LUNDS UNIVERSITET

Future Warfare: Navigating AI Integration in Military Combat Decision-Making

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Master in Management

May 2024

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Abstract

The integration of Artificial Intelligence (AI) into Military Combat Decision-Making Processes (MCDMP) has been capturing the attention of numerous nations and international organisations. This thesis explores the complex realm of military decision-making, often marked by high-stakes situations and time constraints, which can lead to cognitive biases and heuristic-driven errors. Adding new technologies to processes in which critical decisions need to be made will require certain adjustments and approaches by the human operator. Due to the humanitarian impact of the decisions taken, AI integration must be done carefully, addressing potentially hindering factors to ensure that there is a responsible use of these technologies. Some of these surround the human-AI collaboration, specifically the acceptance of the technology, which can impact its usage and development, as suggested by the literature. Our research will employ a multifaceted qualitative approach, combining a review of academic literature, interviews with experts in military science with AI knowledge, and interviews with military personnel to provide a comprehensive understanding of the impressions held by specialists and military personnel regarding AI as a decision-support system (DSS).

This study raises awareness of the importance of cognitive constructs in fostering human-AI collaboration and uncovers the current perspectives military combat decision-makers have on using AI technology to aid decision-making. We aim to contribute to the ongoing discussion regarding the challenges and opportunities of integrating AI as a DSS in military operations. We will offer insights that can facilitate a more informed and effective adoption of AI technology in high-stakes contexts. Through the Technology Acceptance Model (TAM) and the Technological Frames theory, we unveil perception, assumptions, expectations and trust as factors that impact the acceptance of AI as a DSS. Thus, enabling the enhancement of the effectiveness of military combat decision-making through the usage of AI tools responsibly.

Keywords: Military Combat Decision Making Processes (MCDMP), Artificial Intelligence (AI), Human-AI Cooperation, Assumption, Expectations, Trust, Perceptions, New Technologies Acceptance, Challenges in AI Adoption, AI in Military, AI in Decision Making.

Abstract (Portuguese)

A integração da Inteligência Artificial (IA) nos Processos de Tomada de Decisão em Combate Militar (*MCDMP*) tem captado a atenção de inúmeras nações e organizações internacionais. Esta tese explora o complexo domínio da tomada de decisão militar, frequentemente marcado por situações de alto risco e limitações de tempo, que podem levar a enviesamentos cognitivos e erros impulsionados por heurísticas. A adição de novas tecnologias a processos nos quais decisões críticas precisam ser tomadas exigirá certos ajustes e abordagens por parte do operador humano. Devido ao impacto humanitário das decisões tomadas, a integração da IA deve ser feita com cuidado, abordando fatores que possam dificultar o uso responsável destas tecnologias. Alguns desses fatores envolvem a colaboração Humano-IA, especificamente a aceitação da tecnologia, que poderá influenciar seu uso e desenvolvimento, como sugerido pela literatura. A nossa pesquisa empregará uma abordagem qualitativa multifacetada, combinando uma revisão da literatura académica, entrevistas com especialistas em ciência militar com conhecimento em IA e entrevistas com militares para fornecer uma compreensão abrangente das impressões mantidas por especialistas e militares sobre a IA como um sistema de suporte à decisão (*DSS*).

Este estudo destaca a importância dos construtos cognitivos na promoção da colaboração Humano-IA e revela as perspectivas atuais que os decisores de combate militar têm sobre o uso da tecnologia de IA para auxiliar na tomada de decisões. O nosso objetivo é contribuir para a discussão contínua sobre os desafios e oportunidades de integrar a IA como um DSS em operações militares. Oferecemos reflexões que podem facilitar uma adoção mais informada e eficaz da tecnologia de IA em contextos de alto risco. Através do T*echnology Acceptance Model* (*TAM*) e da *Technological Frames theory*, revelamos a percepção, suposições, expectativas e confiança como fatores que impactam a aceitação da IA como um *DSS*, permitindo assim a melhoria da eficácia da tomada de decisão em combate militar através do uso responsável das ferramentas de IA.

Palavras-chave: Processos de Tomada de Decisão em Combate Militar (MCDMP), Inteligência Artificial (IA), Cooperação Humano-IA, Suposições, Expectativas, Confiança, Percepções, Aceitação de Novas Tecnologias, Desafios na Adoção da IA, IA no Setor Militar, IA na Tomada de Decisões

Acknowledgements

First and foremost, we would like to acknowledge the computer room in Alfa 1 at LUSEM, which became our sanctuary during the challenging period of Margarida's laptop crash midway through our thesis.

On a more serious note, we would like to express our gratitude to all the military personnel and the researchers who generously shared their perspectives with us, enriching our research with their extensive professional and academic knowledge. We are deeply grateful for their openness and willingness to contribute to our work especially considering the sensitivity of the topic. Next, we extend our gratitude to NATO and the Innovation and Transformation Division of the Portuguese Armed Forces for their invaluable assistance in shedding light on our research and providing insights and suggestions. Furthermore, thank you to all the other intervenients who helped shape our study.

We would also like to express our sincere gratitude to our thesis supervisor, Stein Kleppestø. Your guidance and keen interest in our research topic have been invaluable throughout the writing process. Your continuous feedback, coupled with the freedom you afforded us to shape our research according to our own vision, has been instrumental in our academic journey. We would like to extend our heartfelt gratitude to Hassan Hamadi, doctoral student at LUSEM. Your unwavering support, guidance and encouragement have been pivotal in bolstering our work and providing crucial orientation throughout our research journey.

On an individual level, I, Mafalda, would like to express my deepest gratitude, first and foremost, to my mother. You are the strongest and most fearless woman I have ever known, and you inspire me every day. To my father, thank you for teaching me that I should never hold myself back and always pursue my dreams. To my granddad, your pride in me and your constant reassurance that everything will be alright has been a guiding light. A special thanks to my grandmother; I hope you are watching over me with pride. This is for you. Lastly, to my thesis partner, thank you for balancing my moments of delusion with your steady support, and for all the laughs, shared worries, and late-night reassurances. Your companionship has made this journey much more joyful.

On a personal note, I, Margarida, would like to thank my family and friends. A special thank you to my parents, you have supported me and stood by my side through each of my choices and dreams, regardless of the efforts they required from you. To my grandparents, thank you for always being so proud and encouraging, all your candles, words and gestures of support brought me comfort and motivation during this year. And to my sister, Simone, my inspiration and pillar, thank you for always believing in me and having my back, unconditionally. Everything my family has done for me throughout my life has brought me to where I am today and I could not be more thankful to every single one of them. To my friends, both old and new: your support has been invaluable. Your constant words of encouragement, gestures of support, and simply being there for me when I needed most, have made this journey possible. I cherish each of you and the unique role you play in my life! Last, but not least, a special thank you to my thesis partner, Mafalda. Your unwavering trust in our capabilities, dedication to our research, and cheerful sense of humour has made this thesis not only possible but also enjoyable.

Thank you!

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Abbreviations

AI (Artificial Intelligence)

COA (Course of Action)

COE (Council of Europe)

DM (Decision Making)

DSS (Decision Support System)

Ed./Eds (Editor/Editors)

Edn (Edition)

IDSS (Intelligent Decision Support System)

MCDMP (Military Combat Decision-Making Process)

MDMP (Military Decision Making Process)

ML (Machine Learning)

N.d. (No Date)

No. (Number)

OODA (Observe Orient Decide Act)

P./Pp. (Page/Pages)

TAM (Technology Acceptance Model)

UN (United Nations)

UNODA (United Nations Office for Disarmament Affairs)

Vol./Vols. (Volume/Volumes)

XAI (Explainable AI)

Terminology

Autonomous Systems	Systems capable of performing tasks without human intervention.
Explainable AI	AI systems are designed to provide clear, understandable explanations of their processes and decisions.
Human-Machine Interaction	The collaborative processes and dynamics between human users and AI systems.
Intelligence Decision-Support System	An AI-based system that supports the decision-making activities of human users.
Machine Learning	A subset of AI that involves training algorithms on data to enable systems to learn and improve from experience
MCDMP	Decision-making in military operations that involve the use of force, either lethal or non-lethal
Participants	Experts and Military Personnel who were interviewed by the researchers
Technological Frames	The mental expectations and assumptions that individuals hold about technology, shape how they perceive and interact with technological systems.
Technology Acceptance Model	A theoretical model that explains how users come to accept and use technology, emphasising perceived usefulness and perceived ease of use as key determinants.

1. Introduction

1.1. Background

Over the past decade, with the increasing role of artificial intelligence (AI) in society and its integration into many aspects of daily life, and various industries, there has been a growing debate on its integration into military operations (UNODA, 2019; Federspiel et al., 2023; Ponzio & Siddiqui, 2023). AI applications in the military sector are not new: AI is already influencing military decisions in many countries regarding communications and logistics, (Mayer, 2023; Scale, 2024). However, the debate grows stronger when it discusses the application of AI in systems like lethal autonomous weapons (UNODA, n.d.; Roff, 2014; Galliott & Wyatt, 2020) or in the cycle of decision-making in combat operations (REAIM, 2023).

The impact of military combat decisions cannot be overstated. Military personnel operate in high-stakes and stress-inducing environments, and decision-makers must constantly opt for actions that can mean life or death, often with time pressure and limited information to decide. According to Kahneman (2011), this type of fast and, consequently, intuition-driven decisions, can lead to faults and biases in the decision-making process. Traditionally, humans and automated systems have fulfilled complementary but separate functions within military decision-making processes (Hosack, Hall, Paradice, & Courtney, 2012). However, literature and organisations suggest that AI holds the potential to enable a deeper integration in decision-making processes. This focus on utilising AI-enabled systems for decision-support (NATO, 2019), also known as Intelligent Decision-Support Systems (IDSS), has then been fueled by the recognition of the impact that AI can have in enhancing operational effectiveness and modifying the military operational decision-making process (Christie & Ertan, 2022; Meerveld et al., 2023).

By leveraging AI functions, DSSs can analyse complex data sets and detect patterns that might elude human cognition (Moisescu et al., 2010). Van den Bosch & Bronkhorst (2018) state that the use of IDSSs can mitigate cognitive biases inherent in human decision-making and provide rapid sense-making capabilities, thus aiding in situation understanding.

Consequently, AI can ease the burden of stressful decisions (NATO, 2019). However, potential risks are also being discussed, such as concerns surrounding the ethical and legal implications, for example, the accountability and transparency of employing AI in a high-stakes environment, where human lives are impacted by the outcomes (Johnson, 2022; Guterres, 2023).

Furthermore, the level of AI integration in decision-making processes has also been under discussion. For some, human-AI cooperation is the ideal balance between technology and human action (human in-the-loop), while others envision AI taking over the entire decision-making process (human on-the-loop and human off-the-loop). So far, humans and support systems have fulfilled complementary but separate functions within military decision-making processes (Hosack et al., 2012). Nevertheless, technological advancements suggest that AI holds the potential to enable a more aware, coordinated, and integrated human-AI integration in decision-making processes. To accomplish that, the responsible use and integration of AI is crucial (NATO, 2021; REAIM, 2023; European Commission, 2021).

Hence, due to the biased and impactful consequences AI can have, especially when considering AI integration in decision-making processes which have potentially lethal outcomes, it becomes paramount to ensure there is a successful implementation of the human-AI collaboration. For that, some factors need to be taken into consideration, which are the result of relevant frameworks when discussing the integration of new technologies, such as AI. As highlighted by the TAM (Davis, 1989) and the Technological Frames theory (Orlikowski & Gash, 1994; Kaplan & Tripsas, 2008), individuals' perceptions, assumptions, expectations about new technologies, and their levels of trust play crucial roles in human-AI dynamics. As we will expose later on, all of these cognitive constructs intertwine and unfold into five relevant notions: perceived usefulness and perceived ease of use (Davis, 1989); expectations and assumptions (Orlikowski & Gash, 1994; Kaplan & Tripsas, 2008), and trust (Baroni et al., 2022).

Humans and AI can have different perspectives on the situation they are facing, and therefore different ideas regarding the right course of action to choose. Especially when considering the high-stakes scenarios in which military decision-makers often operate such as combat operations, where military decision-makers need to consider numerous variables amidst deep uncertainty (Jong et al, 2014). In these scenarios, the consequences of the wrong decision can

be tremendous, potentially escalating problems and leading to the loss of human lives. The way military personnel make sense of AI is crucial, as it will influence the adoption of the suggestions given by the AI-enabled decision support system. Insufficient efforts have been made to understand or assess this situation and to address the previously mentioned factors. Some authors have highlighted the importance of training military personnel to enable and improve their interaction with AI systems (Kerbusch et al., 2018; Van den Bosch & Bronkhorst, 2018). The improvement of skills and competencies seems pivotal to address the cognitive factors that impact integration, and hence leverage human-AI collaboration. Yet, so far this topic seems to have been neglected (Boutin et al., 2023; Schraagen & Diggelen, 2021), especially in decision-making processes that occur in MCDMP.

1.2. Problem Statement

As stated, existing studies and research have focused on the importance of individuals' perceptions and level of trust when integrating new technologies. Negative perceptions and lack of trust can affect the usage and development of AI in MCDMP, and misusing AI in combat missions can have devastating consequences, including but not limited to, the loss of human lives. For instance, unintended conflict escalations can occur due to misinformation or misinterpretation of potential imminent threats. Ethical dilemmas also arise from discrimination, lack of cultural awareness, or biases embedded in AI algorithms. These issues underscore the critical nature of the problem at hand: a lack of positive integration of AI-enabled decision support systems in MCDMP, where humans fully understand how to utilise AI effectively and trust the outcomes and suggestions presented by these systems, can lead to catastrophic outcomes.

In high-pressure and time-sensitive scenarios, which characterise combat operations, the risks associated with AI misuse are magnified. Decisions made under these conditions often have life-or-death implications, generally with little time to assess the situation and opt for a course of action, Moreover, these decisions can have personal and professional repercussions on the decision-maker. Although these life-or-death decisions have a tremendous impact, the risks of integrating AI without proper acceptance and understanding of the AI tool in MCDMP do not seem to be prioritized.

