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ANDRZEJ PAWLIKOWSKI*

The EU's defence ambitions in the field of defence technological and industrial development**

Abstract: The European Union (EU) has long aspired to bolster its defence capabilities, particularly in the realm of defence technological and industrial development. This study scrutinises the EU's evolving defence ambitions against the backdrop of a rapidly changing global security landscape. Faced with multifaceted security challenges and growing geopolitical uncertainties, the EU has embarked on a journey to enhance its strategic autonomy and bolster its defence industry's competitiveness. Through a comprehensive analysis of EU policy documents, defence strategies, and industrial initiatives, this study delineates the EU's efforts to foster innovation, collaboration, and interoperability within its defence ecosystem. Moreover, it explores the mechanisms employed by the EU to leverage synergies between civilian and military research, harness emerging technologies, and fortify its defence industrial base. By delving into the complexities of EU defence initiatives and their implications for transatlantic relations, regional security dynamics, and industrial cooperation, this study contributes to a nuanced understanding of the EU's quest for strategic sovereignty and technological prowess in an increasingly contested world.

Keywords: European defence policy, defence technological development, EU defence industry, defence innovation, defence self-sufficiency, EU

* University Professor, Director of the Strategic Studies Institute, National Security Faculty, War Studies University, Warsaw, Poland. https://orcid.org/0000-0002-9449-1204, a.pawlikowski@akademia.mil.pl.

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military cooperation, strategic defence technologies, EU arms industry, defence cybersecurity, critical infrastructure protection.

1. Introduction

In an era characterised by unprecedented geopolitical uncertainties and the continual evolution of security landscapes, the European Union (EU) stands at a critical juncture, compelled to redefine its defence ambitions in response to emerging challenges. This imperative arises from a complex interplay of factors, including geopolitical shifts, the rise of non-traditional threats, and the accelerating pace of technological advancements. The EU is actively steering itself towards a future characterised by enhanced autonomy and technological sophistication, recognising the indispensable role cutting-edge defence technologies play in ensuring not only the territorial integrity of its member states but also the overarching strategic interests of the EU.

The emergence of defence technologies is no longer merely a matter of military strategy; it has evolved into a strategic imperative essential for the very foundation of the EU's security architecture. As Europe grapples with an array of threats, ranging from conventional military challenges to cyberthreats and asymmetric warfare, the need for a robust defence technological and industrial base becomes increasingly paramount. This extended introduction seeks to delve deeper into the nuanced and intricate layers surrounding the development of defence technologies in Europe.

At its core, this exploration aims to unravel the historical trajectory that has shaped Europe's approach to defence, tracing the collaborative efforts originating in the aftermath of World War II. These historical roots laid the foundation for regional security alliances and paved the way for collective defence mechanisms that continue to evolve in response to contemporary challenges. By examining this historical continuum, we gain insights into the evolution of the European defence landscape and its adaptation to shifting global dynamics.

The contemporary challenges facing Europe are multifaceted and dynamic, requiring a multifaceted response. From traditional military threats to the complexities of hybrid warfare and intricacies of cyber-vulnerabilities, the security paradigm has become increasingly complex. Against this backdrop, the imperative for technological innovation in defence becomes not only strategic but also existential. Consequently, the EU is actively engaged in navigating these challenges by recognising the

critical need to fortify its defence capabilities through a holistic and forward-looking approach.

Considering these imperatives, this extended introduction sets the stage for a comprehensive exploration of Europe's defence ambitions. The subsequent sections will delve into specific aspects, including ongoing initiatives, collaborative projects, and the strategic vision underpinning the EU's endeavours. By scrutinising historical contexts, analysing contemporary challenges, and emphasising the indispensable role of a robust defence technological and industrial base, this study seeks to contribute to a nuanced understanding of Europe's trajectory towards a more secure, autonomous, and technologically advanced future.

