competências dos agentes organizacionais e no desenvolvimento de conceitos informacionais e na rastreabilidade da ação ocorrida no âmbito do estudo. Conclui-se que o conceito da Organização Digital permite acrescentar eficácia e eficiência à gestão da Força Aérea.

***Palavras-Chave**: Entidades Organizacionais, Força Aérea Portuguesa, Organização Digital, Posições Organizacionais, Transformação Digital*

1. Introduction

The legislation that regulates the Armed Forces consists of a set of documents that provide the foundations for building the organisation. These National Defence documents include the Status of Military Personnel (EMFAR) (Ministry of National Defence (MDN), 2015), the Human Resources Information and Management System (SIG-RH) and the Merit Assessment Regulations for Military Personnel (RAMMFA) (MDN, 2016).

The "organisation" is one of the research topics of the master's programme in organisational engineering of the Air Force Academy (AFA). It has been addressed in several master's dissertations and scientific papers, some of which are mentioned in this article.

One of the aims of the studies conducted at the AFA was to develop a Digital Organisation (DO) (or Online Organisation) that could make important information on about the organisation available in digital format in a coherent systemic way. This would contribute to the goal of dematerialising[1] organisations, one of the measures mandated by the Paris Agreement (Council Decision (EU) No. 2016/1841, 2016) and the European Green Deal (European Commission, 2019, p. 27). In Portugal, these measures are set out in the Roadmap to Carbon Neutrality 2050 (Council of Ministers Resolution (CMR No. 107/2019, 01 july 2019) and the National Energy and Climate Plan 2030 (CMR No. 53/2020, 10 july 2020). It would also

[1] Making the transition from a physical to a digital platform (e.g. dematerialising documents).

enable the creation of links between data repositories and the production and proposal of a set of useful indicators for the organization's management.

The design of the Organisation must also comply with the requirements of mechanisms that develop and accredit civilian competencies, such as the National Catalogue of Qualifications (NCQ) (National Agency for Qualification and Vocational Education and Training, I.P, 2024). Other factors related to supply / demand (recruitment / retention) must be made tangible in order to provide the Air Force with factual arguments that allow for making the costs of turnover tangible because early separation (***early termination***) means that a resource must be replaced, which takes time and involves significant costs; identifying the impact on the Mission since, even if the resource can be replaced, an organisational position lost a resource and another one with similar skills and experience will need to be recruited; providing quantitative data on the Air Force's product in terms of preparing assets for the job market, as one of the provisions of the contract system is that contract personnel will be trained in competencies recognised outside the organisation.

Over the last few years, the Air Force has been systematising the organisation's data and adapting to the evolution in regulations and procedures.

The Air Force has also evolved significantly as a result of the integration of new technologies in the modern weapons systems that are currently being integrated in military capabilities, the most recent being the aerospace capability. The AFA carried out a comprehensive study to identify the competencies that allow its employees to perform the functions required for the organisation to achieve its objectives, and which are essential for Mission success.

According to the research conducted at the AFA, organisations use carbon resources (people) and silicon resources (computers, for example), and are composed of Organisational Entities (OE) and Organisational Positions[2] (OP) (Páscoa et al., 2011b; Monteiro, 2014; Telha et al., 2014).

An OE is an abstract, intangible being that subdivides the organisation into components, each with a mission and competencies in a specific area. An OP is integrated in an OE and uses carbon and silicon resources that possess the attributes required to perform those functions.

This means that it is essential to link the concepts of National Defence, System of Forces, Disposition of Forces, Mission, EMFAR, RAMMFA and competencies through a computer application that will be used to manage the organisation and to identify the impact of unforeseen actions (such as the departure of highly qualified personnel) on the Mission's success. The study explores a topic in the field of military sciences, in the area of military techniques and technologies and the subareas decision support and information technology engineering.

The speed and amount of transactions that occur in organisations has increased significantly with technological innovation, making it essential to acquire IT resources that provide mechanisms, such as performance indicators (KPIs), that enable monitoring

[2] Job positions held by people who perform specific functions.

the organisation's processes in real time, as well as adjustment mechanisms to correct discrepancies.

However, KPIs alone are not sufficient. Self-awareness is crucial to understand and react to the constant stimuli (internal and external) that affect the organisation. This means that the organisational design should include a set of well-defined concepts that reflect current knowledge and that can be used to predict how a given change will affect the organisational resources choreography and assess its impact on the Mission's success. They should also be able to record contexts, actions and organisational parameters, so that lessons can be learned, and ensure all decisions are traceable by evaluating their degree of success.

Real-time self-awareness and traceability of the organisation domain requires suitable Information Artifacts (IA) to interlink different application contexts and enable rapid decisions by anticipating their outcomes.

The answer to the question "what is necessary to manage the organisation in real time by linking different contexts and anticipating the impact of any changes in resources and contexts?" should be multi-faceted and multi-domain, and identify the essential elements to support decisions.

Therefore, the problem is that the Organisation's current design and updating mechanisms are not compatible with real-time awareness and do not allow for rapid traceable decisions.

This study's research objective (RO) consists of optimising the way the organisation is managed by comparing planning to execution by aligning the concepts of OE and OP.The research question (RQ) is "How can the organisation acquire the self-awareness to make traceable decisions in near-real-time?" A plausible axiom is proposed: that obtaining information to support rapid decision making implies a near-real-time representation of the organisation's management application. As the axiom was considered plausible, the first subsidiary research question (SQ-1) was formulated: How can the Air Force organisation be represented in near-real-time? In this study, "representing" entails building an IA that provides the organisation with near-real-time guidance and complies with the Research Requirements (RR): RR-1 Identifying organisational concepts in order to create value and improve decision making; RR-2 Identifying the OEs and OPs and describing their attributes; RR-3 Identifying relevant concepts and developing an IA to manage the organisation in real time; RR-4 Ensuring that actions are traceable.

With regard to assessment, this study will propose methods of assessing if the IA is useful and capable of supporting decision making. A second subsidiary research question (SQ-2) was proposed: How can the IA be assessed to determine its suitability and benefits for the organisation, bearing in mind a set of specific requirements?

The specific requirements addressed in SQ-2 are: To assess if the IA is useful by identifying the features that were developed; To assess if the IA is able to support decision making and make their outcomes tangible through specific criteria and indicators.

The RRs addressed in SQ-1 concern the design and development of the representation IA and reflect the contributions to science that this study intends to make, which are described in section 1.5.

1.1. Research Methodology

According to Kuhn (1996) and Lakatos (1978), a research is can be generally defined as "an activity that contributes to the understanding of a phenomenon" (Association for Information Systems, 2022). Research can recreate an object of interest (in its entirety or a part of it) to obtain essential knowledge for predicting its behaviour.

This study used the Design Science Research (DSR) methodology (Vaishnavi & Kuechler, 2004/21) adopted by Páscoa and Morgado (2023) to analyse the views that will be needed to understand the context and processes that influence the research object. Factual knowledge about reality is acquired through social constructions, such as language, shared meanings, documents, tools and artifacts which are able to explain complex phenomena through meanings that human beings can understand. Ensuring rigour in the engineering process and the precision and usefulness of the IA that will be developed is also essential to understand and obtain knowledge about a given domain.

DSR generally involves designing an artifact to improve the analysed domain and generate knowledge about it (Baskerville, 2008; Baskerville et al., 2018).

Therefore,

> information systems engineering involves designing and modelling information processing systems in organisations, ensuring they comply with technological requirements and requirements derived from organisational, social and human sciences (Caetano, 2008)

According to Hevner et al. (2004), research on information systems based on DSR involves two paradigms: the behavioural science paradigm, which seeks to develop and justify theories that explain or predict human or organisational behaviour and; the design science paradigm, which seeks to extend the boundaries of human and organisational capabilities by creating new and innovative artefacts. These paradigms, which are positioned at the confluence of organisations and technologies, are vital to the Information Systems domain. In this methodology, knowledge and understanding about a problem domain are achieved by building and implementing the artifact.

To assess if the artifact works and is compatible with the research standards that pertain to design and development, seven guidelines will be followed to understand, execute, test and assess the study:

– Guideline 1, Problem Awareness. Awareness of a problem can come from many sources. The outcome of this phase is a proposal for a future study.

– Guideline 2, Suggestion and Tentative Design of an Artifact. The study should produce an idea and a tentative design of a viable artifact, which can be a model, a method or an instantiation.