The problem of not ensuring a correct acceptance regarding AI integration in MCDMP is multifaceted and carries significant consequences. Firstly, without understanding and relying on the tool, military personnel may hesitate to accept the suggestions provided by AI tools, undermining the potential benefits they offer and resulting in slower decision-making processes. Secondly, if expectations and assumptions of military personnel are not aligned with the capabilities of AI this will hinder acceptance. Military personnel may not see the usefulness of the tool and opt for less effective or non-optimal solutions. This could lead to less informed choices due to the lack of access to comprehensive data and analytical insights that AI can provide. Moreover, major adversaries of military forces are already integrating AI into their operations. As stated by Katrina Manson (2024), failure to embrace AI integration could result in a strategic disadvantage on the battlefield. As quoted by Donahue, US military commander, “You will not have a choice. Your adversaries are going to choose for you that you have to do this” (Manson, 2024). We are past the point of deciding whether to integrate AI or not in MCDMP. Hence, we shift the focus to the acceptance and impressions surrounding AI integration in MCDMP to ensure operational effectiveness, strategic advantage, and mitigate potential risks on the battlefield.

The TAM and the Technological Frames theory provide valuable frameworks for assessing factors that impact acceptance and impressions of AI integration. Additionally, conducting in-depth interviews with military personnel can offer insights into their specific perceptions towards AI systems, their assumptions and expectations, and their level of trust. Without addressing these critical factors, the potential benefits of AI in enhancing MCDMP effectiveness and speed cannot be fully realized, and negative consequences can surface. Therefore, it is imperative to explore which factors military personnel, and researchers, consider paramount to ensure a positive integration of AI-enabled decision-support systems. Additionally, it is crucial to understand what are the current perspectives of military personnel regarding AI integration in MCDMP, and their level of trust towards these new technologies. Assuming they consider these important factors, if the perceptions are not positive, and there is a lack of trust, then further measures need to be taken to address the potential risks and prevent negative outcomes.

1.3. Research Purpose

This research aims to explore the critical cognitive factors impacting human-AI collaboration in MCDMP. Through semi-structured interviews, we will investigate the current perceptions that military personnel have regarding AI integration as a DSS, and assess the level of trust military decision-makers and military scientists with AI knowledge place in AI systems. By doing so, our research purpose is to increase awareness of the critical need for a responsible integration of AI into MCDMP. We seek to shed light on the factors that influence a smooth human-AI collaboration, driven by the significant consequences it can lead to if it is not integrated positively and utilised with caution in military combat operations.

We will delve into the perceptions, expectations, and assumptions surrounding the adoption of AI in the MCDMP. By analysing theoretical frameworks and gathering insights from both military scientists in the field of AI governance and military personnel, this research will uncover the current state of military impressions of AI integration and to what extent do these stakeholders trust AI as an DSS. By elucidating these factors, important alongside the preparedness of the technology's capability, this study aims to provide valuable insights for military institutions globally, for researchers, and at a more general level, for decision-makers in other industries with high-stakes decisions.

Our conclusions will assist stakeholders in navigating the complexities that involve integrating AI as a DSS of MCDMP, enabling them to anticipate and prepare for potential challenges and risks, without compromising human lives or the integrity of military operations. Additionally, we aim to create awareness of the need for further future research to facilitate a responsible and effective integration of AI into MCDMP, by focusing, for example, on ways to foster trust in AI systems in military contexts.

By addressing the following questions, we seek to contribute to the ongoing discussion on AI's role in military operations and provide insights into fostering effective human-AI partnerships in MCDMP. This will be crucial for preventing the severe consequences of AI misuse, and for leveraging the technology to its fullest potential in improving military operations, assuring a responsible and careful use of AI as a DSS.

1.4. Research Questions

Research Question 1: *What are the factors that military personnel consider more relevant when integrating AI into their combat decision-making processes?*

Research Question 2: *How do AI experts and military personnel comprehend the role of AI-supported tools in military combat decision-making?*

Research Question 3: *To what extent do military decision-makers & researchers trust AI systems to enhance the combat decision-making processes?*

1.5. Delimitations

This research will primarily focus on military decision-makers and personnel within European military contexts. While insights from other regions may be considered, the study's primary emphasis will be on the perspectives prevalent in European military institutions. Within military decisions, we will delimit our scope to decisions in combat operations, due to their high-stakes nature, using AI for logistics or human resources falls out of the scope of this thesis. We acknowledge the diversity in military decision-making processes across different countries and this research will provide a general overview of the steps taken, as delving into specific national procedures does not bring value to the thesis.

Additionally, while technological capabilities might influence the integration of AI in MCDMP, our focus will be on how human military decision-makers understand and interact with AI systems. Regarding the level of integration of AI systems in the DM process, we assume an integration where humans will be involved in the process (human in-the-loop), based on current discussions by relevant stakeholders. Nevertheless, we acknowledge the possibility of an eventual replacement of humans by AI in the entirety of the decision-making process.

1.6. Outline of the Thesis

The subsequent chapter establishes the theoretical framework, providing a comprehensive overview of the current state of AI integration in MCDMP and tackling relevant concepts, such as Artificial Intelligence, and military decision-making processes. It also presents important models of technology acceptance, Technological Frames and TAM, addressing the concepts related to the models: perceptions, assumptions, expectations and trust. The third chapter details the research methodology, including the qualitative approach, selection criteria, and data collection and analysis methods. It covers semi-structured interviews, data analysis techniques, and measures for validity and reliability, along with ethical considerations. In the fourth chapter, an analysis and discussion of the data collected are presented. The findings from the literature and interviews are unveiled and discussed, starting with the current state of AI integration in the MCDMP, and categorizing the findings in (1) perceived usefulness, (2) perceived ease of use, (3) expectations and assumptions, and (4) trust and trustworthiness. Moreover, we will provide answers to the research questions. Finally, the fifth chapter will reflect on the research, by providing a summary of the main findings, the contributions of the research, and recommendations for further research and industry actions.

2. Theoretical Framework

2.1. Artificial Intelligence Technologies and Its Application to Military Decision-Making Processes

2.1.1. Definition of Artificial Intelligence

Albeit being a seemingly recent concept, Artificial Intelligence has been the object of study since the middle of the XX century (Turing, 1950). Turing was the first to question the possibility of having intelligent machines, in 1950, however, it was McCarthy who coined the term "AI", in 1956, (COE, n.d.). Throughout the years there has been a growing interest in the potential of AI and the development of the concept. In the past decade, it has gained a more relevant place and consideration as a disruptive technology (Augustyn, 2017). Despite the growing interest and focus on this technology, there still does not exist a consensual definition of AI. This is due to the complexity of the concept along with the difficulty of conceptualising intelligence. Even though there is no consensual definition, there is still value in attempting to mitigate the fuzziness of the concept, to enable coherent and clearer research. (Devedzic, 2022).

The European Commission (2018) defines AI as "systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals". The United States Department of Defense defines it as "the ability of machines to perform tasks that normally require human intelligence" (Allen, 2020). Whereas other international institutions, such as the United Nations accept that "there is no universal definition of AI", recognising it as "a discipline of computer science that is aimed at developing machines and systems that can carry out tasks considered to require human intelligence" (UNRIC, 2024).

There are various dichotomies when it comes to the concept of AI (Devedzic, 2022). For the purposes of this thesis, we will present three dichotomies and clarify our stance on it. From this, we will narrow the focus to the concept of AI when applied to decision-making processes and, more specifically, in the defence sector. The first distinction will be between "weak" AI and "strong" AI, to introduce different stages of AI, and what they mean in terms of capabilities. After presenting different stages, and their capabilities, we will discuss the dichotomy of "human-driven" AI, where there is a human in-the-loop, and "autonomous" AI, to unveil the level of integration of AI in military combat decision-making processes (MCDMP). The level of AI integration will have consequences in responsibility assessment and allocation, possible algorithmic biases and discrimination (Devedzic, 2022; European Commission, 2019a; Ivanov, 2023) and the level of testing and training. Finally, we will introduce the difference between "black-box" AI and "explainable" AI, which influences the previously mentioned level of integration.

It is important to clarify that we do not aim to analyse with depth different branches of AI, nor do we find it important to identify which are the correct denominations, or to explain the characteristics of the technical side of AI. There are various categorizations of AI and its ramifications, as well as multiple designations for the same concept or idea, however, its clarification is not relevant at this stage of the research. Instead, we aim to unveil in what sense and at what level do we envision AI integration in MCDMP (see Figure 3).

2.1.1.1. Weak AI and Strong AI

Weak AI, also referred to as Narrow AI, or Handcrafted Knowledge Systems, is an AI classification where the system does not possess the capacity for general intelligence or consciousness. This means it functions solely within the confines of its programmed instructions, operating only within the limits of what it was taught. (Allen, 2020; Martinez, 2019; QA, 2024).

Strong AI, also referred to as General AI, or Machine Learning, is an AI classification that operates with training data. In this case, the AI system goes beyond its explicit coding learning from data and making decisions taking insights from past experiences. (Allen, 2020; Martinez, 2019; QA, 2024).

It is still under debate if we have reached a phase of AI that takes into consideration and adapts to the feedback of its surrounding environment, or if we are still at a point where AI only operates without learning. (Allen, 2020; QA, 2024). This uncertainty regarding the current state of AI might be due to the discrepancy in opinions regarding concepts´s designations.

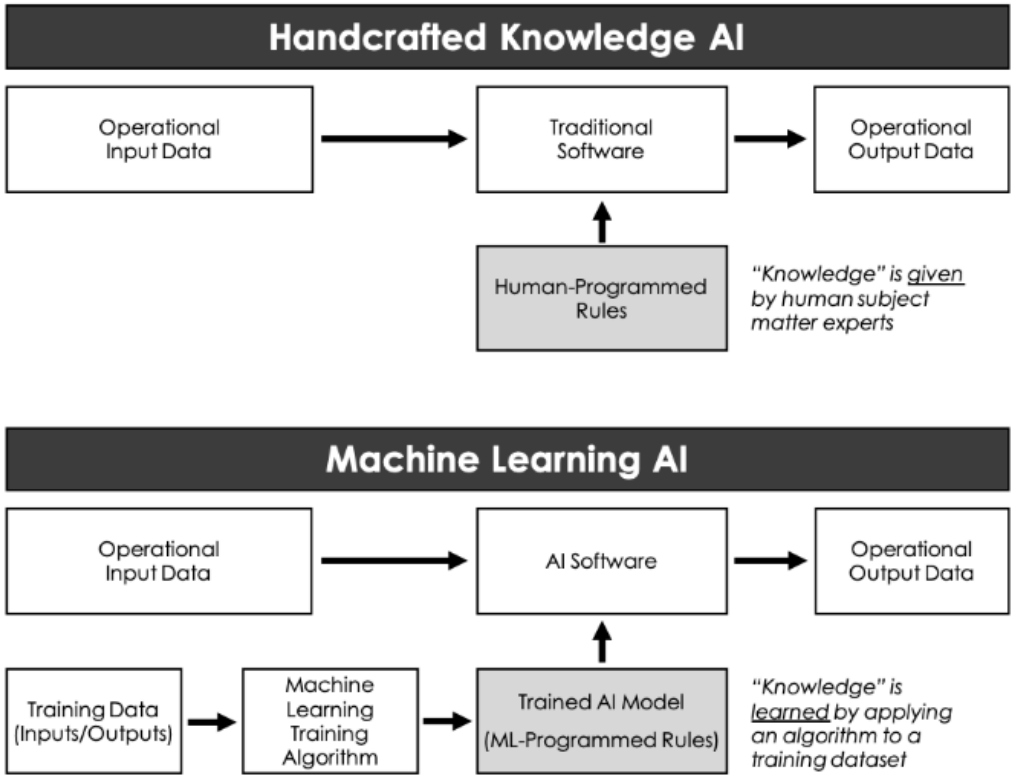

Figure 1: Diagram of AI Approaches - Retrieved from Allen (2020)

Additionally, there is another stage of AI, referred to as Superintelligence AI, where AI systems become self-aware, exceeding human intelligence and having sensient properties, (QA, 2024). This stage is merely a hypothetical development of AI.

2.1.2. Level of AI Integration

2.1.2.1. Human in-the-loop and Autonomous AI

Having human-AI cooperation in the decision-making process differs from a completely autonomous AI-enabled decision-making process, where humans do not take part in any stage of the process. In this matter, NATO (2019) identifies 3 possibilities, depending on the level of autonomy of AI: humans can either be off-the-loop, when AI has complete autonomy to act, and humans cannot do anything about it; humans can be on-the-loop, when AI has complete autonomy, but humans retain the power to cease its actions; or humans can be in-the-loop, when they retain control over the AI systems. When it comes to military combat decision-making processes, keeping humans "in-the-loop" is seen as the optimal option when considering integrating AI-enabled systems, as opposed to having the entire process being run exclusively by AI (Dear, 2019; Devedzic, 2022).

Considering the current state of AI integration in military decision-making processes, the paradigm is presently focused on keeping humans as the final decision-makers (European Commission, 2019a). This human-centric approach aims to use AI as a decision-support system (European Commission, 2019a), which can facilitate and improve the military decision-making process, despite having considerable shortcomings: insufficient trust, and model rigidity, vulnerability and incomprehensibility, among others (Van den Bosch & Bronkhorst, 2018). Therefore, this thesis focuses on the collaboration between humans and AI in the process of making military decisions on the battlefield, when AI is used as an decision support system (DSS) (Kaklauskas, 2015).

2.1.2.2. Black-box AI and Explainable AI

In the following chapters, we will refer to the importance of understanding the process that leads to a certain decision from AI, as suggested by Balis & O'Neil (2022), as this explainability will influence the level of integration of AI, as observed in the figure below (Van den Bosch & Bronkhorst, 2018).