2. Methodology and Selected Research Methods

This study's methodology is structured rigorously, beginning with the precise formulation of a research goal: to critically evaluate the strategic and defence frameworks within the EU, with an emphasis on fostering greater security and defence industrial cooperation among member states. The research identifies a central problem—fragmentation of defence policies across the EU—which complicates the integration of emerging technologies and strategic initiatives at the EU level. This problem is analysed systematically and its persistence is verified in the study's conclusions, which highlight the ongoing challenges in achieving a cohesive and unified European defence strategy despite numerous policy initiatives.

The research methods employed in the study are multifaceted and robust, combining both qualitative and quantitative approaches. The study undertakes a thorough analysis of historical developments in European defence policy, using a synthesis of geopolitical trends to inform strategic forecasting. This forecasting is underpinned by scenario planning and risk assessment techniques, which are designed to anticipate future security challenges and inform potential policy responses. The methodological framework also includes an examination of strategic documents, policy frameworks, and expert analyses, providing a comprehensive and nuanced understanding of the EU's evolving defence posture.

A critical examination of the sources reveals that the documents analysed are predominantly programmatic and strategic, reflecting the official policy objectives of the EU. These sources are essential for understanding the theoretical underpinnings of the EU's defence strategies.

However, they also carry inherent risks related to their implementation. The study acknowledges that while these documents outline ambitious goals and strategies, the realisation of these objectives is often hindered by practical challenges, such as political divergences among member states, economic constraints, and complex logistics of coordinating defence efforts across diverse national contexts. Thus, this study not only provides a critical analysis of existing strategies but also underscores the potential discrepancies between strategic planning and practical execution within the European defence framework.

3. Historical Perspective

The roots of Europe's defence endeavours lie within the tumultuous aftermath of World War II, a period marked by widespread devastation and a profound need for collaborative reconstruction and security efforts across the continent. The ravages of conflict served as a compelling catalyst for nations to recognise the imperative of unity in not only physically rebuilding their war-torn territories but also establishing a collective security apparatus that could safeguard against future threats. This pivotal juncture in history witnessed the birth of collaborative initiatives that laid the foundation for Europe's defence architecture.

One most significant milestone during this transformative period was establishment of the North Atlantic Treaty Organization (NATO) in 1949. NATO, formed by a coalition of European and North American nations, embodied a collective commitment to mutual defence against potential external aggressors. The alliance, with its cornerstone principle of collective defence, served to create a unified front against the backdrop of escalating Cold War tensions. NATO's formation represented a pivotal moment in European history, fostering solidarity and cooperation among nations with shared democratic values in the face of an ideologically divided world.

After NATO's establishment, Europe witnessed a series of regional security initiatives that further fortified the continent's collective defence mechanisms.[1] These initiatives were characterised by a commitment to cooperation and coordination, reflecting the shared understanding that security challenges transcended national borders. The evolving nature of these collaborative efforts not only responded to the immediate post-war

[1] Western European Union – 1954; European Union's Common Security and Defence Policy – 1999; Nordic Defence Cooperation – 2009; Baltic Defence Cooperation – 1994.

needs but also laid the groundwork for a resilient and adaptive defence framework capable of addressing the geopolitical shifts of the future.

Over the ensuing decades, the European defence landscape underwent transformative phases, each shaped by the prevailing geopolitical dynamics. The Cold War era, dominated by bipolar tensions between the Western and Eastern blocs, saw Europe as a focal point of global power struggles. The continent became a theatre where the ideological standoff manifested in military posturing, strategic alliances, and the constant spectre of nuclear conflict.

With the conclusion of the Cold War, Europe entered a new epoch marked by the dissolution of traditional alliances and emergence of a post-Cold War security paradigm. Shifting from a focus on deterrence and containment, the emphasis moved towards cooperative security. Nations sought to redefine their relationships, forge new alliances, and foster collaboration based on shared interests rather than ideological divides. This post-Cold War era witnessed the blossoming of cooperative initiatives, arms control agreements, and concerted efforts to address emerging threats through diplomatic means.