– Guideline 3, Development. The artifact is implemented in this phase. The aim isto develop technology-based solutions to relevant problems by combining artifacts based on: i) technology (e.g. system conceptualisations and representations, practices, technical capabilities, interfaces, etc.); ii), the organisation (e.g. structures, hierarchical relationships,

social systems, etc.); iii) people (e.g. training, consensus building, etc.).

– Guideline 4, Evaluation. After the artifact is developed, its usefulness, quality and efficacy must be rigorously demonstrated.

– Guideline 5, Conclusions and Contributions. The study should provide a clear, unambiguous and verifiable description of all contributions, including which methodologies were used to design the artefact.

– Guideline 6, Rigour. All artifacts used and / or built in the study must use rigorous methods to ensure that they can be traced, tested and validated.

– Guideline 7, Communication. The study and its findings must be understandable to everyone, and, in the case of technologies, include detailed information on how to build (and implement) the solutions in other contexts.

As the purpose of this article is to describe the process of building a DO, it was based on the various comprehensive studies conducted at the AFA, rather than on more recent studies. The most recent component is the design of the digital organisation (DO), which began in 2023.

The theoretical component of RR-1 is examined in detail in a PhD thesis (Páscoa, 2012), in master's dissertations prepared at the AFA (Andrade, 2015; Bonifácio, 2017a; Monteiro, 2014; Monteiro, 2019; Pires, 2017; Quintas, 2016; Rodrigues, 2016; Santos, 2017) and in several scientific articles(Bonifácio, 2017b; Bonifácio et al., 2017; Monteiro & Páscoa, 2019; Páscoa et al., 2009; Páscoa & Tribolet, 2010; Páscoa et al., 2011a, 2011d; Páscoa et al., 2013a, 2013d; Páscoa et al. 2019, 2021; Pires, 2017; Pires et al., 2017; Quintas et al., 2016; Santos et al., 2017; Santos, 2018; Telha et al., 2014; Telha et al., 2015; Telha et al., 2016a, 2016b;;). The key concepts they address are described in the literature review.

To comply with RR-2, the organisation's paper manuals were consulted and, when available, their contents were adapted and dematerialised. Next, a transversal consistency and standardisation study was performed by the Innovation and Organisational Transformation Division (DivITO) of the Air Force Staff (EMFA), in coordination with all Air Force entities. When OEs were linked to new capabilities such as Space, the findings of extant studies were adapted (e.g. Páscoa, 2024).

RR-3 involved gathering information on how to build computer applications in general and defining functional requirements (FR) (Air Force, 2023). The latter were developed by the EMFA and the Directorate of Communications and Information Systems (DCSI) of the Air Force Logistics Command (CLAFA), which has standards for developing this type of IA.

The process of developing, testing and implementing the application (RR-4), enabling its traceability, was also carried out by the DCSI, based on a conceptual model built by the EMFA in MS EXCEL. Later, the EMFA also assisted in validating the IA.

1.2. Assessment

Once an IA has been built and implemented, an assessment will be carried out according to selected criteria, in order to ascertain:

– the usefulness of the IA in identifying, understanding and scientifically justifying factors relating to the management of the organisation in near-real-time;

– the IA's value in supporting decision making and making the concepts tangible.

By verifying if the IA complies with the requirements derived from the research questions, it will be possible to systematise the activities used to manage the Organisation and its resources. This will provide factual information on whether the requirements are met, achieving the RO.

The scientific contributions that this study aims to make include: explaining the DO structure in a systematised and standardised way, and developing models that not only make it possible to manage the organisation, but also to identify the impact of staff changes or shortages.

1.3. Scope and limitations

The study was hosted by the Portuguese Air Force. It was conducted in 2023 and 2024. This document does not include the structure of the organisation or the list of attributes associated with organisational entities and positions. Therefore, a qualitative assessment will be made by validating the requirements that have been identified and met.

This document is divided into four chapters. The first chapter describes the context, the research problem and its relevance, and identifies the research objective, the research question, the methodology, the assement process and the study scope and limitations.

The second chapter contains the literature review, which includes scientific studies, legislation and practical experience.

The third chapter describes the core components of a Digital Organisation and presents the analysis that provided the answer to the research question and accomplished the research objective.

The fourth and final chapter answers the research question, accomplishing the research objective, validates the intended contributions to science and provides recommendations for future studies.

2. Literature Review

This chapter presents some of the concepts addressed in the AFA studies which were integrated in the design of DO and the computer application that will be used to manage it.

2.1. Organisational Engineering

Ceitil (2010) states that technological, political, economic, social and cultural changes are an inevitable reality in an organisational context that is increasingly competitive, which means that organisations must embrace change in order to survive.

For Magalhães and Tribolet (2005), whether an organisation survives is determined by the challenges it faces at any given moment in its history and by its ability to respond, adapt and change.

Organisational Engineering involves analysing the knowledge that organisations use to improve efficiency, efficacy, communication and coordination, which is applicable to any type of organisation that aims to improve its performance (Organizational Engineering Institute, 2024).

2.2. Organisational Transformation and Innovation

The concepts of transformation and innovation are interconnected. As transformation is triggered by the an organisation's need to be competitive in its sector, change must occur at a pace that exceeds the organisation's ability to acquire the resources it needs to carry out its activities. Innovation, which means the introduction of something "new and unusual", is at the "heart" of any transformation (Alberts & Hayes, 1995).

Transformation and innovation change aspects of the organisation's performance, including its situational awareness[3] (Nifco, 2005), flexibility[4] and agility[5] (Alberts & Hayes, 1995).

The Organisation is the result of permanent interactions with its environment and is in constant evolution (Páscoa et al., 2010; Páscoa & Tribolet, 2010; Páscoa 2012).

Kotter (1996) argues that organisational transformation must be consistent in order to be successful, proposing eight steps to monitor the process, maximise the chances of success and minimise pitfalls:

– Establish a sense of urgency, which is essential to empower others and maintain the credibility required to drive change and ensure compliance;

– Selecting human resources with the right characteristics and levels of trust, as well as a shared strategy and objectives;

– Involving the organisation's senior managers in developing a change vision and strategy;

– Communicating the Change Vision, inspiring trust in people and a shared awareness of the objectives and direction;

– Launching a broad initiative to train the organisation's human resources to deal with any situations that may emerge;

– Creating short-term wins which are visibly and undeniably associated with change in order to consolidate the actions that were taken and identify the "next step";

– Consolidating improvements and producing more change, creating traceability and explaining how value was created;

– Anchor new approaches in the organisational culture, permanently changing the way people think.

In 2009, the Chief of Staff of the Air Force (GEN CEMFA) issued a directive (Air Force, 2009) containing a set of actions, which represented his vision of aligning the organisation's strategy and information systems.

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[3] Awareness of the present moment and of the actions that can be taken.
[4] The ability be successful in multiple ways by idealising future possibilities and different ways of attaining them.
[5] The ability to act quickly, decisively and effectively to anticipate, initiate and benefit from change.

A 13-month action plan was developed and launched in March 2009. It consisted of the following actions:

– Developing interorganisational doctrine[6] (United States Air Force, 2021) (concepts, procedures) by creating a model to design the operations and maintenance manuals;

– Modelling maintenance and operation processes and activities;

– Defining metrics and indicators to support decision making in information systems;

– Standardising the data repositories (operational, maintenance, personnel);

– Creating monitoring mechanisms;

– Creating an organisational engineering area of study at the Air Force Academy, in the master's degree programme of the Air Force Pilot speciality.

The organisational transformation process has been described by Malico (2010), Costa (2011), Páscoa et al., 2011b and Páscoa & Tribolet (2014);

The first Strategy Map (SM), which represented the CEMFA's transversal vision for the Air Force (and included vectors of value creation), was based on the studies conducted at the AFA (Oliveira, 2011; Oliveira et al., 2011; Oliveira et al., 2014Páscoa et al., 2011c; (see Figure 1), and the corresponding Balanced Score Card (Fernandes, 2011; Fernandes et al., 2011; Guedes, 2013; Horta, 2013; Moreira, 2012; Páscoa et al., 2013a; Páscoa et al., 2013b, 2013c; Páscoa et al., 2015; Páscoa et al., 2016), now called the Organisational Cockpit[7], which also provides for the integration of performance assessment tools (Gaio, 2016; Gaio et al., 2017).