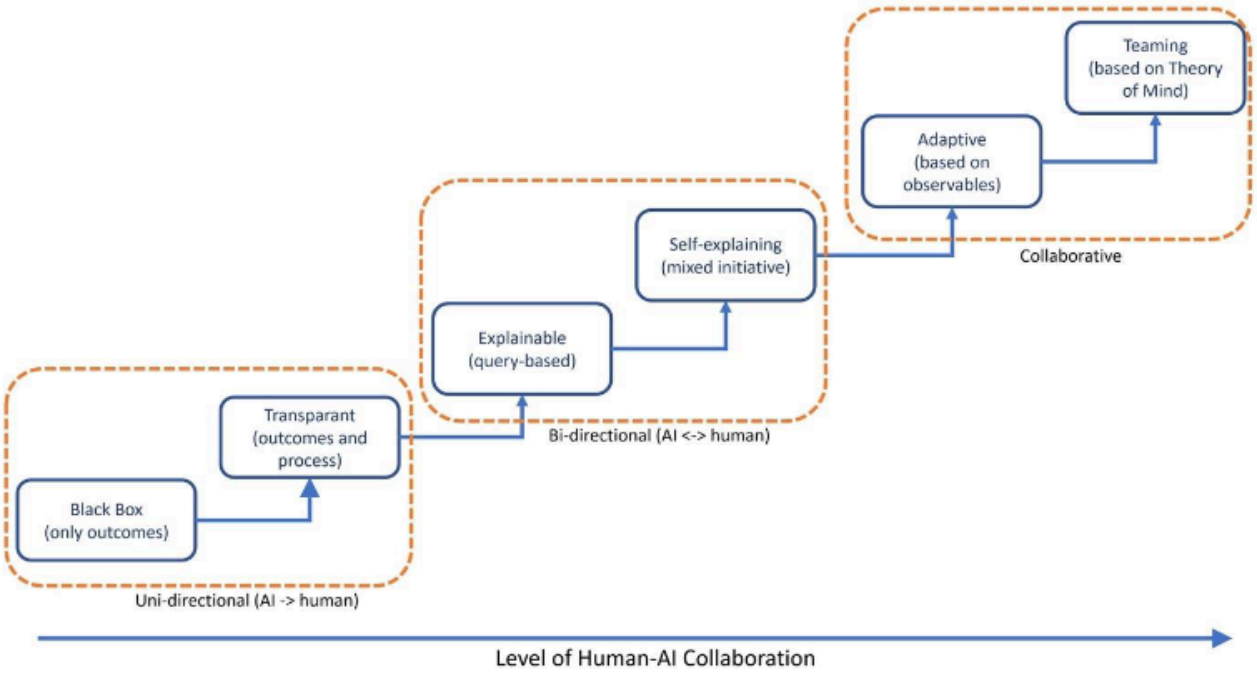

Figure 2: Levels of human-AI collaborative decision-making - Retrieved Van den Bosch & Bronkhorst (2018)

This is due to the impact that explainability can have when talking about trusting AI (O'Hara, 2020; Søgaard, 2023). It is then important to clarify what is meant by explainable AI and its distinction from black-box AI. It is not clear in the literature which of both AI-systems would be used for aiding the battlefield decision-making process, however, machine-learning systems are often associated with opaque reasoning due to their complexity (Holzinger, 2018).

Explainable AI, also referred to as XAI, alludes to a model of AI that clarifies its decisions, by demonstrating the data collected and analysed, its reasoning, and the process that leads to a certain decision. With this model, humans can understand the outcome, or decision, of the system, which is crucial in a high-stakes environment, such as the ones that can be found in the defence sector. Explainability and transparency are especially relevant when trying to mitigate algorithmic biases, such as discrimination. (Devedzic, 2022).

Contrasting with XAI, the term black-box refers to AI models that are unclear regarding its decision-making process, making it impossible to ascertain the reason behind the decision or to comprehend what data was collected and how it was processed. This can unintentionally enable the perpetuation of biases and discrimination, which can have devastating consequences when making a decision on the battlefield. (European Commission, 2019b). Enhancing comprehensibility is essential to mitigate the 'black box' perception often associated with AI systems (Hoff & Bashir, 2015).

2.1.3. Military Decision-Making Processes

The complexity and impactful consequences of combat operations decisions require the military to follow thoroughly established decision-making processes to ensure legitimacy and respect for human and international laws. There is no universal decision-making combat operations decision-making process, and the specificities of each process vary depending on the country or region in focus. (International Committee of the Red Cross, 2013).

Presenting some examples, the MDMP (Military-Decision Making Process) is a seven-step process used predominantly by the United States Army (Williams, 2010). As outlined by Janser (2007) the steps are: receipt of mission, mission analysis, course of action (COA) development, COA analysis, COA comparison, COA approval, and orders production. The CSDP Mission Planning Process (Common Security and Defence Policy) is a mission planning framework presented by the European Union (EU), used for military operations, as well as civilian and mixed operations, concluding in several lines of operation with decisive points, to affect opponents' centre of gravity (Mattelaer, 2010). The OODA (Observe Orient Decide and Act) is a decision-making cycle proposed by John Boyd, presenting a more simplistic and broad view on the process of making decisions (Johnson, 2022), interpreted and used by some military troops (Hammond, 2013).

We do not find it relevant to focus on a specific process, as the impact will be similar, but rather have in mind the common major steps of the processes, to understand where AI can be integrated. We identified the following common features: (1) the process starts by receiving a mission from a higher authority; (2) information is collected and analysed; (3) courses of action (COAs) are established; (4) COAs are compared and the optimal is chosen; (5) the

chosen COA is executed. Note that these are cyclic and continuous steps, constantly updated by new information (Van den Bosch & Bronkhorst, 2018).

2.1.4. Contemporary Paradigm of AI Technologies Integration in Military Decision-Making Processes

From Intelligence, Surveillance, and Reconnaissance (ISR) to logistics and communications, AI is already being used by the military in many countries (Mayer, 2023; Scale 2024), making, or influencing, decisions, in these areas. Nevertheless, the evolving possibilities of AI applications in the military seem never-ending (NATO, 2020), and countries are increasing their investment to expand and improve AI integration in various military applications.

NATO (2019) has identified, among others, two pressing key areas in which AI can be integrated into military operations: robotic autonomous systems, and information and decision support. Although both can be very impactful in military operations, we are focusing on the latter, as studying the application of AI as an DSS can enable promising enhancements in decision-making processes (Kaklauskas, 2015). This focus will allow us to thoroughly analyse the dynamics of human-AI teaming in MCDMP: how human cognitive factors can hinder or smooth the integration process, and the importance of positive impressions and trust in the AI-enabled system. Fostering mutual awareness between decision-makers and AI systems is imperative for optimising decision-making processes in military combat operations (Van den Bosch & Bronkhorst, 2018).

The Figure 3, shown below, condensates the level of integration of AI and the level of collaboration between AI and the human decision-maker for a visual representation of the possibilities mentioned in the sections above.

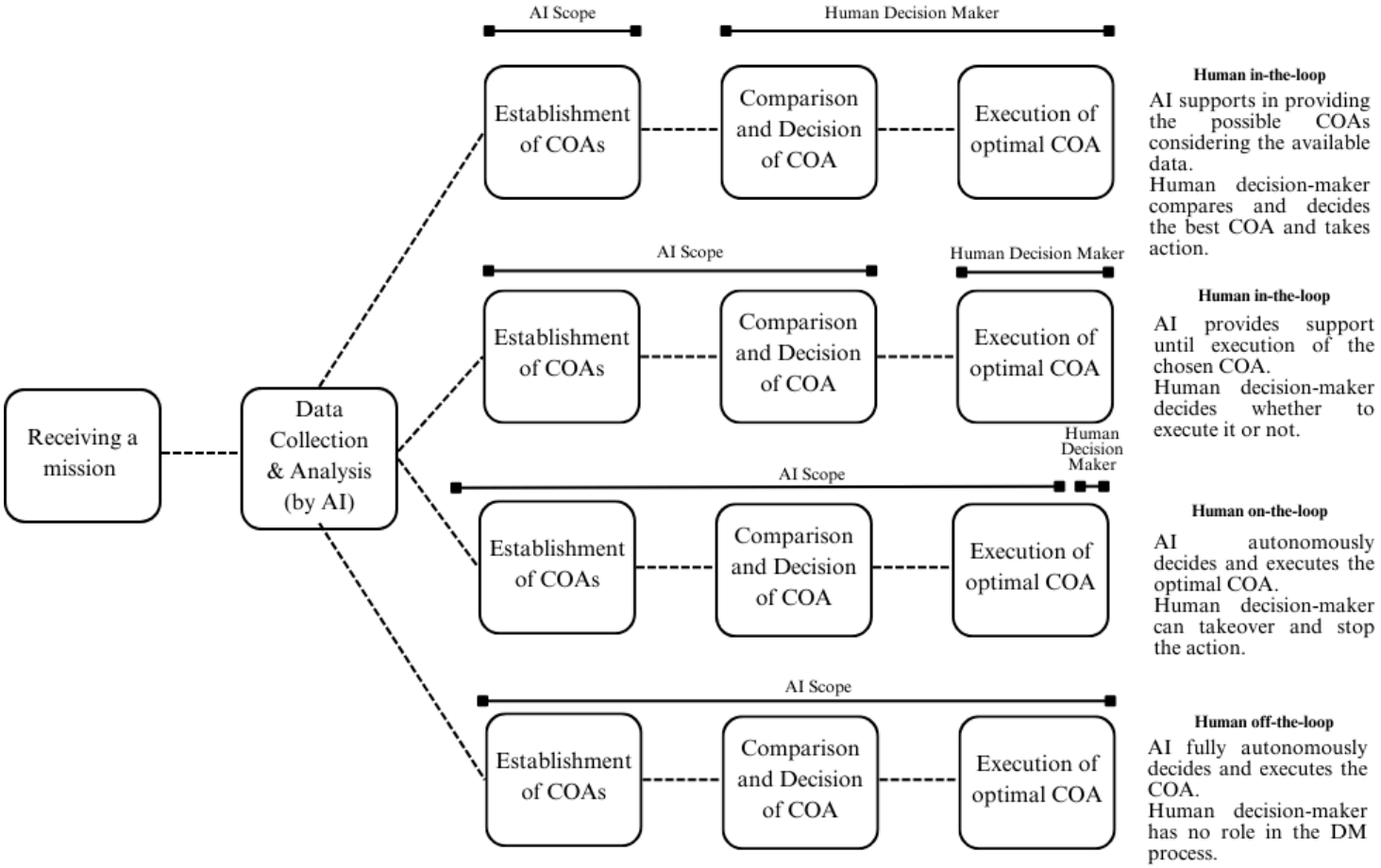

Figure 3: Simplified model of AI Levels of Integration in Military Combat Decision Making Processes - by the authors (Meleiro & Passos)

2.2. Perceptions, Assumptions, Expectations, and Trust in AI

2.2.1. The Technology Acceptance Model: Extended to AI

When faced with new technologies, different factors play a role in people's acceptance and consequential attitudes towards them. The Technology Acceptance Model (TAM) provides a framework of such factors, identifying perceptions as a crucial element for the usage of the technologies (Lee at al., 2003; Marangunić & Granić, 2014), as observed in Figure 4. TAM was first introduced in 1986 by Fred Davis, gaining significant notability in the following years. It identifies two types of perceptions as factors to impact technology usage: perceived usefulness; and perceived ease of use (Davis, 1989). This model has been applied to various settings and types of technologies, being more recently considered for AI applications.

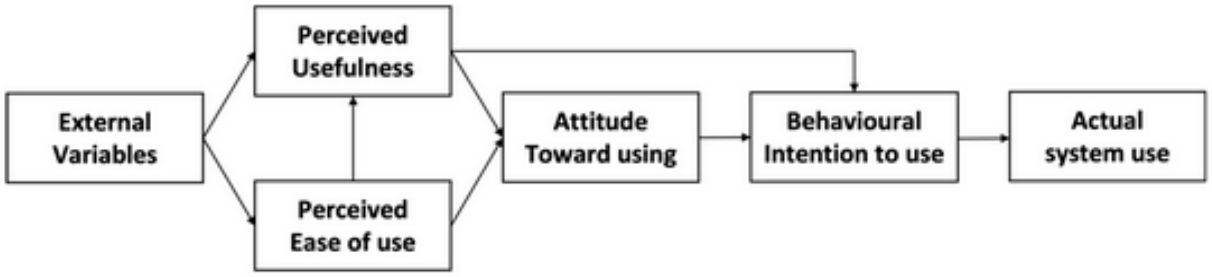

Figure 4: Perceived usefulness, perceived ease of use, and user acceptance of information technology - Retrieved from Davis (1989)

Perceptions are defined by the Oxford Dictionary as “The process of becoming aware or conscious of a thing or things in general; the state of being aware; consciousness”. Cambridge Dictionary goes further by defining it as “a belief or opinion, often held by many people and based on how things seem” and “the way that someone thinks and feels about a company, product, service, etc.”. When discussing the perceptions of usefulness and ease of use by military personnel regarding AI in combat operations, it is more appropriate to use the latter definition. Hence, perceived usefulness refers to how effective military personnel think AI to be, that is, a belief that AI can enhance their decision-making performance. The perceived ease of use refers to how accessible military personnel think AI will be, that is, a belief that they can use AI as a DSS without considerable effort.

Perceptions are the result of external variables, as observed in Figure 4. Factors such as past experiences and cultural influences can model the understanding of AI as a DSS, its utility and usability. These factors also shape the assumptions and expectations individuals have, which will then affect the lenses through which new technologies will be perceived: theoretical frames (Orlikowski & Gash, 1994; Engås et al., 2023; Leonardi, 2010). That means that assumptions and expectations frame the way military personnel attribute meaning to AI.

Additionally, studies suggest an extended version of the TAM incorporating other external elements that surface as relevant for user acceptance of AI-enabled systems, such as trust (Baroni et al., 2022). When individuals perceive an AI technology as easy to use, they are more likely to develop trust in the technology and perceive it as useful. According to Baroni et al. (2022) there is a positive relation between the perception of the ease of use, the perception of the usefulness, and the trust in the systems. Hence, for AI-enabled decision-support systems, it is crucial to design the system to be user-friendly and intuitive to facilitate its adoption (Choung et al., 2023).

2.2.2. Technological Frames

Kaplan and Tripsas (2008) name the assumptions, expectations, and knowledge used to make sense of new technologies, as Technological Frames. The authors define Technological Frames as what "guides the actor's interpretation of what a technology is and whether it does anything useful" (Kaplan & Tripsas, 2008, p. 791). The concept was first coined by Orlikowski and Gash (1994), who defined Technological Frames as the lens through which actors perceive and derive meaning from a technology, guiding their categorization of the unknown technology and criteria selection for evaluating its performance.

All of the concepts mentioned in this framework are closely related to perceptions: assumptions, expectations, and knowledge. Assumptions can be defined as "something that you accept as true without question or proof" (Cambridge Dictionary), that is, assumptions are ideas individuals create about something, without having concrete evidence for it. Expectations are defined by the Cambridge Dictionary as "the feeling or belief that something will or should happen". Knowledge is having "skill in, understanding of, or information about something, which a person gets by experience or study" (Cambridge Dictionary), which in this case would be knowledge of AI.