In essence, Europe's defence landscape is a tapestry woven with the threads of collaboration, adaptation, and resilience. From the immediate aftermath of World War II to the shifting alliances of the Cold War and the cooperative security initiatives of the post-Cold War period, the trajectory of Europe's defence endeavours reflect continual evolution in response to the dynamic geopolitical currents shaping the continent's destiny.[2]

4. Evolution of Defence Industries

The evolution of defence industries in Europe is intricately woven into the fabric of broader economic and political developments that have defined the continent's history. Throughout various epochs, defence industrial complexes have stood as pillars, not only contributing to the advancement of military capabilities but also playing pivotal roles in technological innovation, job creation, and regional stability. The symbiotic relationship between defence industries and the broader economic and political forces has often been a driving force in shaping the trajectory of European nations.

[2] See European Union, 2018; European Union External Action, 2021; NATO, 2012; NATO 2018; NATO, 2021.

Historically, defence industrial complexes emerged as catalysts for technological innovation, serving as incubators for cutting-edge advancements. The demands of military requirements often spurred research and development, leading to breakthroughs that eventually found applications beyond the defence sector. The defence industry's contribution to technological progress extended far beyond the battlefield, influencing civilian technologies and bolstering overall industrial competitiveness.

Moreover, defence-related projects have traditionally been engines for job creation, providing employment opportunities and contributing to economic growth. The scale and complexity of defence endeavours necessitate a skilled workforce, driving investments in education and training. This not only enhances technological expertise but also fosters a workforce capable of addressing broader societal challenges.

However, the landscape of defence industries in Europe has undergone profound shifts in response to changing global dynamics and the emergence of asymmetric threats. The once predominantly state-centric defence industrial complex has witnessed a transformation, with greater emphasis on collaboration between the public and private sectors. The evolving nature of security challenges, including cyberthreats, non-state actors, and unconventional warfare, has underscored the imperative for agility and technological sophistication in defence capabilities.

The need for technologically advanced defence capabilities has taken centre stage as Europe navigates a security environment marked by fluid geopolitical landscapes and unpredictable threats. The European defence sector faces the formidable task of adapting to these challenges, necessitating a paradigm shift in approaches to research, development, and innovation. The traditional defence industrial complex must evolve to embrace emerging technologies, leverage synergies with the civilian sector, and foster a culture of innovation that can swiftly respond to evolving security needs.

Amidst these challenges, ensuring continuous development of cutting-edge technologies becomes paramount. The European defence sector is tasked with balancing the dual objectives of enhancing security and maintaining economic competitiveness. Collaborative efforts between member states, strategic partnerships with industry leaders, and a commitment to research and development are crucial elements in overcoming these challenges.

In summary, the evolution of defence industries in Europe is a dynamic journey shaped by historical contexts, economic imperatives, and geopolitical realities. As Europe confronts the demands of a rapidly changing security landscape, the defence sector must adapt, innovate, and collaborate to ensure not only the continent's security but also its position at the forefront of technological progress and economic resilience.

5. Contemporary Challenges

The contemporary security environment in Europe unfolds against a backdrop marked by an intricate web of challenges, transcending conventional notions of military threats. The EU navigates through a landscape where traditional military challenges coexist with an array of unconventional, cyber, and hybrid threats. This multifaceted security matrix necessitates a holistic and adaptive approach, prompting the EU to confront the imperative of fortifying its defence capabilities to effectively safeguard against emerging threats.

Traditional military threats, while not diminishing in significance, now share the stage with a spectrum of non-traditional challenges. Unconventional warfare, characterised by asymmetric tactics employed by non-state actors, demands a recalibration of defence strategies. The ability to respond to irregular and unpredictable threats becomes imperative in maintaining regional stability and the protection of vital interests.

Furthermore, the advent of cyberwarfare has ushered in a new era of vulnerability, where digital infrastructure and interconnected systems are potential battlefields. The EU, like other global actors, must grapple with the constant evolution of cyberthreats that can undermine national security, economic stability, and even the functioning of critical infrastructure. Developing resilient cybersecurity measures becomes a crucial component of any comprehensive defence strategy.

Hybrid warfare, a blend of conventional and unconventional tactics, poses additional challenges. This form of warfare involves a combination of military, economic, and informational elements, often employed simultaneously to exploit vulnerabilities and achieve strategic objectives. The nuanced nature of hybrid threats demands a flexible and multifaceted defence posture, capable of responding to diverse challenges with agility and precision.