[6] Doctrine is a military term. Like regulations in enterprises, it is based on experience, best practices and learned lessons, defining how capabilities should be used in a given operation, shaping the way future technologies and capabilities will be integrated.

[7] The term "cockpit" is part of the Air Force's culture and refers to sets of indicators that contain useful information. Aircraft have a cockpit with a set of indicators.

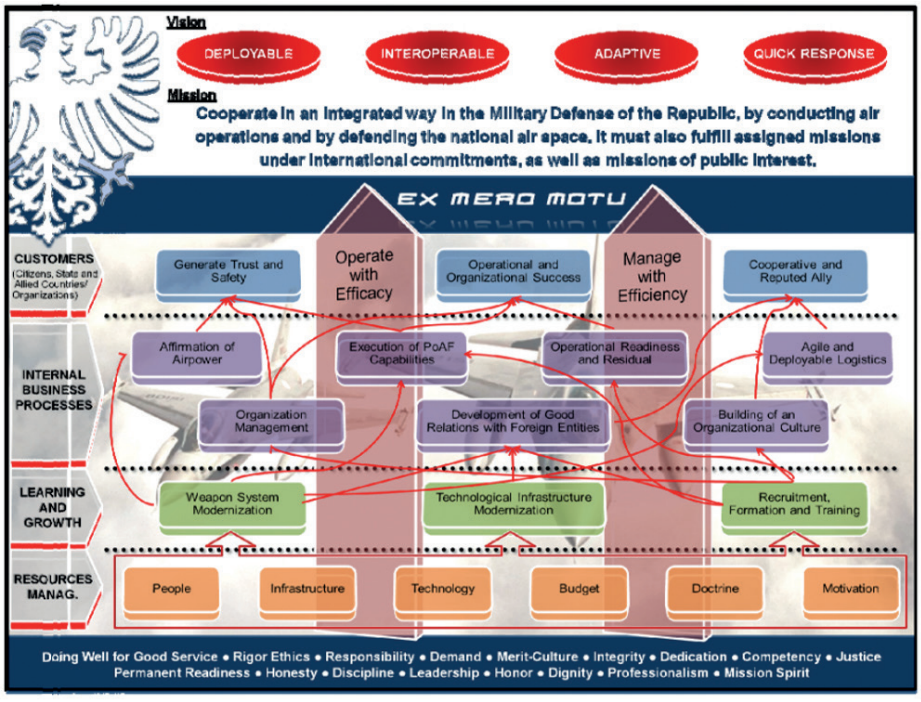

Figure 1 – Air Force Strategy Map published in 2011
Source: Oliveira, 2011; Oliveira et al., 2011; Oliveira et al., 2014; Páscoa et al., 2011.

People, technology, doctrine and motivation are structuring elements in the Air Force, driving the vectors of value creation that improve the operational product, trust, cooperation and the organisation's reputation.

2.3. Digital Transformation

The European Union (EU) has developed a Digital Transformation (DT) strategy (European Commission (EC), 2022) with five objectives:

– Foster a **digital culture** by adopting new ways of working, which entails the creation of new digital platforms with collaborative tools, as well as training staff to identify ways in which they can improve their autonomy, agility and productivity;

– Enable **digital-ready policymaking** – dematerialisation helps the organisation respond quickly, appropriately and accurately using digital solutions supported by digital partnerships between policy and information technologies (IT);

– Empower **Mission-driven digital transformation**, which means rethinking and redesigning organisational processes and using IT to improve efficiency, synergies, transparency, simplify the reusability of solutions, improving the efficiency and predictability of operations, promoting the "sharing by default" principle, in line with cyber security rules, and training staff by designing and implementing cyber awareness models (Páscoa et al., 2023)

– Ensure a **seamless digital landscape** that is effective, efficient and secure, an IT systems environment, digital solutions and datasets characterised by simplicity (as opposed to complexity) and based on a reinforced corporate architecture practice that emphasises reusing, then buying, then building new digital solutions when needed. This will entail: increasing the use of open source software, an integrated development model, a cloud-first approach, an interoperability by design approach, security checks for purchased software, modernisation and innovation pilot projects that involve multiple OEs, early involvement of end users and, finally, developing an integrated data ecosystem;

– Maintaining **green, secure and resilient infrastructures** based on energy-efficient digital solutions, tools, infrastructures and technologies, in order to help the organisation (the Air Force) achieve the goals outlined in the Air Force Roadmap for Carbon Neutrality 2050 (RCN2050PrtAF) (Air Force, 2022; Pinto & Páscoa, 2023) and other similar initiatives (Calaixo et al., 2022; Correia et al., 2022), as well as with the environmental goals set out in the Paris Agreement (United Nations (UN), 2015) and subsequent climate pacts (UN, 2024; European Commission, 2019) and, in Portugal, in the action plan for digital transition (Portuguese Government, 2020) and dematerialisation by reducing consumption of paper and computer consumables (Council of Ministers Resolution (CMR) No. 51/2017, 2017; CMR No. 141/2018, 2018).

2.4. Studies conducted at the Air Force Academy

In 2013, to improve the efficacy and efficiency of human resource management through a competence-based model, the Air Force Academy created a new Avenue of Research (AR) that aimed to "*understand the processes involved in the design of the organisation, including its processes, the agents who carry them out and their competencies and qualifications, in order to create a digital, dynamic and reconfigurable organisation*" (AFA, 2024).

The investigation was divided into three themes:

– Organisational design – developing the competencies architecture and the wheel of transversal and specific competencies;

– Information in Organisational Design – developing the Air Force's business model and its architectural and informational representations;

– Analysis of Organisational Design Efficacy – developing the DO model, which includes the different components of a service member's life, and preparing a dissertation on the role of military university education in the acquisition of competencies.

The investigation was completed in 2019 and several master's theses and scientific articles were published. The following sections present the main findings of the Organisation AR.

2.4.1. Organisational Concepts

A digital (online) organisation model was proposed to align the competencies required for the organisation to function and individual competencies (Páscoa, 2012; Páscoa et al., 2019; 2021). The model represents the OE and OP concepts associated with the management of

resources (human, material and information) according to competencies. Each concept is described individually and the relationships between components are explained.

OEs are non-tangible, high-level organs (e.g. Air Force, General Staff) of an organisation, which are filled by personnel (Monteiro, 2014; Páscoa et al., 2011d; Telha et al., 2014). An OE has the following attributes: Mission, Competencies; Description; Structure; Organisational Framework (organisational position(s)); Description (Name), Hierarchical dependence.

An OP can be defined as a specific position or function performed by the employees of an organisation (Páscoa et al., 2011d). It has the following attributes: Designation (Name); Qualifications (language proficiency; required and desirable qualifications); Functions (a set of responsibilities and activities).

2.4.2. Organisational competencies

Hammouch et al. (2021) state that organisational competencies are one of the main assets of enterprises and that competency models are a systematic way to exploit technological innovations by combining and transposing them into organisational competencies.

Škrinjarić (2022) argues that the rapid pace of digitalisation, automation and robotisation forces companies to attempt to predict new values, trends and consumer needs and adjust their products accordingly, which requires them to constantly adapt competencies and competency-based models.

White (1959) notes that the term "competence" refers to demonstrable personal characteristics that enable job performance at high levels. They comprise a set of knowledge, skills, traits, motives and self-concepts (Spencer & Spencer, 1993).

According to Quintas (2016),

> Transversal competency is an observable behaviour associated with each and every individual belonging to the Organisation, intrinsic or developed in various organisational contexts and useful for the PRT AF." These competencies play a key role during staff turnover between organisational positions and in the selection of candidates to join the organisation [...] [ensuring] that the most competent person in every situation is chosen. (Quintas, 2016; Telha et al., 2016a)

The wheel of transversal competencies (Figure 2) was adapted from Eichinger & Lombardo (2005). It includes six groups of competencies (Individual Excellence, Strategic Skills, Military Skills, Courage, Results and Operational Skills).

Telha et al. (2016a) and Quintas (2016) also defined a set of proficiency levels to describe each transversal competence in more detail: "level 0 - non-existing, level 1 - basic, level 2 - intermediate, level 3 - advanced, level 4 - expert".