Assumptions and expectations will be very relevant throughout this study, as they both influence and are influenced by perceptions. The three concepts interconnect in the way our past experiences and judgement can impact the way we anticipate future happenings, which can then affect our understanding of things. In fact, according to Lord and Taylor (2009), assumptions and expectations often influence the perceptions individuals have of new technologies. Military personnel' perceptions towards AI as a DSS can vary based on what they assume to be true, for example, about AI's characteristics, and what they anticipate regarding the integration of AI into MCDMP. Additionally, perceptions can affect assumptions and expectations. The way military personnel perceive the usefulness and ease of using AI as a DSS can shape their beliefs about AI's characteristics and their suppositions about its eventual performance.

The intricacies of the concepts might make it difficult to separate in practice, despite their distinct definitions. In particular, assumptions and expectations can become interchangeable when discussing something that is yet to be integrated, such as AI as a DSS. In addition, since AI as a DSS for MCDMP is a tool that has not come to life and been presented to military personnel or the general public yet, the knowledge of the technology becomes very difficult to assess. Hence, the knowledge of AI is not, at the moment, a relevant factor for the present research.

Orlikowski and Gash (1994) were pioneers in seeing the value of individuals' expectations of technology and individuals' assumptions about technology. The authors identify and present three spheres that reflect individuals' interpretations surrounding new technologies: the nature of technology, technology strategy and technology in use. The nature of technology refers to people's understanding and knowledge of the technology and its capabilities. The technology strategy relates to the purpose for which the organisations decided to adopt a certain technology. And the technology in use regards the perceived usefulness of the new technology.

The interactions of these Technological Frames explain why technological transitions are so difficult. To have a dominant technology that further develops in practice, a collective technological frame is needed between the stakeholders (Kaplan & Tripsas, 2008), as having different ways of making sense of new technology can lead to contradictory actions and impact group dynamics (Orlikowski and Gash, 1994). In the context of AI integration in MCDMP, the military's perceptions, assumptions, and expectations of AI will therefore not only impact its usage but also its development and team dynamics.

2.2.3. Trust in AI and its Impact on the Integration in MCDMP

Alongside the importance of perceptions, assumptions and expectations when discussing human-AI collaboration, recently, trust is also identified as a crucial factor for successful integration (Balis & O'Neill, 2022; European Commission, 2019a). To reach the full potential of AI as a DSS, it will be crucial to calibrate the levels of trust that military personnel have in such systems (Mayer, 2023).

2.2.3.1. Definition of Trust

There is no universally agreed-upon concept of trust (Schilke et al., 2023), highlighting its nuanced nature. According to the Oxford English Dictionary (2024), trust, when used as a verb, entails “To believe (a statement, story, etc.); to rely on the truthfulness or evidence of (a person, his or her senses, etc.)”. Theoretical perspectives further underscore trust as a multi-faceted, multi-level, and dynamic concept (Schilke et al., 2023).

Rousseau et al. (1998, p. 395) define trust as a “psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another”. They emphasise the significance of "confident expectations" and "willingness to be vulnerable" across various fields of study, in traditional definitions of trust. At an organisational level, a commonly used (Bach et al., 2024) definition of trust is “The willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party” (Mayer et al., 1995, p. 712). Furthermore, Robinson (1996, p. 576) defines trust as “one's expectations, assumptions, or beliefs about the likelihood that another's future actions will be beneficial, favourable, or at least not detrimental to one's interests.”

For the purpose of this research, which delves into trust in AI as a decision-making support tool, it is pertinent to focus on core expressions that conceptualise trust rather than a fixed definition. As such, loosely drawing from Lewicki et al. (2006) and Robinson (1996), we will focus on trust as a cognitive process that comprises “a willingness to accept” the suggestions of the machine and “positive expectations” about its competency (outcome of the action) and its intentions (motives).

Additionally, Weiss et al. (2021) advocate considering three key approaches when discussing trust (tridimensional approach): the trustee’s (AI) characteristics, the trustor’s (military decision-makers) characteristics, and the dynamics of their relationship. This holistic approach broadens the understanding of the various factors that influence trust levels, encompassing not only the trustor’s predispositions to it but also circumstantial factors, such as the trustees’s characteristics and their relationship dynamics. Consequently, considering trust is influenced by an existing relationship between parties, the emergence of new trustee

entities, such as AI, is expected to cause fluctuations in trust levels as their relationship evolves (Lewicky et al., 2006), also affecting acceptance of the new tools.

In the following sections, we will be focusing, respectively, on the dynamic of trustor-trustee relationship, and on the trustee's (AI) characteristics. Regarding the third key approach that influences trust levels, the trustor's (military decision-makers) characteristics, it is not relevant to study at this moment, due to the incapability of assessing individuals' propensity to trust.

2.2.3.2. Trusting AI: Dimensions of trust

Balis & O'Neill (2022) propose five dimensions of trust that impact the perception and level of trust that military personnel have in AI. These dimensions pertain to the relationship dynamics between the trustee (AI) and the trustor (military decision-makers), in Weiss et al.'s (2021) tridimensional approach. The first dimension mentioned by Balis & O'Neil (2022) is "deployment trust", which means, trusting the purpose for which AI is being used; "data trust", refers to the data inputs that were provided to the AI system; "process trust", understanding how the systems operate, for example, how data is processed by the AI system; "output trust" regarding the final output, in this situation the decision or suggestion generated by the AI; and "organisational system trust" referring to the overall ecosystem surrounding the application of AI, focusing more at an institutional level. The focus on transparency and explainability has been discussed by some to tackle these dimensions and increase the level of trust in AI (O'Hara, 2020; Søgaard, 2023).

2.2.3.3. Trusting AI: Trustworthiness of the Technology

Trust intertwines with the notion of trustworthiness (O'Hara, 2012), evident in the previously mentioned factors influencing trust and their connection to the trustor's impressions of the trustee's characteristics. Trustworthiness often impacts the levels of trust, yet these are two different concepts (Ryan, 2020). Trustworthiness is connected to the trustee's characteristics, such as, but not limited to, accuracy, reliability and aligned purpose (Søgaard, 2023).

According to the European Commission (2019a), the three essential factors to achieve AI trustworthiness are the robustness of the AI-enabled system, its compliance with the law, and action in accordance with ethics principles. These key factors will be used as measures for the level of trustworthiness of an AI-enabled system.

According to Balis and O'Neill (2022), trustworthiness can influence the level of trust, but it is not always decisive, as both misplaced trust and misplaced mistrust can occur. Therefore, while trustworthiness is important, it is not sufficient on its own. This further strengthens Weiss et al. (2021)'s conception that three key factors impact trust: not only the trustworthiness of the technology, but also the individuals' propensity to trust, and the relationship dynamics between the trustee and the trustor. This is relevant to take into consideration when designing strategies to address the improvement of trust within human - AI cooperation.

2.3. Conclusion

The literature review demonstrates that AI has become a focal point in the military sector, with a particular focus on its potentialities and risks when discussing integration in decision-making processes. However, the concepts discussed are complex and difficult to define, resulting in nebulous and sometimes contradictory conceptualizations. Dichotomies within AI, such as distinguishing between weak and strong AI, as well as assessing the level of AI integration are essential for the understanding of the topic and the capabilities and limitations of AI within military combat decision-making contexts. For the purpose of this thesis, considering one specific decision-making process is not relevant nor does it affect the conclusions, therefore, the acronym "MCDMP" is used as a way to refer to common and general steps taken in military decision-making in combat operations. This stands for the military combat decision-making process.

Within the idea of human-AI collaboration, the Technology Acceptance Model (TAM) was discussed and related to the concept of Technological Frames, and trust, emphasising factors like perceptions, assumptions, expectations and trust. The multifaceted nature of trust in AI and important considerations regarding this concept were laid out. These frameworks and

notions present crucial ideas for the successful integration of AI in military combat decision-making processes when considering the need to establish a relationship between humans and AI. Nonetheless, these concepts are interconnected in a complex way. After considering the literature analysed and reflecting on the concepts, we recognise trust as a product of perceptions, and that both these concepts influence each other. Given the current state of AI development as a DSS, it is not yet possible to assess military decision-makers' knowledge of AI capabilities. Additionally, distinguishing between assumptions and expectations remains challenging in practice.

3. Methodology

3.1. Research Approach: Qualitative Research

To explore perceptions, expectations, and assumptions on the integration of AI into MCDMP we conducted a qualitative study with an inductive approach. Because some of the issues investigated in this research are challenging to quantify with measurable metrics (e.g., trust dynamics and perceptions), a qualitative approach was considered an appropriate method that allows for a more detailed exploration of complex or subjective phenomenons than quantitative methods could provide (Maxwell, 2013). The descriptions of opinions, feelings, and emotions available to us following a qualitative approach allow for the interpretation of their meanings and implications with greater precision (Tenny et al., 2023). Moreover, as suggested by Rahman (2016), qualitative research is particularly well-suited for investigating intricate topics, as it allows us to gain a better understanding of beliefs, perceptions and attitudes in line with their military setting and culture.

Due to our investigation's fine-grained research profile - the way military personnel understand AI integration - we may answer more explicitly to "how" and "why" by conducting this type of non-descriptive study. As Tenny et al. (2023) point out, measuring the intricate systems associated with impressions and beliefs is complex, thus qualitative instead of quantitative findings are to be expected. While qualitative research offers valuable insights into the specific context of AI integration in military decision-making, it is important to acknowledge its limitations. Qualitative research does not provide an exhaustive representation of all conceivable viewpoints, instead, it aims to enable a more complete description of the research opportunity as it exists *in situ*.

In addition, qualitative research is not restricted merely to simple outcome testing or the examination of linear models, but since the dimensions in the current study were identified not to have a linear relationship or a strictly sequential order, it could not be conducted as such (Maxwell, 2013). Grounded in a qualitative research approach, this investigational study aspires to elucidate the perceptions, trust establishment and impressions on the implications of AI integration in MCDMP.

3.1.1. Time Horizon

The goal of the current study is to understand current opinions about the integration of AI and level of acceptability of the topic of study, while also projecting likely levels of acceptance. While the primary emphasis lies on current impressions of AI adoption, it is important to highlight that technological advancements and consequential evolving factors, for example, trust (Bach et al., 2024), may shape attitudes and perceptions in the future. This research examines how perception influences judgments and predictions about future adoption patterns and technological progress. We use the concept of Technological Frames and the TAM framework to explain how perceptions can affect the deployment of AI systems. By considering both present and future perspectives, this study aims to provide a thorough understanding of the role of perceptions in integrating AI into MCDMP.

3.2. Research Design: Selection and Choices

The nature of the phenomenon under investigation in this research required the use of a qualitative research approach. Exploratory research is valuable in identifying the positive/negative beliefs about particular phenomena as it brings insight into understanding these social phenomena (Yauch & Steudel, 2003). This is particularly useful when evaluating how such views affect different physical, social, and cultural realms (Maxwell, 2013).

In order to effectively collect qualitative data and thoroughly address the research questions, we chose both to review the literature and conduct semi-structured interviews. This multi-method design provides an appropriate level of insights valuable for approaching complex issues such as the impressions surrounding the integration of AI as a DSS in MCDMP. It enables to overview and observe the interaction of cognitive factors, like perceptions, assumptions and expectations, as well as the environment in which the AI tool is to be implemented. Therefore, extensive qualitative data collected from literature review and semi-structured interviews with expert researchers and military personnel facilitate the analysis and connection of the information obtained for speculation on a future integration and implementation of AI in DSS within military decision-making frameworks.

Zhang (2019) also notes that perceptions are really dynamic and multifaceted, which might mean that an over structured research methods do not fully capture the breadth and variety of the topic in question. Hence, we opted for a qualitative approach and a focus on semi-structured interviews, to mitigate a possible narrowness in the research. Technology change, as a broad concept, and a cumulative process enhancing change over time (Vial, 2019), requires a qualitative approach to capture the changes in impressions of technology. Yet, when choosing to explore one specific aspect - AI integration to support combat decision-making within military contexts - employing a qualitative research design, allows us to untangle the complex issues surrounding technological change best. This approach enables a comprehensive overview of technology acceptance and its influence on decision-making processes, addressing the multifaceted and context-dependent nature of these changes (Denzin & Lincoln, 2018).

3.3. Data Collection Method

3.3.1. Field Selection

Due to the time constraints and shortage of resources, we conveniently opt to take one field of interest: the military. This decision enabled us to focus on deeply understanding the selected industry and gather more data related to that industry which would not be possible if we attempted to collect data on more than one industry. Additionally, recently, the military sector has emerged as a significant area witnessing a surge in AI investment (Henshall, 2024; NATO, 2019). This heightened interest can be attributed to the nature of warfare, which often acts as a catalyst for transformative advancements. For instance, the invasion of Ukraine by Russia has compelled nations and even organisations like NATO to substantially increase their allocations towards AI and automation, reaching unprecedented levels (Heikkilä, 2022).

Undoubtedly, the military field is characterised by its high stakes and fast-paced environment. Human lives hang in the balance, and a single error can lead to devastating consequences on the battlefield. The extremeness of this environment highlights the gravity of

decision-making within the military domain. While other industries may operate within fast-paced environments, the critical difference lies in the magnitude and urgency (the decision time frame is reduced) of decision-making within the military domain, particularly in combat circumstances. Moreover, the consequences of these decisions often reverberate far beyond the immediate context, impacting national security, geopolitical stability, and the lives of countless individuals.

Despite the challenges and struggles inherent in navigating such a difficult field, the significance of the outcomes achieved compensates for the arduousness of the journey. In addition, the military's operational environment is inherently VUCA - Volatile, Uncertain, Complex, and Ambiguous - (Williams, 2010), making it a critical field for studying the impressions of AI integration. Understanding how AI is understood and how these beliefs can influence the future integration of an AI decision-support tool is mainly through trust and reliability. Trust reveals itself as crucial in such a high-stakes and high-pressure environment - “When lives are in the balance, trust is a vital factor.” (Castoro & Krawchuk, 2020).

3.3.2. Literature Review

In conducting our research, we did a thorough literature review to gather and evaluate existing academic theories, research findings, and perspectives relevant to our chosen area of inquiry. We aimed to critically examine the body of knowledge surrounding our research topic, with a focus on providing readers with a comprehensive understanding of the narrow existing, often puzzling, landscape.