As the geopolitical landscape continues to evolve, the EU faces the urgent need to fortify its defence capabilities, to not only respond to current challenges but anticipate and address those that may emerge in the future. The interplay of technological advancements adds another layer of complexity to this imperative. Cutting-edge technologies, such as artificial intelligence, autonomous systems, and advanced sensors, offer both opportunities and challenges. The EU must harness the transformative potential of these technologies to enhance its defence capabilities while also navigating ethical considerations and potential risks.

Economic considerations further underscore the urgency for a coherent and forward-looking defence strategy. Investments in defence technologies not only contribute to security but also drive economic growth, foster innovation, and create high-skilled jobs. Striking a balance between economic viability and security imperatives becomes crucial in crafting a sustainable defence framework.

At the heart of this complex interplay lies the imperative for strategic autonomy. The EU seeks to assert its ability to act independently in matters of defence, reducing dependencies on external actors and ensuring self-sufficiency in critical areas. Achieving strategic autonomy requires a comprehensive understanding of evolving threats, a commitment to technological innovation, and a cohesive defence strategy that aligns with the broader geopolitical ambitions of the EU.

In conclusion, the contemporary security challenges facing Europe demand a comprehensive and dynamic response. The EU, recognising the multifaceted nature of threats, must fortify its defence capabilities through a combination of strategic foresight, technological innovation, and economic considerations. Crafting a coherent and forward-looking defence strategy is not merely a response to current challenges but a proactive endeavour to secure the future stability and resilience of the European continent in an ever-changing global landscape.

6. Imperative for Technological Advancement

In the dynamic landscape of the 21st century, technological innovation has surged forward at an unprecedented pace, ushering in breakthroughs across various domains such as artificial intelligence, cyber-capabilities, space exploration, and autonomous systems. Recognising the transformative potential inherent in these advancements, the EU has embarked on a

visionary journey to harness cutting-edge technologies, strategically integrating them to enhance its defence capabilities. This deliberate and forward-thinking approach is emblematic of the EU's commitment to not only adapt to the evolving security paradigm but actively shape it.

The intersection of civilian and military technologies has emerged as a focal point in the EU's pursuit of a technologically advanced defence apparatus. The emphasis on dual-use applications, which can simultaneously bolster economic competitiveness and security resilience, underscores the interconnected nature of contemporary challenges and opportunities. This holistic integration acknowledges that advancements in technology are not confined to the realm of defence alone; rather, they permeate every facet of the society and industry.

As the EU navigates the complexities and opportunities presented by these advancements, the development of defence technologies stands as a linchpin in shaping the future of European security. This exploration seeks to peel back the layers of Europe's defence ambitions, as not merely as a reactive response to immediate threats but also a proactive endeavour to position the continent at the forefront of global technological leadership.

The overarching goal of this study extends beyond mere analysis of current challenges; it aims to provide readers a comprehensive understanding of the historical evolution, current challenges, and future trajectories of Europe's defence capabilities. In doing so, it seeks to unravel the intricacies of how Europe, acting collectively, strategically positions itself amid the evolving geopolitical complexities that define the 21st-century security landscape.

Delving into the historical roots of collaborative defence efforts, this study scrutinises the multifaceted challenges posed by diverse security threats, from traditional to emerging unconventional forms. Furthermore, it emphasises the imperative for technological advancements, recognising that the ability to navigate and leverage cutting-edge technologies is integral to maintaining a robust defence posture.

The extended purpose of this study goes beyond a simple examination of defence technologies. It ventures into the intersections of defence and civilian technologies, acknowledging the dual-use potential that not only enhances security but also contributes significantly to economic competitiveness. By doing so, the study aims to unravel the strategic decisions, policy frameworks, and collaborative initiatives undertaken by the EU. These initiatives play a pivotal role in bolstering the EU's defence

technological and industrial base, aligning it with broader economic and strategic objectives.