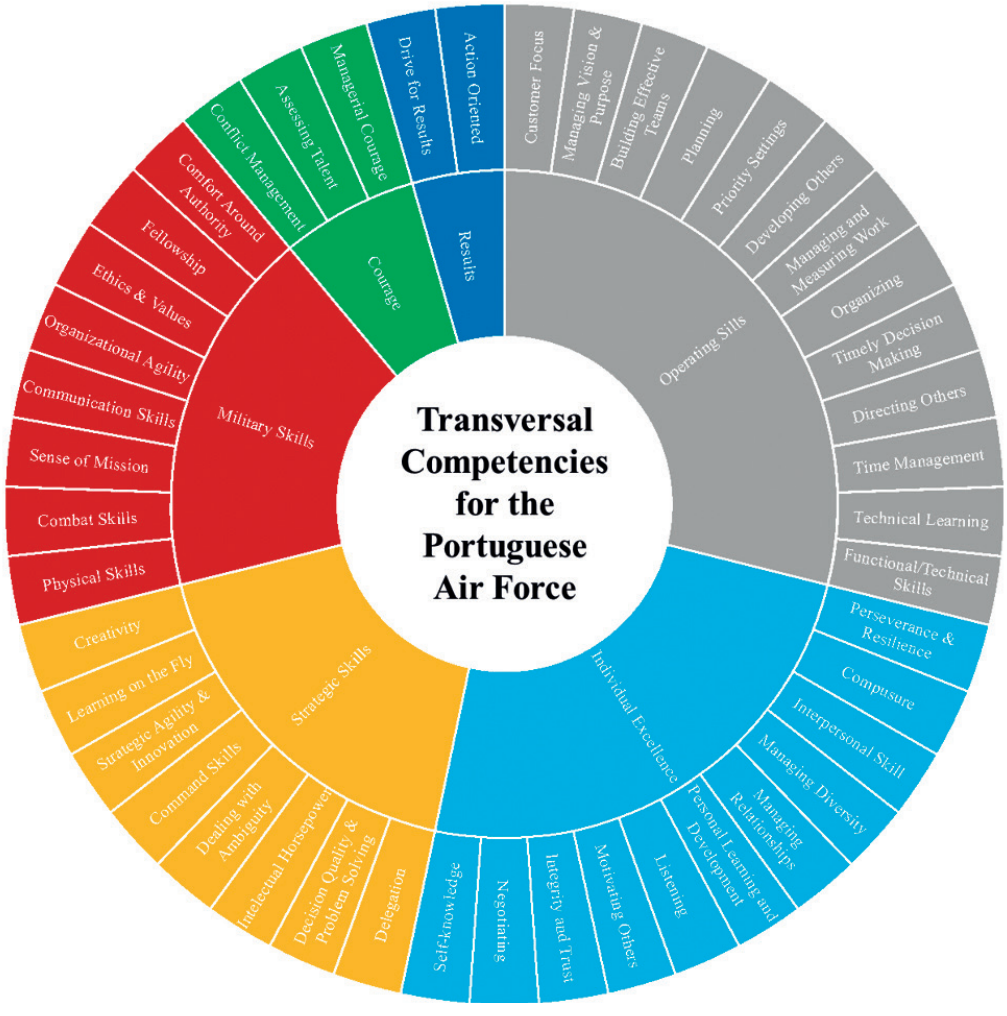

Figure 2 – Transversal competencies wheel for the Air Force
Source: Quintas, 2016; Telha et al., 2016a (adapted from Eichinger & Lombardo (2005)).

Specific competencies associated with specialities in the operations, maintenance and support areas were also designed. Bonifácio (2017a; 2017b; Bonifácio et al., 2017) defines specific competencies as "*an observable characteristic of an individual in the organisation that allows them to perform the technical functions that they have been assigned, which can be developed through experience or vocational training.*"

Specific competency wheels were developed for the specialities of the Operations (shown in Figure 3), Maintenance and Support areas.

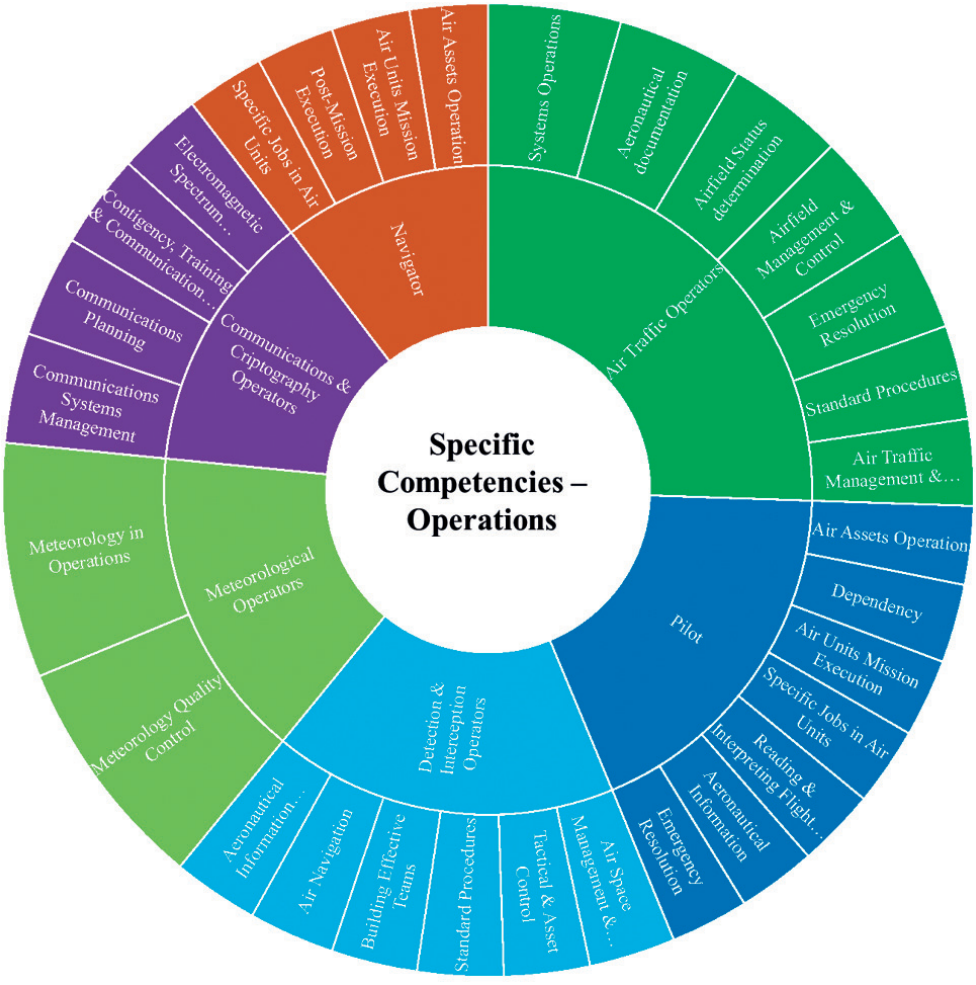

Figure 3 – Specific competencies for the Air Force
Source: Bonifácio (2017a; 2017b), Bonifácio et al., (2017).

2.4.3. Competencies Architecture

According to Lankhorst (2013), managing complexity in large organisations requires an architecture. A competency architecture can be defined as *"...the set of all necessary competencies for the organisation processes, their representation and explanation, the relationships between them, how they are developed and the organisational positions in which they are required..."* (Telha et al., 2016b; Rodrigues, 2016). Rodrigues (2016) developed a model to explain the competencies architecture (see Figure 4) and defined how it should be used to manage the organisation's competencies, also defining rules that must be applied according to the organisation's needs, in order to optimise staff recruitment and fill OP. In addition to matching an employee's competencies with the competencies required for a specific OP, these rules also aim to retain and develop new competencies by filling other OPs.