The literature review process involved systematically identifying and analysing a wide range of scholarly works, including academic articles, military unclassified papers, scientific articles from Government Defense Agencies, think tanks’ research publications, among other relevant sources (~100 sources). Through conducting interviews, we also gained access to a variety of restricted-access documents. We sought to ensure that our review encompassed both seminal works and recent publications, using scientific and trustworthy databases such as ResearchGate, JSTOR, LUBSearch, Google Scholar and several think tanks’ publications, such as RUSI, RAND Corporation, Chatham House, and Brookings. Hence, we acquired an

understanding of current theories and research, complementing it with a deeper knowledge of more established frameworks.

Our review had several primary goals. Firstly, we sought to offer readers a comprehensive overview of the academic theories and concepts relevant to our research question. To achieve this, we categorised our research into relevant keyword-related categories and systematically classified each article accordingly. Subsequently, we conducted thorough reviews of selected articles, books, and papers to identify those most pertinent to our objectives. Finally, we synthesised and presented this information in a coherent and structured manner to establish the theoretical framework underpinning our research. Due to the particularity of the military field, we prioritise documents directly from military personnel or institutions that are directly correlated to military sciences and technology.

Moreover, we aimed to conduct a critical assessment of the current research findings and pinpoint any notable trends, discrepancies, or areas of debate within the literature. The literature on AI adoption in military contexts draws upon various academic theories and frameworks. One key theory is the concept of human-machine collaboration, which posits that AI systems can augment human decision-making capabilities in complex operational environments (Kaplan & Tripsas, 2008). Additionally, the literature emphasises the importance of trust in AI systems, as military personnel must rely on these systems to provide accurate and timely information for decision-making (Lukyanenko et al., 2022).

To connect human-machine collaboration and the fostering of trust, we will draw insights from the theory of Technological Frames and the Technology Acceptance Model (TAM). These frameworks will help us understand how perceptions and other cognitive structures, such as assumptions and expectations, influence the adoption and trust in AI systems within the military context. Technological frames consist of assumptions, expectations, and knowledge about technology that shape how users perceive and interact with it. These frameworks will provide a crucial base for identifying potential barriers to adoption. This theory allows us to delve into the subjective experiences and impressions of military personnel, providing a nuanced understanding of their future attitudes towards AI integration. The Technology Acceptance Model (TAM) provides a structured approach to assessing the factors that influence the acceptance and use of new technologies. In the context of military decision-making, perceived usefulness can be understood as the degree to which military

personnel believe that AI systems will enhance their decision-making capabilities and operational effectiveness. Perceived ease of use refers to the extent to which they find AI systems user-friendly and accessible. By applying TAM, we can systematically evaluate how these perceptions influence the willingness of military personnel to adopt and trust AI technologies.

This endeavour was undertaken to illustrate our capability to evaluate previous researchers' concepts and propositions critically, due to the dispersed and sometimes contradictory conclusions in this field of study. Additionally, there is limited information available regarding specifically the study of human-AI collaboration in military combat decision-making processes. This required us to employ a rigorous approach, integrating diverse sources and drawing insights from related fields, due to our commitment to construct a comprehensive understanding on the subject. This demonstrates our capacity to formulate autonomous and well-founded conclusions. Through our comprehensive and critically engaged review of the literature, we aim to contribute valuable insights to the narrow existing body of knowledge in our chosen field of inquiry.

3.3.2.1. Possible Alternative Research Frameworks for Our Work

After identifying several frameworks that could potentially apply to our research, including the Technology-Organization-Environment (TOE) Framework, Task-Technology Fit (TTF) Theory, Unified Theory of Acceptance and Use of Technology (UTAUT), Social Cognitive Theory (SCT), and Resource-Based View (RBV), we conducted a thorough analysis. Upon closer examination of our research questions and purpose, we determined that these theories did not fully align with the scope of our field of work. Consequently, we made the decision not to incorporate them into our study. Instead, we chose to draw inspiration from these frameworks to inform our thinking processes and approach.

3.3.3. Semi-Structured Interviews

Given the complexity of our research questions and the need to capture diverse perspectives from military decision-makers, we employed semi-structured interviews as our main qualitative data collection technique: semi-structured interviews. This method provided a platform for participants to share their experiences, insights, and concerns regarding the integration of AI into military decision-making processes. By facilitating open-ended discussions and allowing participants to express their views freely, we were able to gather rich and detailed data, enabling a comprehensive analysis of the research topic.

3.3.3.1. Target Selection

Our selection of participants started by dividing our sample into 2 groups: Military Scientists with knowledge of AI and Military Personnel.

Military Scientists with AI Knowledge: We conducted interviews with military scientists who possess expertise in AI to gain a comprehensive understanding of the intersection between the military domain and AI integration. Our objective was to delve into the broader implications of AI usage in military operations and to explore their perspectives on the development of future tools aimed at promoting enhanced decision-making process. This envisioned tool would facilitate close collaboration between humans and machines. Our interviewees included experts affiliated with various think tanks and professors from esteemed universities across Europe. Through these interviews, we aimed to gather diverse experiences and insights to juxtapose them with the perspectives of military personnel.

For the selection of Military Scientists with AI knowledge, we employed a criterion sampling method, which involves choosing participants based on predetermined criteria (Tenny et al., 2023). Initially, we identified relevant think tanks, referred by NATO to us in a previous interview, that specialise in topics related to AI in the military domain. From this pool of think tanks, we further refined our selection by reviewing published articles and research papers to identify individuals who were most qualified and experienced in our research area. This process ensured that we engaged with experts who possessed the necessary knowledge and insights to contribute meaningfully to our study.

Military Personnel: Our research also entailed delving into the perceptions, expectations and assumptions of military personnel who possess significant battlefield experience and have participated in international missions. We conducted interviews with high-ranking personnel ranging from major generals to lieutenant colonels, representing various sectors within the military sphere. By engaging with military personnel, we aimed to gain insights into their needs and readiness regarding the potential integration of an AI-enabled tool for promoting less biased and faster decision-making processes. These perspectives from military personnel are invaluable for understanding the practical considerations and challenges associated with implementing such technology in real-world military combat operations.

To ensure a comprehensive understanding of the military domain, we adopted a broad approach by interviewing personnel from diverse positions within the military. This allowed us to capture a range of opinions and understandings of AI, as different ranks within the military hierarchy may hold varying perspectives. However, due to the sensitive nature of the military domain and the challenges associated with accessing military personnel, particularly those outside of Europe, our research was limited to European countries. This decision was made to ensure that we could effectively engage with relevant stakeholders and gather meaningful insights within the constraints of our study. We initiated our selection process by reaching out to potential interviewees through LinkedIn. Through initial responses and engagements, we were able to expand our network of military personnel using the "snowball effect" method, whereby participants referred other potential interviewees facilitating further connections and expanding our pool of participants (Tenny et al., 2023).

It is worth noting that many of the military personnel we interviewed displayed limited awareness of the development and potential applications of AI in the military context. Their perspectives were often confined to what could be considered common knowledge about AI, with a particular emphasis on technologies such as "Chat GPT". However, some individuals demonstrated a deeper understanding of AI, driven by personal curiosity rather than formal training or institutional knowledge. While these variations in knowledge level were observed, they did not significantly impact the overall findings of our study, as their impressions of the impact of the integration were similar.

3.3.3.2. Respondents

Military Scientist with AI Knowledge			
Participant	**Role**	**Organisation**	**Date**
P1	Research Analyst - C4ISR and Emerging Tech	Royal United Services Institute	April 22
P2	Professor of International Relations	University of Rotterdam	April 24
P3	AI Governance Researcher Research Fellow	University of Rotterdam Young Security Conference	April 18
P4	Director of Military Sciences Former Senior Advisor Policy and Strategy Former Assistant Head Strategy	Royal United Services Institute Afghan Ministry of Interior Affairs, Royal Air Force Ministry of Defence, United Kingdom	April 26

Military Personnel			
Participant	**Role**	**Organisation**	**Date**
M1	Military International Mission	Army Chief of Staff, Portuguese Army	April 15
M2	Major-General International Mission	Portuguese Military Armed Forces	April 24
M3	Military Pilot International Mission	NATO	April 24
M4	Tenant-Colonel International Mission	Portuguese Military Armed Forces	April 24
M5	Tenant-Colonel PhD Researcher and Professor	Portuguese Military Armed Forces Military Academy	April 29

M6	Major-General International Mission	Portuguese Military Armed Forces	April 30
M7	Major-General International Mission	Portuguese Military Armed Forces	May 3
M8	Commodore International Mission	Head of Innovation and Transformation Division, Portuguese Military Armed Forces Navy	May 13

Figure 5: Respondents - By the authors (Meleiro & Passos)

3.3.3.3. Interviews Design

We took on a semi-structured interview approach to gain comprehensive insights regarding our focal topic. In this case, unlike unstructured interviews, we maintained a general list of questions to ensure consistency and facilitate comparisons across different respondents. Our interviews were done using open-ended questions so that the interviewees freely express their opinions without any influence from our side. Before the interviews, informed consent was obtained from all participants, who were given the option to consent to recording and to indicate their preference for anonymity.

In our semi-structured interviews, we had a set of guiding questions, but the questions were flexible and might even vary from interview to interview (Saunders et al., 2007). Some questions might have been omitted if a topic had been discussed in adequate detail, while follow-up questions were asked based on the content in the responses from the interviewees to clarify certain points. Additionally, the order of the questions may have varied from one interview to another, as some interviewees answered a topic before being formally asked about it.

During the interviews, participants were invited to speak freely about what they thought of, behaved towards, and believed on topics of interest for our study, making our end non-directive. It was intended that this type of approach to the interview would bring forth rich and diverse views from the respondents and contribute to an in-depth understanding of the subject matter.

The designed general list of questions for our interviews is included in Appendix A.

3.3.3.4. Data Saturation

"Saturation is the most frequently touted guarantee of qualitative rigour offered by authors to reviewers and readers."

Morse (2015, p. 587)

After conducting 12 interviews, we reached data saturation. As Given (2015, p. 135) describes, saturation occurs when additional data no longer yield new emergent themes. This was evident in our interviews with military personnel, where responses consistently fell within the same thematics, exhibiting just minor variations. Grady (1998, p. 26) similarly notes that data saturation is reached in interviews when the researcher starts hearing the same comments repeatedly: "It is then time to stop collecting information and to start analysing what has been collected."

In our case, the interviews revealed a convergence of perspectives and beliefs, with participants frequently reiterating the same points. This repetitive pattern led us to believe that further interviews would unlikely contribute additional insights, confirming that we had sufficiently explored the topic. Recognising these indicators, we decided to conclude our data collection and shift our focus to analysing the data collected. This allowed us to focus on understanding the themes and patterns that had emerged, ensuring an exhaustive analysis of the perspectives of military personnel on AI integration in decision-making processes.

3.4. Data Analysis

3.4.1. Analytical Work on the Data

As Sekaran and Bougie (2016, p. 332) assert, qualitative data analysis involves "making valid inferences from the often overwhelming amount of collected data". For us to effectively dissect this data and make valid inferences, we utilised thematic analysis as our primary method. According to Saunders et al. (2019 p.664), thematic analysis involves "searching for themes, or patterns, that occur across a data set". For us, thematic analysis provided the flexibility and simplicity we needed to present our findings clearly, making it more effective than other techniques.

Our analysis involved a meticulous examination of the transcripts from both Military Personnel and Military Scientists with AI Knowledge to identify recurring patterns and overarching themes that relate to our research questions. We started with the transcription of the interviews, followed by a manual review of the content. During this review, we extracted pertinent information, categorised it, and delved into identifying the underlying human attitudes and beliefs, using the findings of the literature review to guide us. Given the complexity of this subject of study, we revised our list of categories multiple times to reach what we believe is the optimal solution. We undertook an interpretivist approach allowing the data to guide the process, cross-checking the results from our data categorization with the selected theoretical frameworks. This approach acknowledges the diversity in participants' experiences and perspectives, reporting this variety rather than reconciling differences.

Analysing such data requires sensitivity to its variability and complexity to be meaningful (Saunders et al., 2019).

This stage of data analysis - “quantification” - quantifies the specific feelings or other observations that were recorded (Sekaran & Bougie, 2016), essentially examining themes across the data. We classified our data into five groups: Trust, Perceived Usefulness, Perceived Ease of Use, Expectations, and Assumptions. A significant challenge was the iterative interrelationship between expectations and assumptions, as they often overlapped, despite their distinct definition. This categorisation framework was crucial in providing us with the ability to capture and analyse emerging themes at a global level. The versatile insights we obtained were a direct result of organising the data into these specific categories, which were closely related to our research questions. These insights were articulated and enriched by the literature review and expert interviews. By comparing and contrasting the data from the 3 sources (military personnel interviews, military scientists with AI knowledge interviews and literature review), we discerned similarities and disparities, enabling us to elucidate the topics of discussion: factors influencing the integration of AI tools for decision-making support in military combat operations. The structured approach not only facilitated a clearer understanding of the underlying patterns but also enhanced the robustness of our findings, ultimately contributing valuable knowledge to our research.

Having completed this analysis, we proceeded to draw conclusions and address our research objectives. We synthesised the key findings, presenting them with clarity and conciseness, supported by pertinent quotes from the interviews. We prioritised quotes that directly addressed the core themes of our research questions. These quotes were chosen to illustrate the primary insights and perspectives shared by the participants, ensuring they were directly relevant to the topics being discussed. This involved identifying comments that encapsulated common viewpoints, thereby providing a balanced reflection of the overall data ensuring representative value.

Our comprehensive approach facilitated a rigorous and systematic analysis of the data, enabling us to identify common themes related to AI integration in MCDMP. This culminated in a discussion that incorporates findings from both the literature and the interviews, as illustrated in the visual representation of our methodology below.