As it addresses these multifaceted dimensions, the study aspires to foster a nuanced discourse on how Europe navigates the delicate balance between autonomy and collaboration. It recognises that achieving a technologically advanced defence apparatus requires a strategic blend of self-reliance and cooperative endeavours. The insights provided herein aim to serve as a valuable resource for policymakers, scholars, and stakeholders interested in deciphering the complexities and strategic considerations that underpin the EU's defence ambitions.

In conclusion, the extended purpose of this study transcends the immediate landscape of defence technologies; it contributes to informed discussions and insights that can actively shape the future trajectory of European defence endeavours. In an era marked by rapid technological advancements and dynamic geopolitical shifts, this exploration endeavours to be a beacon guiding the EU towards a future where technological innovation is woven seamlessly into the fabric of its security and strategic autonomy.

7. History and Background

Over the years, the concept of joint European defence activities has evolved in response to shifting geopolitical landscapes, security threats, and the imperative of fostering greater cooperation among European nations. This brief history delves into the trajectory of collaborative defence efforts within Europe, tracing the milestones and developments that have shaped the continent's approach to collective security and defence. From the aftermath of World War II to the present day, the journey of joint European defence activities is emblematic of the continent's ongoing quest for peace, stability, and resilience in an ever-changing global environment.

The past decade has marked a significant resurgence in European security and defence efforts, catalysed by pivotal events such as the December 2013 European Defence Summit. This summit served as a catalyst for a fresh wave of collaboration and coordination among European nations, signalling the dawn of a new era characterised by heightened defence cooperation. Amidst the backdrop of escalating geopolitical tensions and an array of challenges confronting Europe from various quarters, the unveiling of the EU Global Strategy in 2016 served as a pivotal

moment. This strategic blueprint, coupled with a flurry of initiatives launched in the aftermath of 2016, underscored the profound transformation underway in the EU's security and defence policy landscape. The EU's response to the evolving security landscape has been multifaceted, reflecting a proactive approach to addressing emerging threats and safeguarding the continent's stability. This period has witnessed a notable shift towards greater integration and solidarity among EU member states, with efforts aimed at bolstering collective defence capabilities and fostering strategic autonomy.

Furthermore, the post-2016 initiatives have sought to enhance interoperability among European armed forces, streamline defence procurement processes, and reinforce strategic partnerships with NATO and other key stakeholders. The emphasis on enhancing resilience, agility, and innovation has been central to the EU's endeavours in strengthening its security and defence architecture.

In response to the intricate geopolitical dynamics of the 21st century, the EU has acknowledged the necessity of adapting and enhancing its security stance to safeguard the interests of its member states and promote enduring peace and stability. The sustained momentum in European security and defence underscores a collective dedication to addressing contemporary challenges and fortifying the continent's resilience for the years ahead.

Illustrative of the EU's expanded aspirations in security and defence policy are pivotal initiatives such as the inception of Permanent Structured Cooperation (PESCO) in 2017, launch of the European Defence Fund (EDF) in 2019, and establishment of the Directorate-General for Defence Industry and Space (DG DEFIS) in 2021, among others. These initiatives exemplify the EU's proactive approach towards fostering greater cooperation, bolstering defence capabilities, and advancing strategic autonomy in safeguarding European interests and promoting global peace and security.[3] All of these initiatives will have undeniable consequences for the EU's institutional identity and political transformation from a purely civilian international actor to a potential military and technological power on the international stage. Behind these various policy and institutional developments is an EU-led defence technological and industrial policy intended to shore up the European Defence Technological and Industrial Base (EDTIB). The above developments illustrate a metaphorical alignment of planets that created a favourable environment for defence industrial and

[3] See European Commission, no date.

technological policymaking. Geopolitical pressure on Europe, and on larger EU member states in particular, encouraged them to shore up Europe's strategic autonomy in defence. These circumstances gave the European Commission a window of opportunity to take a more proactive role in security and defence technological and industrial matters. The EU's lack of domestic investment in defence, coupled with a growing sense of defensive regionalism regarding the United States, also contributed to this policy environment.