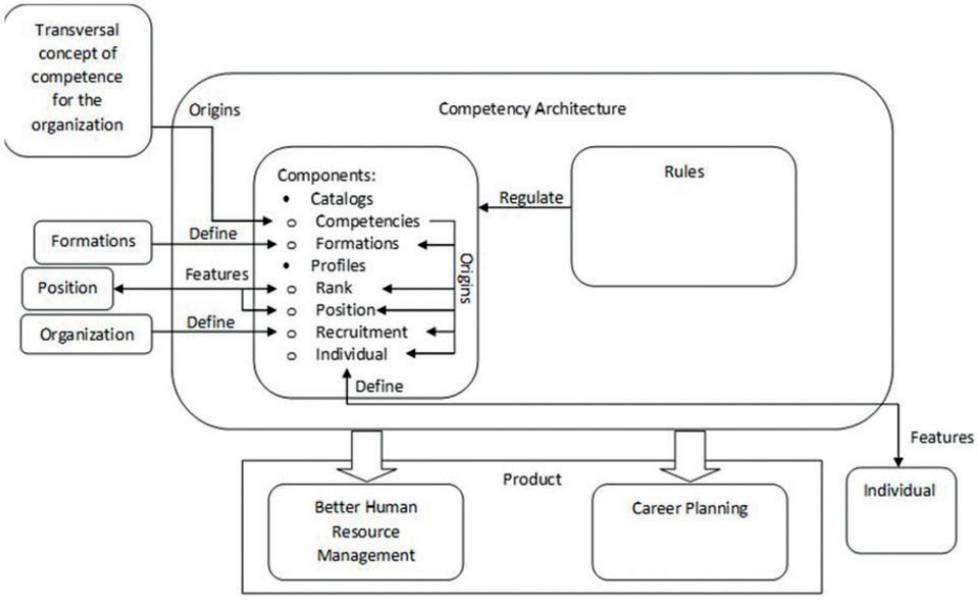

Figure 4 – Competencies Architecture for the Air Force
Source: Rodrigues (2017a; 2017b).

Rodrigues (2016) also developed the concept of competency profiles, which should exist for each OP (because they are essential to perform the role) and should match the competency profile of the person who fills the position. If a person's competencies correspond to the minimum level of competency defined for an OP, they are considered suitable for that position. If the person does not have the competencies required for a given OP, they should be assigned to an OP with a different competency profile. Another option is to train the person to develop a set of competencies that make them suitable for the OP.

2.5. The Digital (Online) Organisation

Santos (2017, 2018), Santos et al., (2017) and Páscoa et al., (2019, 2021) defined the Online Organisation prototype for the Air Force (Figure 5), which consists of a resource management model that can be used to manage the staff and the Organisation effectively according to competencies. It comprises several components and rules.

Each component (Individual, Competencies, Merit Assessment, Resources and OE/ OP) is composed of attributes and relationships with other components, and is managed and governed by rules.

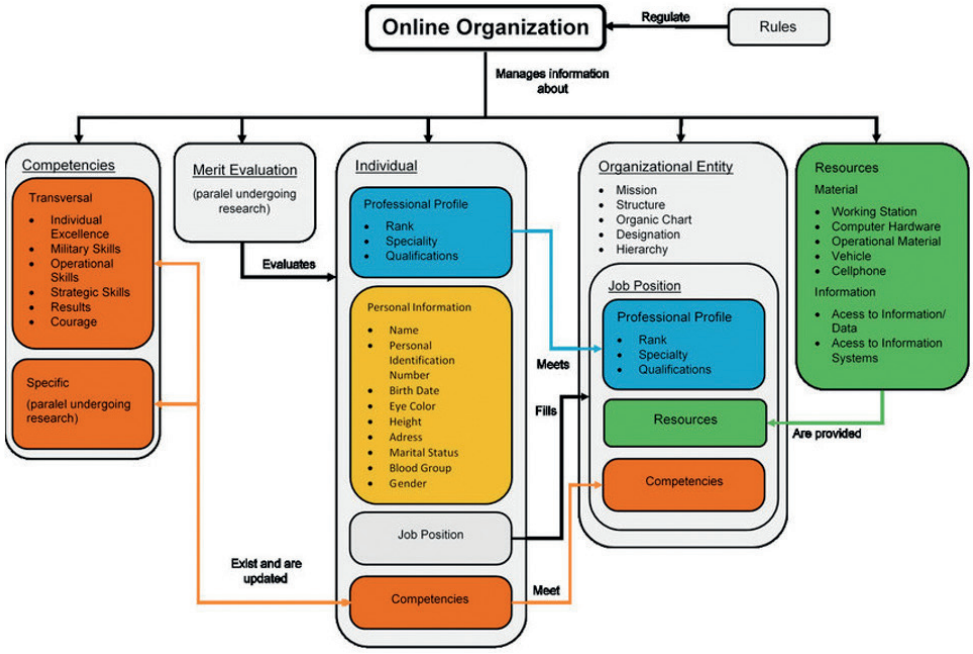

Figure 5 – Online Organisation
Source: Santos (2017, 2018), Santos et al. (2017) and Páscoa et al. (2019, 2021).

During the research, the individual competencies architecture was implemented using EXCEL, and field exercises were conducted to develop the competencies, which were attended by four multinational companies and two universities (a total of about 200 people). The events involved activities that trained five individual competencies, according to levels of proficiency and the competence profiles developed with the participating companies.

3. Digital Organisation

As mentioned earlier, the practical component of the investigation developed at the AFA involved designing a competencies architecture by defining individual and specific competencies with associated profiles and levels.

The organisational component that was already addressed in the Air Force's physical organisational manuals (one for each entity) was not dematerialised. This format presented the normal difficulties inherent to handling paper:

– It was not easy to obtain all the manuals;

– High consumption of paper and computer consumables;

– Updates are time-consuming and specific for each sector;

– The descriptions of OE and OP attributes are not standardised;

– It does not include KPI;

– Research is time-consuming because one must read the manual until the desired information is found;

– Comparing the information in manuals is time-consuming because it is necessary to read one or more manuals in order to find and compare the desired information;

– The value of OPs is not calculated;

– It does not include the organisational competence concept;

– It does not include a comparison between the number of staff and the organisation's staffing matrix;

– The data repositories are not interlinked.

In addition to dematerialising manuals and generating considerable savings in terms of paper consumption and computer consumables, the DO introduced the concepts identified in the AFA studies listed in the literature review:

– Enabling free text searches in all organisational views, standardising the fields used to describe the OEs and OPs according to the concept of prototypical OE and OP and creating an OE catalogue;

– Linking the concepts and repositories related to National Defence (e.g. EMFAR, RAMMFA and SIG-RH) to civilian competencies and functions such as the ones described in the NCQ;

– Presenting KPIs in custom searches by OE and OP and including a free text search feature;

– Integrating the concepts of organisational competencies and levels of competence, according to the transversal and specific competency wheels;

– Standardising the OE and OP attributes across the organisation, ensuring that the OP attributes are the same in all areas of the Organisation;

– Integrating the concept of OP value by calculating its costs and attributions based on Standard Language Proficiency (SLP) and security clearance requirements, the cost of which should also be calculated;

– Linking OEs to their OPs, the Staff Plan (SP) and the Staffing Matrix (SM);

– Dematerialising the governance model used to manage the Organisation;

– Creating profiles with access permissions for all operations, from consulting the individual attributes of OPs to managing the DO.

As mentioned above, most concepts were taken from the studies conducted at the AFA, including the Online Organisation model designed in 2017 and adapted for this project.

This chapter describes the concept, the guidelines from senior management, the FR created for the IA, the data model adapted from Santos (2017, 2018), Santos et al. (2017) and Páscoa et al. (2019, 2021), the responsibilities, the timeframe and the capability that was built. Finally, it describes how the requirements were validated and the results of the IA assessment, and confirms that the RO was achieved and the research questions answered.

3.1. Concept

Bearing in mind that the Organisation is a structure that has been optimised to accomplish a Mission, and the concepts taken from the National Defence documents, the data repositories and the Mission, the Digital Organisation concept (Figure 6) aims to make the Air Force

organisation available in digital format through a Computer Application, in order to:

– Standardise the method used to introduce the information, as well as the information itself, and provide access to a set of management indicators through a quick search;

– Integrate transversal concepts to improve situational awareness about human resources and their qualifications and competencies;

– Create links to relevant data resources (SIG-RH, NCQ, RAMMFA)

– Identify the impact of staff turnover by using models to calculate the cost of an OP to quantify how much was invested in it.

The Digital Organisation is a way of retaining information in the Air Force about the organisational architecture and its relationship with the factors and objectives outlined in the strategy.