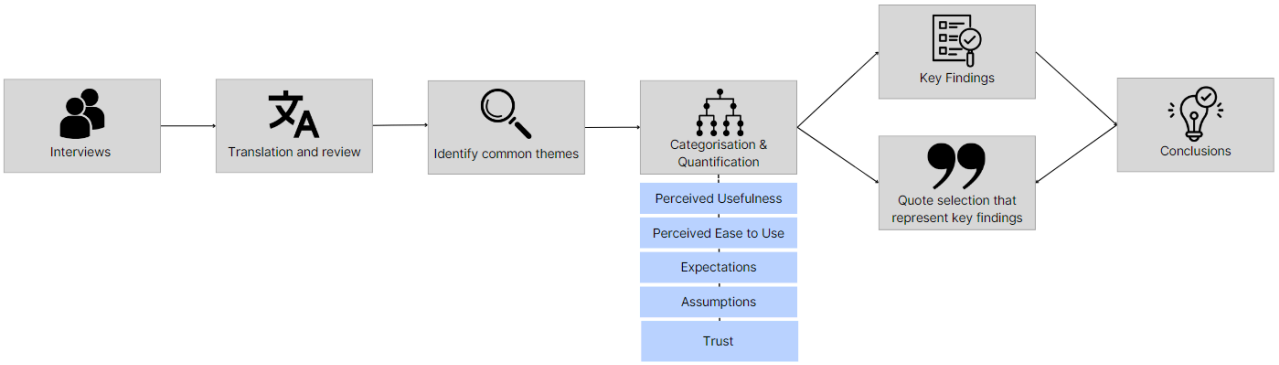

Figure 6: Overview of empirical data collection, analysis and conclusions - By the authors (Meleiro & Passos)

3.4.2. Audio Recording & Transcription

To cater to our interviewees' preferences we provided a range of technology tools, like Google Meets, Zoom and WhatsApp FaceTime for the interviews. Before each session participants were asked to choose their preferred communication platform. With their approval, we recorded the interviews using a voice recorder to ensure that all important discussions were captured for reference. However, we faced some difficulties with recording on the computers, so we also used phone recorders as a solution. Despite these challenges, we maintained documentation during the interviews by taking notes alongside the recordings. These notes helped capture cues, behaviours and valuable insights shared by the interviewees. To the participants who did not wish to be recorded, note-taking proved crucial to remember the content of the interviews and the observations held. Moreover, the audio recordings proved valuable, for revisiting the interviews during the analysis stage. They allowed us to extract insights and information that may have been missed initially, ensuring an understanding of the collected data.

To transcribe and translate interviews we utilized Whisper, a speech recognition (ASR) system trained on 680,000 hours of multilingual and multitask supervised data from various online sources (Radford et al., 2023).

3.4.3. Translation

Some interviews were held in the interviewees' mother language, which is also our mother language, Portuguese. To facilitate the transcription and translation process to English, we used a specifically designed tool: DeepL. We ran the transcriptions through a meticulous review performed by us to correct any discrepancies or errors identified in the AI-generated transcripts. This ensures the reliability and fidelity of the translated data. The methodological approach allowed us to effectively overcome language barriers and analyse the interview data more efficiently, thereby facilitating comprehensive insights and robust findings in our research.

Some of the quotes used in this study are directly translated from Portuguese to English through DeepL.

3.5. Research Limitations

While qualitative research offers valuable insights, it is not without limitations. One notable weakness, as identified by Anderson (2010), is the potential for researcher bias. Given the intricate nature of studying digital ethics, we, as researchers, recognized the importance of understanding our own biases and situational contexts. To mitigate this, we try to the best of our efforts to acknowledge backgrounds, cultures, and access to digital technologies, refraining from imposing normative suggestions regarding objective ethical principles.

Another challenge arises from our presence during the data collection, particularly in semi-structured interviews, which may influence participant responses (Anderson, 2010). To address this, we formulated questions to encourage descriptive discussions, avoiding preconceived biases. Additionally, we adopted the snowball sampling method, but parallel networks were established to minimise bias in participant selection (Cohen & Arieli, 2011). Despite efforts to mitigate bias, subjectivity remained inherent in both of us and participants' perspectives. To counteract this, the interpretation process involved individual analysis followed by collaborative discussions, leveraging diverse backgrounds to integrate different viewpoints.

In ensuring the reliability of the study, consistency was maintained across research design, sampling, data collection, and analysis techniques. However, the relatively small sample size poses a limitation, although efforts were made to gather comprehensive insights. While the findings offer insights applicable to the military sector, generalizability to other industries remains possible but limited due to the resource constraints. Moreover, limitations in the interviews guideline design and the study scope may have influenced data collection and analysis. Despite efforts to cover various case studies and challenges, the research primarily focuses on military combat applications and future difficulties encountered during a possible adoption process within the military domain. We have found it challenging to keep few interviewees focused on topics relevant to our thesis, as their responses turned into areas such as logistical or strategic planning, which fall outside the scope of our research. Looking back, we would have to refine our interview questions and provide clearer guidelines to ensure that the discussions remain aligned with the specific objectives of our thesis.

On a last note, due to time limitations inherent in academic research, this study may not capture the full spectrum of impressions and experiences across all military institutions. Efforts were made to ensure a diverse sample, but comprehensive coverage of all perspectives may not be feasible within the allotted time frame.

Overall, while the study provides valuable insights into a possible AI adoption in combat military decision-making, comparisons with other industries and comprehensive coverage of all cases and challenges were constrained by time and resource limitations.

3.6. Validity and Reliability

According to Saunders et al. (2019, p. 218), validation is “the process of verifying research data, analysis and interpretation to establish their validity/credibility/authenticity”. The validation is important to us, as researchers, since our goal is not only to draw conclusions that are plausible but also reliable and valid (Sekaran & Bougie, 2016). In terms of validity and reliability, this thesis adheres to the framework outlined by Lincoln and Guba (1985), which encompasses four interconnected components: credibility, transferability, dependability, and confirmability.

Credibility, or internal validity (Sekaran & Bougie, 2016), was ensured through continuous communication with our research supervisor and with researchers and professionals consulted before initiating this thesis to gain insights into the current state of AI integration in military combat decision-making and the EU perspectives on the topic. Additionally, we maintained sincerity and openness, avoiding any judgments to ensure that interviewees' opinions were not influenced. Furthermore, in our interviews, we accounted for negative cases, demonstrating our commitment to analysing results as they emerged (Saunders et al., 2019).

Transferability, referring to the ability "to design a similar project to be used in a different, although suitable, research setting" (Saunders et al., 2019 p. 451), was addressed by thoroughly presenting the research setting/context and delineating research boundaries and limitations.

Confirmability, characterised by ethical and responsible research conduct (Bryman & Bell, 2011), was upheld by presenting data collection, analysis, and interpretations transparently, ensuring the traceability of the research process from raw data to conclusions.

Dependability was achieved by thoroughly examining the process, emerging data, and interpretations (Amin et al., 2020). To ensure dependability, we engaged in close collaboration with our research supervisor, regularly submitted research status updates, and sought recurring assistance from other researchers to gain more detailed insights. This approach helped us maintain a high level of dependability throughout the study.

3.7. Ethical Considerations

This research adheres to ethical guidelines presented by Sekaran and Bougie (2016) regarding participant confidentiality, informed consent, and responsible data handling. However, due to ethical constraints, access to certain sensitive information or individuals was restricted, impacting the depth and sample size of the study.

As argued by Sekaran and Bougie (2016, p. 159), “informed consent of the subjects should be the goal of the researcher”. Therefore, informed consent was obtained from all participants before the interviews were conducted. Participants were fully informed about the nature and purpose of the study and their right to withdraw from the study at any time without any consequences. Verbal consent was obtained before conducting the interviews, ensuring that all participants agreed to the recording and understood their participation was voluntary.

In addition to securing informed consent, maintaining confidentiality was particularly critical in the context of military decision-making processes, where sensitive information and personal security are paramount. Confidentiality, as emphasised by Sekaran and Bougie (2016), is not only a right of the respondents but also helps to gather more honest and unbiased answers. The data collected in this study will be kept confidential and will be accessed solely for this research. Personal information, including names and contact details, will remain private and will not be disclosed in any part of the study. Additionally, any information relative to the identity of the participants, as well as all the recordings made, will be permanently deleted after the conclusion of this research.

Our literature review was guided by principles of academic integrity and ethical scholarship. We ensured that all sources cited in our review were properly referenced, thereby acknowledging the contributions of other researchers and avoiding any charges of plagiarism. By adhering to these standards, we aimed to uphold the highest standards of scholarly rigour and integrity in our research endeavours

3.8. Chapter Summary

In this chapter, we detailed the methodology employed to gain comprehensive insights into our focal topic, specifically the integration of AI tools in military combat decision-making processes. Our qualitative approach encompasses literature review and semi-structured interviews, data analysis through thematic analysis and ethical considerations, ensuring rigorous and systematic research practices.

We adopted a semi-structured interview approach, guided by Saunders et al. (2019). This method involved maintaining a general list of open-ended questions to ensure consistency while allowing flexibility for interviewees to express their opinions freely. Informed consent was obtained from all participants, ensuring they understood the study's nature and their right to anonymity.

4. Research Results and Discussion

In an attempt to clarify concepts and help to elucidate the dynamics surrounding this topic, this chapter will overview the interconnection of the different concepts and frameworks previously presented, and intertwine them with the findings from the semi-structured interviews.

4.1. The Current State of AI Integration in MCDMP

The current discussion in the literature is that there are growing efforts to integrate AI into military operations. This is already happening in some areas, such as logistics, and the potentialities of further applications are numerous. However, the definitions of some concepts are not always clear, nor consensual, and the discussions often appear to be abstract and imprecise, especially in the current developments and integration timeline of AI in MCDMP.

The perspectives of interviewees on the current state of AI integration in MCDMP reflect the literature, indicating a diverse range of views and cautious optimism. Interviewees generally see AI as a supportive tool that enhances human capabilities rather than replacing human decision-makers. Yet, opinions regarding the current state of development and eventual integration of the tool express a lot of uncertainty. In our understanding from the empirical data, there is no universal truth about when and how AI will integrate MCDMP.

(M7): "[AI integration] it may take some time, but it is already happening",

Some participants noted that this integration is already in motion in several areas such as HR and logistics. However, all of the participants agreed that the future will inevitably include AI in MCDMP.

Additionally, there was not a common opinion on the extent of the integration in the decision-making processes. The interviewees emphasised the importance of AI in data analysis and information collection, which significantly improves decision-making speed and operational efficiency. This is achieved by using Narrow AI, which refers to AI systems designed to perform specific tasks (Allen, 2020; Martinez, 2019; QA, 2024), however, the usage of this concept was only explicitly stated by one participant.

4.2. Acceptance of AI

When focusing on AI as a system that can aid decision-making in combat operations, its integration is subject to several factors, such as perceptions - perceived usefulness and perceived ease to use, assumptions, expectations, and trust, according to the reviewed literature and frameworks analysed.

The theoretical basis for our findings is supported in two prominent theories: the Technology Acceptance Model (TAM), and Technological Frames. According to TAM, the two most important determinants of acceptance for any new technology are: perceived usefulness and perceived ease of use. More specifically, perceived usefulness is demonstrated by the fact that AI can help to improve decision-making performance (in military context), while perceived ease of use embodies how user-friendly AI systems need to be made (Davis, 1989; Lee at al., 2003; Marangunić & Granić, 2014). We have observed these themes in our research and analysed them to fully comprehend the participants' perceptions.

Furthermore, from the Technology Frames theory, we know that the expectations and assumptions of military decision-makers and military scientists with AI knowledge shape the lenses through which they can understand how AI might be used. These frames split the impressions of AI whether as a helpful tool that can improve their decision-making skills or an intricate system requiring yet further investigation for its integration due to ethical and security concerns (e.g. biases, malicious use cases), as raised by some participants. These frames influence the acceptance towards AI and potentially the path of the new technology.

Our empirical data revealed a connection between the perceptions outlined in TAM (perceived ease of use and perceived usefulness) and the assumptions and expectations described in Technological Frames. Trust emerged as a vital, connecting factor among all these elements.

We organised our findings and discussion into three dimensions, presented through the lenses of the two frameworks used in our work, and also examined trust in AI. While each section presents distinct conclusions, it is evident from the data collected that trust holds an important role in shaping military attitudes towards AI acceptance as a future tool for combat decision-making. Therefore, in each subsection, we will present our findings and discuss their impact on trust and *vice-versa*.

In summary, our analysis suggests that in order for AI to be accepted as a decision support system within military combat operations the perception of its utility and usability are salient factors, but it should also be framed as a tool that will add value to the decision-making process rather than substitute or take over human control in the decision-making process, conforming with the Technological Frames held by military personnel for easier acceptance. We further argue that trust is a key enabler in closing this gap between perceptions and frames. Our findings underscore the importance of building and maintaining trust to ensure successful AI adoption in military decision-making processes.

4.2.1. Perceived Usefulness

As seen in the TAM framework, perceived usefulness is key to the acceptance of AI. In our empirical data, it was undoubtedly observed that military personnel and military scientists with AI knowledge both firmly agree that AI can be an advantage in combat decision-making mainly due to its superior analytic capability when compared to humans.

The first "perceived usefulness" we gathered from the interviews was more accurate and faster data collection and analysis. One common perspective is that AI's analytical capabilities surpass human capabilities in processing and analysing vast amounts of data, which is critical for mission planning. For instance, interviewees (M8 and M7) clearly highlighted that:

(M8): "One of the ambitions of using AI is to speed up the processes and improve the quality of the decision, because it has more information"

(M7): "It enhances decision-making so that it is more complete and faster."

However, we could observe that previous experiences with AI integration in data collection strongly influence the perceived usefulness of future integrations in combat decision-making. We choose to acknowledge this influence from past interactions as it is part of participants' lenses through which they perceive AI, their technological frames. Consequently, we observed that consistently among our interviewees there is a perceived idea that AI can significantly accelerate information processing and analysing, allowing for speed and completeness in the process, as we can see from the following statement:

(M5): "Clearly, artificial intelligence will have a greater analytical capacity than humans in collecting information that allows us to understand the conditions under which the mission will take place."

Another topic, not as prominently discussed as AI's analytical capabilities, was its potential to be useful in mitigating cognitive bias, as mentioned by some interviewees. As one interviewee (M8) stated:

"AI can benefit in the elimination of cognitive biases in a wide variety of military decision-making, whether in the operational and logistics areas, such as in the information war."

This quote represents the idea from some participants that AI should be useful in providing more objective decisions by presenting a potentially less biased analysis than humans. From the interviews, the perceived usefulness of completeness and collection speed was stronger than the perceived usefulness of the possible bias mitigation AI capabilities. This aligns with current literature, which has yet to strongly establish a connection between AI integration in decision-making and bias mitigation.

Undoubtedly, AI is recognized by the participants and highly efficient in time-sensitive scenarios, primarily due to AI analytical capabilities and also due to the potential to reduce biased outcomes. We believe that this positive view of AI is also prompted by the past experiences with AI tools within or outside the military scope. These past experiences seem to have enabled a growing acceptance and perceived usefulness of AI.