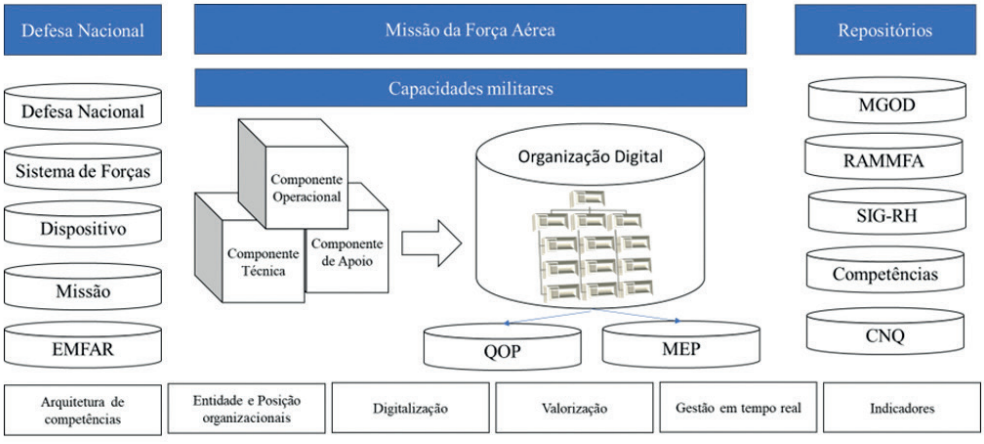

Figure 6 – Digital Organisation Concept
Source: Air Force (2023).

3.2. Guidelines

The directive that guides the development of the Digital Organisation Management Module (MGOD) that dematerialises the SP (which defines the Air Force Organisation) includes the following guidelines:

– Dematerialising the Organisation;

– Standardising concepts, specifically with regards to OEs, when updating the Regulations for the Organisation of Air Bases;

– Standardising the names of OEs according to the concepts and levels described in Table 1.

Table 1 – Names of OEs

Type of OE	Organisational levels
Support to the Chief of Staff	Services, Section, Sector.
Base Unit	Base Unit (Air Base), Group, Squadron, Flight, Section, Sector.
Transversal competency management, does not include executive actions	Office (preferably) without subdivisions (if there are subdivisions, they should be given the names already used by Centre).
Aggregates transversal competencies	Centre, Section, Sector.
Analysis, planning and design body	Division, Department, Section.
Body with transversal functional/technical competencies	Directorate, Department, Section, Sector.
Manoeuvres, Transit or Radar Station Unit	Similar to a Base Unit, in which the levels decrease according to the number of staff allocated to them.

Source: Air Force (2023).

– Standardising the name of the OP, e.g. Commander, Director, Chief, Deputy, Mechanic, Assistant Mechanic, etc;

– Reviewing the personnel numbers in the SP, aligning it with other Air Force regulations (e.g. the number of staff assigned to the operation and maintenance of military capabilities);

– Reviewing Positions occupied by the same person;

– Preparing the SM (based on the OPs), which includes the specialities, ranks (in the case of military personnel) and staff numbers;

– Revisit the concepts of SLP, Accreditation and Qualification, aligning them with the National Catalogue of Qualifications (NCQ), when applicable;

– Introducing the concept of "OP Value" in order to determine its value;

– Developing the DO governance model;

– Comparing the OPs defined in the Organisation to the positions that have been filled and confirm if they meet all requirements;

– Ensure that the action is traceable;

– Linking the repositories, e.g.: the EMFAR, by implementing the rules set out in that document; with the RAMMFA, establishing a relationship between the concepts related to assessment and functions; the National Catalogue of Qualifications, when relevant, by establishing a direct equivalence between military and civilian competencies, in order to facilitate the transition to civilian life at the end of the military contract (when applicable); and the SIG-RH, by assigning a code to OPs to improve awareness and automate the process through which the KPIs and other concepts are updated.

3.3. Functional Requirements

FR (Table 2) serve two purposes. On the one hand, they specify exactly what the IA should do; on the other, they are the key element in the validation process.

Table 2 – Functional Requirements for the IA

Category	Level	Description
User 1	Access	Individual users must access the Application using the Organisation's usual login (username and access key)
User 2	Levels	There should be four levels of access: 1. Administrator. Manages the system, specifically the functions associated with the information system 2. Organisational Administrator. Has access to the tables and is able to check, insert and change their contents (including the OEs and OPs) to ensure the information is always consistent; 3. Organisational User. Can make changes to the information available on the Organisation's OEs and Positions (data administrators). 4. User. Has access to the information on their Position.
Operations 1	Specific queries regarding OEs	With regard to the OEs, the following questions must be answered: 1. What is the total number of OEs (what is the structure of the Organisation)? 2. How many OEs are there in a given OE Group (one or more Groups)? 3. What is the Mission of one or more OEs? 4. What are the Competencies of one or more OEs? 5. What is the Structure of one or more OEs? 6. What is the Organisational Chart of one or more OEs? 7. What are the Themes of one or more OEs (and can they be replaced with a keyword search in the Mission and Competencies domains)? 8. How many levels does an OE have?
Operations 2	Queries related to specific OPs, linked to various tables	With regard to the OPs, the following questions must be answered: 1. What is the total number of OPs (Positions in the Organisation)? 2. How many can be occupied by the same person? 3. What are the characteristics of an OP (individual query)? 4. How many OPs require a specific Rank? 5. What are the required Ranks for each OP? 6. How many OPs require a specific Speciality? 7. What are the required Specialities for each OP? 8. How many POs require a specific SLP? 9. What are the required SLP levels for each OP? 10. How many OPs require an Essential Qualification? 11. What are the required Essential Qualifications for each OP? 12. How many OPs require a Security Clearance? 13. What are the required Security Clearances for each OP? 14. How many OPs require a Desirable Qualification? 15. What are the required Desirable Qualifications for each OP? 16. Free text search feature in the Comments field 17. How many OPs require a specific Function? 18. What are the required Functions for each OP? 19. What is the value of a given OP?
Operations 3	Insert, delete, change, access	Should be possible in all Application Tables, as long as the user has the appropriate level of access. Queries should allow for full or partial visualisation, distribution and aggregation operations.

[Cont.]

Operations 4	Information (link to other repositories)	Regarding Information, the following questions must be answered: 1. What are the total staff numbers and the number of staff for each OE/OP who are disfunctional (are assigned to Positions which are not compatible with their attributes), and which were identified by comparing planned actions to the actions that were taken? 2. What are the means and standard deviation of the number of functions (this can also be calculated for other concepts) with similar names, and how many (and which) Positions fall outside these values? 3. How much does a Security Clearance cost, per OE and OP? 4. What is the Value of each OE and OP?
Operations 5	Statistical and forecast data	Statistical and forecast Data should include the following features: 1. Comparison and Analysis of the number of OEs and of subordinate staff. 2. Analysis of OPs according to their attributes (Rank, Speciality, etc.). 3. Relation to Mission success.
Operations 6	Change Proposals and Changelog	Change Proposals and Changelog should include the following features: 1. History of proposed changes 2. Description of proposed changes, including an impact analysis and a recommendation for a decision. 3. Creation of a new version.

Source: Air Force (2023).

3.4. Data Model

The IA, which was given the designation Digital Organisation Management Module (MGOD), complies with the Air Force standards defined by the General Staff (concepts, SP) and operationalised by the DCSI.

The Data Model described below includes the OEs, OPs and Subsidiary Tables, some of which are transversal to the Organisation. Each OE and OP has a set of attributes that characterize them, which are described in Table 3.

Table 3 – OE and OP attributes

Comp.	Attributes	Description
OE	Code	Generated unique alphanumeric identifier of the OE
	Applicable legislation	
	Name	Free text field identifying the OE, e.g. "Communications and Information Systems Directorate".
	Code of the OE on which it Depends	Alphanumeric identifier of the OE on which it Depends
	Mission	A single sentence describing the mission it performs .
	Competence	Competence(ies) that define the responsibilities .
	Prototypical Organisational Entity	As several OEs have identical descriptors, a Prototypical OE is used, which is essentially a generic concept that serves as a template for creating other OEs. Once the Prototypical OE has been uploaded, it should be possible to change some of the attributes, e.g. "Dependency" and / or "Code". In any case, it is documented that the new OE was created from a Prototypical OE.

[Cont.]