However, concerns were raised. Despite AIs' positive perceptions regarding usefulness, there is a clear consensus that it should not go beyond the supportive role in combat decision-making, avoiding its integration in the practical execution of the tasks aligning with recent guidelines from European Commission (European Commission, 2019a). Interviewees repeatedly stressed the importance of human judgement in the final decision-making process to ensure accountability and underscoring the lack of trust in giving AI full responsibility in the process. AI is seen as a useful tool that provides structured information and it can potentially provide directly a number of possible outcomes, but the ultimate decision and execution is commonly agreed that it must be made by humans - this perspective, shared among participants, known as human "in-the-loop" is also considered by the literature to be the safest and most efficient solution (Dear, 2019; Devedzic, 2022). One interviewee (M2) captured this sentiment well:

"AI should provide tools and data up to the point of decision-making. The final decision must remain with a human to ensure accountability. Because the human question has to be present, that is, there has to be a final evaluation made by the decision-maker."

It is also important to note that not every participant saw eye to eye. There was a dissenting viewpoint suggesting that AI should not play any role in decision-making, as articulated by P3:

"Well, I guess I'm a bit pessimistic because I think AI should be limited to data collection at most."

The interviewee elucidated that the expectation of AI effectively aiding decision-makers is "quite ideal" and unrealistic in some respects aligning with the recent Bloomberg study by Katrina Manson (2024), also cited by the interviewee as a source supporting his opinion. The Bloomberg article mentions that recent exercises have demonstrated that AI is not yet capable of fully integrating the decision-making process.

In summary, we achieve a majority of consensus when it turns to the perceived usefulness of AI integration in MCDMP. Though, one interviewee holds a contradictory opinion. Thus, this underscores the complexity and diversity of perspectives surrounding the integration of AI in decision-making processes and highlights the need for careful consideration and examination of various viewpoints to comprehensively understand the subject matter. While the majority of opinions provide valuable insights and trends, the dissenting voice adds depth to the discussion, prompting further exploration into the reasons behind differing perspectives. Ultimately, in our view the presence of divergent opinions reinforces the complex nature of the topic and underscores the significance of thorough analysis and consideration of multiple viewpoints in shaping informed conclusions and strategies.

4.2.2. Perceived Ease of Use

The interviewees underscore the importance of understanding AI and its capabilities. Based on our empirical data, most military interviewees do not fully grasp the scope of future AI integration in decision-making processes. This highlights the critical need for a thorough comprehension of the tool.

In addition to highlighting the need for understanding the tool, the interviewees acknowledge the potential of AI to aid in information visualisation and hierarchization, facilitating decision-makers' understanding of various options and outcomes (Davis, 1989). They emphasise the importance of adaptability and flexibility in AI systems.

However, the interviewees also raised concerns about the complexity of integrating AI into existing military frameworks, citing a lack of technical expertise and industry skills within military institutions as significant barriers to consider AI easy to use. Participant 1 noted:

"There is not enough skills in the industry, on the military side",

highlighting the need for comprehensive training and institutional support to facilitate AI integration.

Despite recognising the potential benefits of AI, the interviewees expressed scepticism about automated systems and emphasised the importance of transparency, adaptability, and continuous training to build trust in AI systems, aligning with Van den Bosch and Bronkhorst's (2018) insights. We can observe that this scepticism underscores the importance of user-friendly and transparent AI systems to gain acceptance and ease of use among military personnel (Choung et al., 2023).

Participant 1 remarked:

"There is difficulty in integrating it. There is frustration with the processes themselves, and then there is a lack of understanding of the technology,"

These statements highlight the challenges military personnel face in integrating a new decision-making tool. Consequently, in future implementations, we believe opting for explainable AI rather than black-box AI will be crucial. Our data analysis indicates that AI

acceptance is significantly influenced by its perceived ease of use. Simplifying AI outcomes and providing a clear understanding of their derivation will enhance this acceptance. To meet the specific needs of military personnel, explainable AI is pivotal. Additionally, it should adopt a user-friendly approach, thereby facilitating smoother integration.

This approach aligns with the emphasis on transparency and reliability in AI systems, as highlighted in the interviews. Ensuring that military personnel can easily comprehend how AI conclusions are reached will build trust and confidence, critical for successful AI adoption.

4.2.3. Expectations and Assumptions

As we have seen in previous chapters in this Discussion, military personnel hold high expectations for the use of AI in decision-making due to its analytical capabilities of processing more information than the human brain can ever do. To our participants, this ability to process vast amounts of data translates into more informed and timely decisions. In this chapter, we will explore the other assumptions and expectations our participants have regarding this potential tool and shed light in the challenges associated with a possible integration. Moreover, in our findings, we see that participants emphasise the expectation that AI will be able to be trained:

(M5): "Social intelligence, if sufficiently comprehensively trained, can mitigate the biases of human training[...]"

It is expected from military personnel that the tool will be trained prior to its integration to be impactful in the areas that participants see as useful which can be seen in section 4.2.1. above. For some participants, it is important that this training is continuous and widespread across several levels. Participants highlight that the tool should not only be fed with data but also self-learn from its own experiences providing a more complete assessment each time:

(M5): "The level of penetration of artificial intelligence will be monitored at each level, that is, each advisor will use the experiences they have to learn from artificial intelligence to advise the commander."

Such expectations reflect a desire to leverage AI to augment human capabilities, improving situational awareness and operational workflow.

Although we mainly focus on the integration of a machine, participants assume that the implementation process will also focus on them as stakeholders - interviewees stressed the significance of effective integration strategies. Key steps include investing in relevent data and ensuring cognitive understanding of the decision-maker, building trust through transparency in the iterative process, maintaining flexibility and adaptability in the battlefield to accommodate the uncertainty intrinsic to the military combat sphere. Additionally, they emphasised the necessity of interdisciplinary collaboration, training, and continuous experimentation to refine AI integration processes and ensure alignment with operational combat goals. One interviewee introduced the concept of "red teaming", as way for AI to enhance the outcomes in real-time combat:

(M4): "They should also make it [AI tool] as red team."

Red Teaming is known as the strategy employed by military trainings to uncover weaknesses and find flaws in operations to increase the overall robustness of the team in training (Choo et al., 2007). Through the lens of this participant, it is expected that the AI will be designed with red team capabilities to mimic enemy attacks. Our empirical data indicates that his experience has shaped his belief that AI not only can, but should, represent a "red team".

However, different frames of AI are not only seen in its capabilities but also in its level of penetration or practical usage. Some military personnel express scepticism about AI's role in decision-making, fearing it could overstep its bounds. Participant 3 articulates a more cautious perspective, suggesting AI should be confined strictly to data collection:

“[...] the limits of AI involvement or interference in the entire process is just data collection.[...] I think AI shouldn't really be involved in that process [outcome suggestions and decisions] at all.”

The interviewee believes that implementing an AI tool in decision-making is idealistic since it lacks human judgement and awareness which makes it not applicable to real-world scenarios. Additionally, the participant also mentions that AI is not free from bias, diminishing the value that the tool can bring to the military decision-making process. Furthermore, we could observe that there is a concern that military personnel might rely too heavily on the data provided by AI, potentially neglecting the broader context and other critical factors. As P3, interviewee M6 also shows reluctancy to accept a tool that in their view is prone to error almost as much as humans:

"Artificial intelligence is programmed by a man, who has at its base what his values are, what his culture is [...]"

The assumption that AI is programmed by an individual who can have different cultures and values influences its view of the tool - a negative technological frame - impacting trust in using this tool.

These differing perspectives illustrate the technological frames through which AI can be viewed. If technological frames are negative, individuals are likely to take a negative stance toward AI integration. Conversely, if individuals have a positive frame, their stance on AI integration is likely to be positive. The distinct perspectives will also influence the assumptions and expectations for what AI can and should do. For example, those who view AI primarily through a technological frame focused on efficiency and data processing are likely to have high expectations for its ability to enhance decision-making speed and accuracy. This group includes individuals like M5 and M7, who see AI as a tool for continuous learning and decision-making support. Their technological frame aligns with the belief that AI can handle large data sets more effectively than humans, leading to improved

decision-making. Moreover, in this group, we have individuals like M4 who perceive AI as a tool to avoid uncertainty, finding it useful for scenario planning in real-time combat.

On the other hand, interviewees P3 and M6, whose technological frames are shaped by concerns about ethical implications and the potential for misuse, are more cautious. They emphasise the importance of human oversight and the limitations of AI, particularly in understanding complex and diverse contexts. Our observations indicate that the lack of alignment between AI systems and human values and cultures is a significant concern among the participants. AI systems must be designed with a deep understanding of the cultural and ethical contexts in which they will be deployed and it should be clear to its "human-pair" the process behind its reasoning. This includes addressing biases that may be unintentionally embedded during the programming phase.

For this reason, we believe that black-box AI should be excluded from military decision-making processes due to the unclear reasoning behind its outcomes, which can unintentionally perpetuate biases. In contrast, explainable AI offers a more user-friendly approach, fulfilling the assumptions about AI usability and allowing users to understand the process behind the outcomes. This makes it easier to identify and address potential biases and other eventual errors if AI ever lacks context-awareness. The benefits of using explainable AI are even greater because it aligns with ethical considerations and facilitates compliance with regulations, which are crucial for building trustworthiness as a tool (European Commission, 2019a). The transparency provided by explainable AI ensures that the decision-making process can be followed and analyzed from an ethical perspective, which is essential for ensuring that AI systems operate in alignment with human values and cultural norms.

4.2.4. Trust and Trustworthiness

In our findings, trust is clearly positioned as a foundational element in the dynamic interplay between humans and machines, especially within the complex and high-stakes nature of military combat decision-making processes.

Due to our study's inability to measure the trustor's propensity to trust, as seen, our analysis focuses primarily on the relationship between the trustor and the AI tool's trustworthiness. This underscores the importance of examining how trust is built in interactions with technology, especially in scenarios where individual predispositions towards trust cannot be easily measured.

While the literature identifies numerous influencing factors for the acceptance of new technologies, our findings indicate that trust is a central concept both influencing and being influenced by other values. Trust closely relates to the transparency and understandability of AI, as well as its reliability. Although the literature distinguishes between trust and trustworthiness concepts, treating trust as a multifaceted issue, the interviews reveal their interrelated nature.

Drawing from the data, there is no doubt that trust in artificial intelligence (AI) emerges as a cornerstone for its successful integration into military decision-making processes. The sentiments expressed by interviewees underscore the pivotal role of trust in fostering acceptance and reliance on AI systems within the military domain. As one interviewee (M5) emphasised:

"First, human beings, decision-makers, have to be trained to listen and understand artificial intelligence, just as they are today trained to listen to advisors."

This highlights the importance of familiarity and understanding in building confidence in AI-supported decision-making processes. As mentioned by Balis and O'Neill (2022), in the five dimensions of trust, we could observe in the interviews that "deployment trust" is present and interviewees can see the purpose of integrating AI into the decision-making, as remarked by interviewee M8:

"AI can benefit in the elimination of cognitive biases in a wide variety of military decision-making, whether in the operational and logistics areas, such as in the information war".

Regarding "data trust," "process trust," and "outcome trust" - three of the five dimensions outlined by Balis and O'Neill (2022) - we observe that these dimensions are influenced by various perceptions highlighted in the aforementioned categories. These perceptions collectively contribute to the overall trust-building process.

Yet, there is more to discuss. O'Hara (2012) underscores a strong connection between trust and trustworthiness. In our study, participants exhibited a mixed understanding of these concepts, frequently shifting between them without clearly distinguishing their differences, unlike the clarity often found in the literature. For instance, participants frequently mentioned the process of "testing" the machine. This testing process enhances the tool's robustness, which is essential for establishing trustworthiness and increase the level of trust in the AI-DSS. Additionally, trustworthiness is mainly associated with the characteristics of the trustee - in this case, the AI tool - which participanst (M2 and M4) also highlighted:

M2: "[The AI] has to adapt to the [military] units and to the means that these [military] units have. This is a characteristic that you have to have."

M4:"Artificial intelligence [tool] must take into consideration elements of awareness and collateral damage."

Moreover, trust in AI is contingent upon transparency, reliability, and understanding its coding and processes. Another interviewee (M3) articulated concerns, stating:

"So, you need to be very careful and you need to know how it's made […] I would say, for example, it could be deviated by a virus or by, I don't know, something different."

These concerns not only align with recent studies made on overreliance on AI by Bloomberg: “adversaries could attempt to undermine them by poisoning training data or hacking software updates” (Manson, 2024), but also reflect the need for clarity in the AI’s characteristics to foster trust.

Based on our interviews’ findings and the existing literature, it is evident that the development and implementation of explainable AI systems - those which offer clear and comprehensible explanations for their outcomes and processes - alongside routine audits and transparency reports, can enhance the reliability of AI systems and make them more aware of biases or protected from malicious interference.

Additionally, interviewees expressed scepticism about AI's ability to autonomously make critical decisions without human oversight. One participant (M6) remarked:

"I personally would have some reluctance. I always question the part of the numbers […],",

emphasising the necessity of human oversight and understanding in the decision-making process. From the interviews we understand that maintaining a balanced approach where AI supports, but does not entirely replace, human decision-making is crucial for military personnel. We could observe that establishing protocols to ensure critical decisions are reviewed by human experts allow human intuition to guide final judgments. This is seen as non-negotiable for a possible future integration. This common perspective among participants resonates with an integration model that keeps the "human in-the-loop" (Dear, 2019; Devedzic, 2022). This approach respects the expertise of human operators while leveraging the potential strengths of AI, ensuring a collaborative and effective decision-making process.

Another less-mentioned, but also considered relevant, topic for the possible integration of AI into military decision-making is the need for interdisciplinary collaboration. We observe that it is important to form interdisciplinary teams that include technologists, military experts, ethicists, lawyers, and management experts to address the multifaceted challenges associated with AI integration. Such collaboration seems to ensure a holistic approach to AI implementation and, as seen in our interviews, in some cases can foster trust through diverse perspectives.