OP	OP code	A generated unique alphanumeric identifier for each Position, e.g. "1E200.001".
	OP name	Free text field identifying the OP, e.g. "DCSI Director".
	Code of the OP on which it Depends	Alphanumeric identifier of the Position on which it Depends, e.g. "1E000.001".
	OE	Free text field identifying the Organisational Entity to which the OP belongs .
	Rank	Rank (military personnel) or category (civilian personnel) of the person that holds the OP. In the case of civilian personnel, this refers to the Category .
	Speciality(ies)	Speciality (military personnel) or category (civilian personnel) of the person who holds the Position. More than one speciality may be selected for the Position .
	May be occupied simultaneously with another Position	Identification of the Position in the list of Positions available for the OE to which it belongs;.
	Full-time military Positions	Numeric value calculated from the military Positions that cannot be occupied simultaneously with another Position .
	Part-time Military Positions	Numeric value calculated from the military Positions that may be occupied simultaneously with another Position .
	Full-time civilian Positions	Numeric value calculated from the civilian Positions that cannot be occupied simultaneously with another Position .
	Part-time civilian Positions	Numeric value calculated from civilian Positions that may be occupied simultaneously with another Position .
	Security Clearance	Security Clearance required for the Position .
	Essential Qualification	List of essential qualifications (e.g. courses, experience in other Positions) required to hold the Position. May require more than one qualification. Taken from a table with a list of all possible qualifications.
	Desirable Qualifications	List of desirable qualifications (e.g. courses, experience in other Positions) required to hold the Position. May require more than one qualification. Given that a Course could be essential for a given Position and desirable for another, it is taken from the Qualifications table, which contains a list of all possible qualifications.
	Language Qualifications (SLP)	Languages required to hold the Position. May require more than one qualification, e.g. "English 3333" and "French2222". Taken from a table containing a list of all possible qualifications .
	Comments	Description of relevant aspects for the Position .
	Functions	List of functions associated with the Position. More than one function may be selected for the same Position .
	OP Value	Value of the person occupying the position based on the costs calculated for the OP .
	Prototypical Organisational Position	Given that several OPs have identical descriptions, it should be possible to define a Prototypical OP in the application to serve as a template for creating other OPs. After the Prototypical OP has been uploaded, it should be possible to change some of the attributes, e.g. "Rank" and / or "Speciality". In any case, it should be documented that the new OE was created from a Prototypical OE.

The Data Model is also based on the subsidiary tables Mission, Competence, Rank, Speciality, Security Clearance, Qualifications, SLP and Functions.

The studies conducted at the AFA were instrumental in the choices that were made when desiging the concepts and the model, such as the adoption of the competency architecture, the competency profile and the Online Organisation structure, making the necessary changes to accompany the evolution in technologies and concepts.

The DCSI uses the SCRUM methodology (Scrum, 2024) to develop IAs since 2011, using the Outsystems platform (Outsystems, 2024). After defining the functional requirements, the development process is divided into several phases (sprints) in which all relevant stakeholders are involved. Each sprint usually lasts 2/4 weeks and ends with a retrospective review to ensure that the requirements were met. There are currently more than sixty applications are used in different areas of the Air Force.

The OP attributes in the MGOD provide a basis for building the profile of associated organisational competencies, with different levels of proficiency, so that it can be compared to individual competences. Figure 7 contains two examples of views with segregated data.

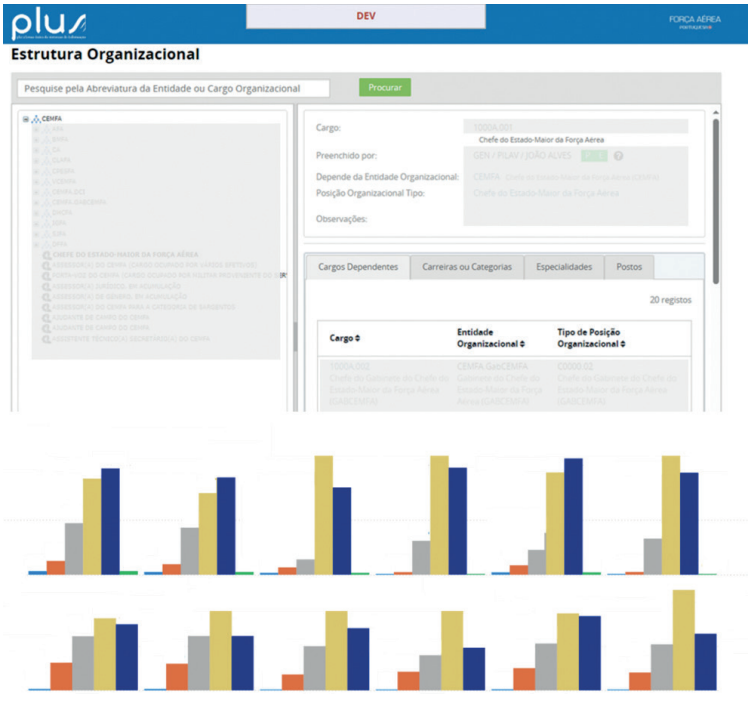

Figure 7 – Examples of MGOD views
Source: Air Force (2024).

The top left view contains the organisational structure of the Air Force. The user can select an OE and access its information, as well as information on the OPs that comprise it. The bottom view shows a graphic with two groups of KPIs.

3.5. Responsibilities and Timeframe

The project was launched at a meeting chaired by the GEN CEMFA. Sectoral meetings were held between the General Staff and the relevant entities, during which the Organisation proposal was optimised as described below.

Table 4 – Responsibilities

Entity	Responsabilities
CEMFA	Guidance and supervision.
	Approval.
Deputy CEMFA (EMFA)	Developing the FRs for the MGOD
	Reviewing the SP with the OE and the Office of the CEMFA, the Deputy CEMFA and the Functional Commands.
	Adapting the designations and harmonising the Organisation's concepts by creating identical structures (catalogues) for identical OEs and creating prototypical concepts to standardise the OEs and OPs
	Elaborating the SM.
	Developing, in coordination with the other OEs, the concepts of OP value, SLP and security clearance.
	Developing the governance model.
	Providing data and concepts in a preliminary version created in EXCEL (Microsoft, 2024).
	Testing and validating the MGOD in coordination with the DCSI.
	Submitting a proposal for the Decision on the SP and the SM.
	Validating and introducing the comments from the OEs.
	Defining the KPIs.
	Developing a proposal to review the regulations on the organisation of air bases.
Logistics Command (DCSI), in coordination with the EMFA and the Directorate of Personnel (DP)	Developing the MGOD, which may include cockpits for Business Intelligence tools, and implementing the KPIs.
	Introducing the following data: Models, Version, Printing, Cockpits, Linking repositories (making it possible to compare planned / current staff).
	Liking the Data Repositories, in coordination with the PD.
	Introducing the Governance Model.
	Testing, validating and publishing the MGOD.
	Producing technical documentation.
Functional Commands	Advising and supervising their OEs and respective attributes.
Air Force Units, Entities and Bodies	Collaborating with the EMFA to develop the organisational structure.

During the project the EMFA and the OEs met almost daily to coordinate the organisation, and, in a later phase, with the DCSI to develop the MGOD. Following Kotter's (1996) recommendations for organisational transformation, nine meetings were held since the project was launched in April 2023. The change vision, objectives and timeframe were developed during those meetings, which were chaired by the GEN CEMFA (involving the

organisation's senior manager and his vision in the project to establish a sense of urgency and the importance of change).

After choosing the team at the launch of the project, in November 2023, the GEN CEMFA approved the Organisation of Air Bases 4, 8 and 11, which was developed using the new DO concepts. This was a short-term win that was visibly and undeniably associated with the change. The process to define the other OEs and OPs was defined with the collaboration of the commanders.

At the time this article was submitted, the OEs and OPs were still being written. The final phase of the process should be developed in the MGOD. The EMFA is finalising the preparations for the DO, the SP and the SM to be issued by the GEN CEMFA.

Validating and testing the MGOD will include distributing it to key users. At this point, the cost of the OP should already be calculated and included, and the requirements identified. Section 3.7.2 contains additional information. As with any computer application, there is a path to improvement that is being travelled, which means that the application will be used by a progressively broader universe.

3.6. Developing the Capability

Once the project is complete, the DO capability will have to be built and embedded into the organisational culture. The Doctrine, Organisation, Training, Materiel, Leadership, Personnel, Facilities / Infrastructures and Interoperability (DOTMLPFI) methodology (North Atlantic Treaty Organisation, 2021) is frequently used in the military (United States Air Force, 2021), and the Air Force uses it in most of its projects to build military capabilities and related services and products.