From the data collected, our most clear finding is that trust in AI emerges as a fundamental prerequisite for its acceptance and utilisation within MCDMP. Drawing insights from the TAM, the establishment of trust is intricately linked to both perceived usefulness and perceived ease of use. Furthermore, the theory of Technological Frames highlights how individuals' perceptions and assumptions significantly influence their level of trust in AI. Trust emerges as a central factor, resonating deeply with the core elements of the TAM framework and shaped by the power of Technological Frames. From the interviews, we gleaned that fostering trust is not just beneficial but essential for the acceptance and effective integration of AI within MCDMP, by enhancing the perceived usefulness and perceived ease to use, and influencing expectations and assumptions.

As military institutions navigate the complexities of AI integration, we argue that fostering trust through transparency, reliability, and interdisciplinary collaboration, among other actions, is essential for the effective and ethical utilisation of AI technologies. Participant 4 (P4) aptly noted,

"More information allows you to make better decisions, but you need to trust AI."

4.3. Key Findings Summary

The literature identifies perceptions, assumptions and expectations as essential factors for a positive use and development of new technologies. Trust was also identified by the literature as a very important factor. When it came to the interviews both with experts and military,

trust was the most highlighted factor out of all these, and was stated as crucial in order for an integration to be possible. Additionally, we literature states that a positive relation with technologies requires positive cognitive constructs. That is, to properly use and develop new technology, such as AI as a DSS, human decision-makers have to possess positive perceptions over its usefulness, positive perceptions over its ease to use, positive assumptions and positive expectations.

In our interviews, we found that military personnel overall have cautiously positive perceptions, both regarding usefulness and ease to use of AI, and negative expectations and assumptions for a fully automated AI tool in MCDMP. Regarding other levels of integrations of AI in MCDMP, the assumptions and expectations are not always common or clear. This will be looked with more detail by answering the initial research questions, in the following section.

To illustrate the connections and iterative processes behind our frameworks, we have created a visual representation of our path, as shown in Figure 7.

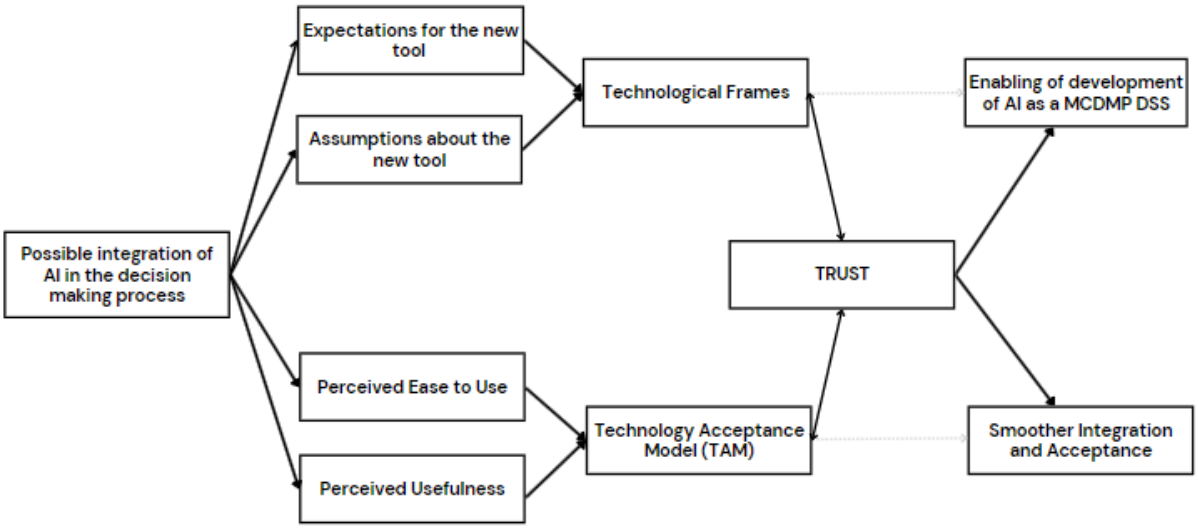

Figure 7: Model of factors that impact AI integration in MCDMP as a DSS, and their interconnectability - By the authors (Meleiro & Passos)

4.4. Answering the research questions

Question 1. ***What are the factors that military personnel consider more relevant when integrating AI in their combat decision-making processes?***

Trust: Trust emerged as one of the most critical factors for military personnel. It is essential for the acceptance and effective integration of AI in military decision-making processes. Trust in AI is built through rigorous testing, proven reliability, and a thorough understanding of its capabilities and limitations.

Transparency and Easiness to Use: Military personnel require AI systems to be transparent in their operations. This involves clear understanding of how AI reaches its conclusions, which is crucial for building trust and ensuring accountability. The user-friendliness of AI systems is another important factor. Military personnel prefer AI tools that are intuitive and easy to use, which facilitates faster adoption and integration into existing processes. For this, undoubtedly, the use of Explainable AI is a non negotiable.

Reliability: AI systems must be reliable and perform consistently under various conditions. This reliability is a key determinant in whether military personnel will rely on AI systems during critical decision-making processes.

Human Oversight: The need for human oversight is emphasised to ensure that AI complements rather than replaces human judgement. This helps in maintaining ethical standards and accountability in decision-making processes.

Question 2. ***What are the perceptions, assumptions, and expectations of military personnel regarding the impact of an eventual AI integration in the decision-making process?***

Perceptions: Military personnel generally perceive AI as a valuable and useful tool that can enhance decision-making processes. They acknowledge the potential of AI to improve operational efficiency and decision quality, particularly in high-stakes and time-sensitive

scenarios. They currently do not perceive the tool as easy to use, therefore recognising the need for training.

Assumptions: There is an underlying assumption that AI can significantly enhance decisions, increase speed and to a certain extent mitigate cognitive biases that often affect human decision-making. However, there is also a cautious stance regarding AI's ability to fully replace human decision-makers since it is still seen as a tool without value and consciousness.

Expectations: Expectations include improved accuracy, faster decision-making, and better handling of large volumes of data. Military personnel expect AI to support decision-making by providing comprehensive analysis and alternative solutions that may not be immediately apparent to human decision-makers. They expect to see a human in-the-loop.

Question 3. ***To what extent do military decision-makers and researchers trust AI systems to enhance the combat decision-making processes?***

Conditional trust: Trust in AI systems among military decision-makers and researchers is conditional. It depends heavily on the system's demonstrated reliability, transparency, and the ability to provide explainable outcomes. Trust is not given unconditionally by military decision-makers but can be earned through consistent performance and reliability tests.

Critical role of human judgment: Despite the potential benefits of AI, human judgement remains crucial. Military decision-makers are cautious about over-reliance on AI and emphasise the importance of keeping humans in-the-loop to ensure that ethical and contextual considerations are maintained. Thus, while they acknowledge that they can trust AI as a DSS if it shows consistent and positive results, this trust will never be complete.

Scepticism and caution: Building upon the critical role of having a human in-the-loop , there is a level of scepticism towards AI’s ability to fully take over decision-making processes. Military personnel are aware of the limitations of AI and the potential risks associated with its integration, leading to a cautious approach towards its adoption.

In summary, integrating AI into existing military frameworks is complex, involving significant technical, organisational, and cultural challenges. The learning curve and resource investment required for effective AI integration are substantial, necessitating careful management and strategic planning. There is an underlying scepticism towards AI's ability to fully take over decision-making processes. Trust in AI is conditional and built through rigorous testing, proven reliability, and a thorough understanding of its capabilities and limitations. Human judgment remains crucial to ensure accountability and ethical considerations.

5. Conclusion

Although we attempted to be as thorough as possible throughout the whole research process, some limitations, namely time constraints, made it difficult to assess the depth required for some aspects related to this topic. For example, consider the importance and impact of cognitive biases in the integration of AI as a DSS in combat operations, or further investigate mechanisms to address the current perceptions, assumptions, and expectations that military personnel have towards AI. Therefore, we acknowledge the contributions this research brings to the military sector, other industries, and the academic field. Nonetheless, we also recognize potential areas for improvement and development, which will be suggested after discussing these contributions.

5.1. Research Contributions

The literature models we focused on, namely the Technology Acceptance Model (TAM) and the Technological Frames theory, emphasise perceptions, expectations, and assumptions, as the key factors that affect the adaptation of new technologies. While these models mention trust, it is not their primary focus. However, our interviews revealed a different perspective, as trust emerged as a crucial factor for the integration of AI as a DSS. This thesis has contributed to emphasise the importance of responsibly integrate such an impactful tool in a high-stakes environment, and raised awareness of the need to carefully consider and address factors that might hinder such integration.

5.1.1. Military Sector Contribution

This research has significantly contributed to the military sector by raising awareness of the importance of perceptions, expectations, assumptions, and trust, when integrating AI into combat decision-making processes. It has highlighted the current state of these factors among military personnel towards this new technology, emphasising the pivotal role of trust in AI. Understanding and addressing these factors is essential for ensuring a successful and

responsible human-AI collaboration. These insights can help military leaders and policymakers develop strategies to foster trust and improve the overall acceptance and effectiveness of AI systems in high-stakes environments.

5.1.2. Broader Implication

Beyond the military, this research offers valuable insights for decision-makers in other sectors looking to integrate AI as a DSS. By identifying and addressing important factors that influence AI adoption, this study provides insights into elements that decision-makers should account for to ensure a smooth and positive integration of new technologies, especially in high-stakes industries. The factors identified and addressed are based in general models for the acceptance of new technologies (TAM and Technological Frames theory), therefore, it is expected that the insights can also be applied to other industries, despite the differences between the magnitude of the decision-making impact.

In the context of larger organisations, focused on profitability and business value, several studies shed light in the mixed results of the effectiveness and performance outcomes of AI adoption in organizations (Borges et al., 2021; Collins et al., 2021; Enholm et al., 2021). The dispersed evidence indicates the necessity of understanding human engagement and motivation (Raftopoulos & Hamari, 2023), which corroborates with the aim of this study to understand the prepositions behind the levels of acceptance of AI. As highlighted by Jain et al. (2023), to adress this gap, its needed to carefully design AI systems that are not perceived as black-box AI to ensure understanding and transparency, enabling users to feel more prepared and willing to accept AI collaboration. This perspective aligns with our conclusions even though we go beyond understanding the tool, analysing other factors that impact technology acceptance, such as perceived ease to use and users' expectations and assumptions, hence complementing existing research.

5.1.3. *Academic contributions*

At an academic level, this thesis prompts a deeper exploration of trust. It is relevant to study TAM and the Technological Frames in light of trust as a central factor, particularly in the military domain. While similar research has been conducted in other sectors, such as healthcare, where quantitative studies have examined the impact of trust, the unique dynamics and consequences of decisions in combat operations necessitate separate and focused studies. Further research should investigate the elements that foster trust in military combat operations and then assess their impact on AI effectiveness and overall outcomes.

5.2. Suggestions

5.2.1. *Sector improvements*

Training programs - Develop comprehensive training programs for military personnel, focused on the human in-the-loop, to improve their understanding and interactions with AI systems. These should focus on building trust by demonstrating the reliability and capabilities of AI tools.

Transparency and Accountability Mechanisms - Implement mechanisms that enhance transparency and accountability of AI systems, ensuring that decisions assisted by AI can be critically evaluated and understood by human operators. This can be done through implementing explainable AI that allows operators to follow the iterative process.

Ethical Guidelines - Establish clear ethical guidelines for the deployment of AI in combat operations, addressing potential issues like biases, cultural awareness and discrimination, in AI-suggested decisions.

Feedback Systems - Implement feedback systems where military personnel can share their experiences and concerns with AI systems. This feedback should be used to continuously improve AI integration and address any potential issues, assuring a human-centric approach

to the integration. Additionally, constant assessments of AI performance as DSS in MCDMP, is crucial to evaluate its effectiveness and trustworthiness.

5.2.2. Future Research

Command and Control Dynamics - Researchers should delve into the potential changes that AI will cause in command and control dynamics within military combat operations. Studies should explore how AI can be incorporated into existing command and control structures, the potential changes in hierarchy, and how these changes can impact overall mission effectiveness. This research will help to further understand how human-AI collaborations can be developed and impact current organisational structures, and hence foster trust in AI-enabled systems.

Trust-building elements - Researchers should conduct further studies to identify specific elements that foster trust in AI systems within military contexts. This research should focus on practical changes and actions that can be implemented to enhance military decision-makers' trust in AI as a DSS.

AI impact on biases - This research touches upon cognitive aspects such as perceptions, assumptions, and expectations, which can be occasionally biased. Biases have been shown to impact decision-making, especially in high-stakes settings. Hence, studying the impact that AI as a DSS can have on decision-making biases in military combat operations will be very valuable for future advances and integration. This can be looked at from both the perspective of human biases mitigation, and biases created or exacerbated by technologies, for example, the automation bias.

5.3. Final remarks

These suggestions are specific actions that can be carried out to ensure a responsible and effective integration of AI as a DSS of MCDMP. This is crucial in the high-stakes and sensitive environments that characterise combat decision-making, where the course of action chosen will sometimes have irreversible and significant humanitarian impacts, potentially involving life-or-death outcomes. Improving trust in AI and enabling its use for the improvement of such decisions is vital for the effectiveness and impact of its outcomes. By addressing critical factors for AI integration, we can ensure that the human-AI teaming will not be an element with negative impact in the future of warfare. Regardless the technology's capacities, human-AI collaboration should be addressed to not hinder AI's potential contribution to a more effective MCDMP, but instead leverage both sides' capabilities.

"In the business landscape, if AI makes a mistake no one dies, in the battlefield landscape errors can cost lives [...] it requires a higher level of trust."

Participant 4

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Appendix A

Interview Guidelines:

No.	Leading Question
1. Establishing Expertise	
1.1	Can you provide insights into your experience or expertise in the field of artificial intelligence and its application in military decision-making?
2. Human- AI Collaboration	
2.1	How do you envision the collaboration between AI systems and human decision-makers evolving in military contexts?
2.2	To what extent do you see AI integrating battlefield human decision-making?
2.3	How would you feel about integrating an AI tool into your decision-making process right now?
3. Envisioned Role of AI	
3.1	In your opinion, what are the key expectations for a new AI tool designated to improve military decision-making processes?
3.2	How do you perceive the potential role of artificial intelligence in military decision-making contexts?

4. Pre-Integration	
4.1	What are the essential factors or considerations that the military should take into account when integrating AI into decision-making processes?
4.2	What framework/scenario is needed for an effective integration of AI into the human DM processes?
4.3	What do you understand as needs for an integration of AI in the whole DM process?*

* This question was designed to reinforce the concepts addressed in question 4.3, as a single question was sometimes insufficient to gather comprehensive data.