A set of **Doctrinal** documents on the DO will be developed, including: updating the organisation of air bases, the FRs that will be used to develop the MGOD, the document to support the organisational transformation and the models used to identify the SLP, Security Clearance and Qualifications attributes and the OP value model.

The organisational doctrine defines the relationship between the DO concepts and the information and knowledge that can be used in defining the strategy and management of the Air Force, the implications of integrating the DO into military capabilities, and other fundamental concepts such as cybersecurity and the various areas of sustainability and climate change, especially the RCN2050PrtAF.

With regard to the **Organisation**, the DO includes a set of guidelines and principles that ensure that the capability is built in a consistent, sustainable manner, maximising the linkages with operations, logistics and personnel, including the preparation and basic training for operational functions, logistics, education, qualification and training, and research, development and innovation.

Successful integration implies providing **Education, Training and Qualification** to personnel performing human resource management functions by obtaining useful information to manage staff in acquiring competencies, managing talent and choosing the best career paths.

With regard to **Material Resources,** staff must know what their functions are and be given the resources they need to perform them.

Regarding **Leadership**, personnel should be encouraged to adhere to the competency-based functions culture. To keep up with the rapid pace of technological change, the Air Force must ensure that it can use the services and products in the MGOD application for its command and control processess, integrating them into the organisational product.

In terms of **Personnel**, all staff must know what they have to do, and their functions and qualifications must be linked to the individual assessment process.

In terms of **Infrastructure**, the material resources associated with the OP's functions and the OE's competencies must be provided. Suitable infrastructures are essential for Mission success.

In terms of **Interoperability**, as the data in the system will be shared, it will be necessary to ensure that the data repositories are compatible.

3.7. Validation and answer to the SQs

The SQs were validated and answered based on their compliance with the RRs (DQ-1) and FRs in Table 5 (DQ-2).

3.7.1. Compliance with the RRs and answer to SQ1

The answer to SQ-1 (How can the Air Force organisation be represented in near-real-time?) and the confirmation of the RRs of the IA that was developed, is described in the next sections:

Table 5 – Validation of RRs and answer to SQ1

RR	Validation
RI-1 Identifying the organisational concepts in order to create value and improve decision making.	The following organisational concepts were identified: organisational competencies architecture and profile, catalogue, prototypical organisational profiles, models for calculating the value of OPs and assigning SLP and security clearance.
RI-2 Identifying the OEs and OPs and describing their attributes.	Introducing the standardised OEs and OPs by uploading catalogues and generic profiles (prototypical OEs and OPs) removes redundancies and ensures that, when an OP exists in the six air bases (for example), it has the same functions and requirements for the OP's attributes, pursuant to the rules set out in the EMFAR. It also ensures that the same assessment is carried out for identical functions (based on the RAMMFA and the SIG-RH).
RI-3 Identifying the concepts and developing an IA to manage the organisation in real time l.	In organisations, real-time concepts require a permanent representation of the organisational reality and the possibility of querying the knowledge repository at any given time through questions and comparisons. The MGOD has a set of KPIs, which are available according to access levels, and a free text search, among other features. The concepts OP value and SLP and security clearance requirements also make it possible to calculate the cost of each OP (and the impact on the Mission in the case of early separation) and to determine the value of the language proficiency and security clearance requirements.
RI-4 Ensuring that actions are traceable.	As the MGOD records all operations, the traceability requirement is met.

The answer to SQ-1 is that the Organisation can be represented in near-real time by implementing the concepts recommended in the DO model, describing the OEs and OPs in a systemic and transversal way, designing and developing a IA (the MGOD) and enabling traceability by documenting all operations executed in the application.

3.7.2. IA Assessment and Answer to SQ2

The IA assessment is included in SQ-2 (How can the IA be assessed to determine its suitability and benefits for the organisation, bearing in mind a set of specific requirements?). It confirms if the artifact complies with the following FRs (Table 2):

User;

– Access. Implemented as defined.

– Levels. Implemented as defined. Currently being tested.

Operations:

– Specific queries to OEs. Implemented as defined, with the exception of the Theme concept, which has been replaced by a general text search feature.

– Specific queries to OPs and links to various tables. Implemented as defined.

– Insert, delete, change, access. Implemented as defined.

– Information (link to other repositories) Implemented as defined.

– Statistical and forecast data. Implemented as defined.

– Change Proposals and Changelog. Implemented as defined. Currently being tested.

The answer to SQ-2 is that the IA was assessed by verifying if it complied with the FRs. When creating the artifact, the DCSI followed the standards for designing, testing and validating IAs, adapting them to the Air Force application development process.

3.8. Research Objective and answer to the Research Question

The RQ is contextualised by SQ-1 and SQ-2, which include the FRs, RR-1 to RR-4 and the validation of compliance with the FRs defined for the IA, as described in the section above.

Based on this analysis and on the assessment of the FRs, the answer to the RQ ("*How can the organisation aquire the self-awareness to make traceable decisions in near-real-time?*") is that organisational self-awareness, which enables traceable decisions in near-real-time, is achieved by implementing the organisational concepts and introducing the OE and OP attributes to validate the FRs that were identified.

Therefore, the RO ("*Optimising the way the organisation is managed by comparing planning to execution by aligning the concepts of OE and OP.*") was achieved by implementing the concepts and including them in the MGOD, making it possible, among other things, to compare the planned OPs to those that have been occupied, confirming if they match the OP attributes, thus comparing planning to execution.

4. Conclusions

The study used the DSR methodology to accomplish the RO and answer the RQ, SQ-1 and SQ-2. The following are the most relevan aspects:

– Guideline 1, **Awareness of the Problem**, involved analysing the context, based on the research project hosted by the AFA, identifying the information elements used in the representation, designing the data model and developing, testing and creating the MGOD;

– Guideline 2, **Suggestion and Provisional Design of an Artifact**. To determine the most appropriate solution to the problem, RRs were defined (Table 2) and the MGOD was designed. In the first phase, the relevant concepts were developed, and the SP was defined in coordination with the various Air Force entities;

– Guideline 3, **Development**. A computer artifact with specific functional requirements was developed to obtain a real-time representation of the organisation, making it possible to:

- Understand and represent the organisational concepts and define views of the organisational reality in the form of KPIs;
- Identify and reify existing concepts, integrating them into the Air Force's management systems to facilitate and support decision making in near-real-time;
- Ensure that all actions are traceable through a changelog;

– Guideline 4, **Assessment**. Specific criteria were defined to assess the usefulness, quality and efficacy of the artifact (MGOD).

– Guideline 5, **Conclusions and Contributions**. The study described clearly, unequivocally and verifiably all its contributions to science, including the methodologies that were used to design the artefact (MGOD).

– Guideline 6, **Rigour**. The DO Project for which the MGOD was designed and developed was based on sources used by the DCSI to develop IA, which employ rigorous methods to ensure that the artifact can be traced, tested and validated. Therefore, it was not necessary to develop specific methods or languages, which made the IA easier to understand and use.

– Guideline 7, **Communication**. The study and its findings are described in the master's dissertations and publications produced at the AFA, which makes it possible to replicate the context of use. This article describes the dematerialisation of the Organisation and the organisational competencies as an element of the DO.

Regarding the methodology, the objectives and research questions are described in section 3.7 (SQ) and 3.8 (RO and RQ).

The answer to the RQ is that, by building the IA, the DO improves the way the organisation and its resources are managed, enabling links to other repositories, including views that correspond to KPIs, making it possible to compare the organisation’s planning to the actions that were taken, calculate the value of each OP and identify the impact of staff turnover on Mission success. Therefore, the RO was also achieved.

The study’s contributions to knowledge are based on the findings of the studies conducted at the AFA. This work has added to those contributions by providing practical experience in implementing the concepts and models used to build another component of the DO, the MGOD.

As for recommendations for future studies, more information about the material resources associated with each OP and the value of the OP qualifications should be included in the

MGOD, and the comparison between organisational and individual competencies should be completed.

Integrating organisational knowledge into the Air Force's information systems makes it possible to understand the organisational reality in near-real-time and compare it to planning. The benefits of this are both tangible and intangible, providing an opportunity to create value. As such, the Air Force has made yet another contribution to digital transformation applied to military capabilities.

"The control of a large force is the same principle as the control of a few men: it is merely a question of dividing up their numbers"
Sun Tzu, A Arte da Guerra

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