In this post-2016 alignment of interests, high-level European political and policy circles realised that advantages in cutting-edge defence and technological areas help define international influence and strategic autonomy.[4]

The EU's security and defence policy field has experienced increased funding and institutionalisation of security-oriented and defence research and development, including critical dual-use technologies. While acknowledging the link between EU defence and civilian science, technology, and innovation policies, this study focusses on the emergence of EU security and defence research and innovation policy.

The goal is to understand the roots, evolution, and multistakeholder representation leading to a supranational European defence research programme. Transnational interest groups, including security corporations, industry associations, and lobby groups, have played pivotal roles in shaping this development. However, civil society actors and elected representatives have been notably absent from these discussions, raising concerns about democratic accountability and oversight.

This raises significant democracy questions for the EU, especially as it considers transformative security and defence policy changes. Greater involvement of the European Parliament and national legislative bodies in decision-making is essential to ensure democratic legitimacy and transparency. Addressing these issues is crucial for the EU to maintain its identity as a promoter of peace and stability.

Even before the 1990s, the European Commission recognised the importance of preserving the competitiveness of the European defence industry, particularly as the geopolitical landscape began to shift with the end of the Cold War. In the 1970s and 1980s, the European Commission acknowledged the strategic importance of the defence sector, for not only security but also economic reasons, leading to efforts to harmonise defence

[4]See Csernatoni, 2021; European Commission, 2021.

procurement policies and promote collaboration among member states' defence industries. In 1985, the European Commission's Communication on Industrial Policy underscored the need to support key sectors, including defence, as part of a broader strategy to enhance European technological capabilities and industrial competitiveness. By 1988, the European Commission had taken further steps by presenting a communication titled 'The European Arms Industry: The Need for Cooperation', which highlighted the necessity of cooperation among European countries to strengthen the competitiveness of the defence industry. This document advocated for reducing market fragmentation, promoting standardisation, and encouraging joint research and development among European defence firms, laying the groundwork for more integrated and competitive defence initiatives in the years to come. Efforts to coordinate defence industrial players with EU security, promote dual-use technological innovation, and advance defence research initiatives have been ongoing. The EU has emphasised the need to maintain the competitiveness of the European defence industry, shaping successive EU-level advisory bodies and influencing research and innovation policy agendas. Relationships between the European Commission, defence industry actors, and expert groups have significantly influenced the creation and priorities of EU security and defence research innovation programmes.[5]

In general, these linkages have actively influenced policy trajectories, often favouring specific stakeholders, and have seen a growing emphasis on dual-use research and capability development initiatives. Initially integrated into the EU's Framework Programmes, these projects have focussed on diverse technological domains such as space, border security, maritime surveillance, cybersecurity, and emerging technologies.[6]

Historical development of closer European security and defence industrial and technological cooperation is a complex affair.[7] This has entailed intricate and interconnected EU-state-industry relations spanning multiple EU institutions, agencies, interest groups, and actors within the security and defence industrial sector. It also demonstrates member states' growing readiness to grant the EU a more substantial role in security and defence affairs. Considering the ongoing discussions regarding the EU's defence and technological autonomy, it is imperative to thoroughly outline

[5] Karampekios and Oikonomou, 2018, p. 182.
[6] See Csernatoni, 2016, pp. 174.
[7] See Martins and Mawdsley, 2021, pp. 94.

the costs and benefits of European security and defence research and innovation programmes.[8] Furthermore, it is essential to delve deeper into the contributions of various interest groups and EU institutions. This discussion is closely tied to a growing consensus among member states regarding the necessity for the EU's Common Security and Defence Policy (CSDP) to adopt a higher level of strategic ambition, recognising the advantages of establishing a European defence industrial and technological research and innovation policy.

However, establishment of a unified European approach to security and defence technological and industrial matters has faced challenges. Simultaneously, the European Commission's expanding competencies in these domains remain contentious among other EU institutions and member states. This sensitivity highlights the deeply rooted national protectionism surrounding security and defence issues, as well as the ongoing competition with organisations such as the European Defence Agency (EDA) in shaping the direction of the EU's security and defence policy agenda.[9]

In the aftermath of World War II, Europe faced the daunting task of rebuilding shattered economies and ensuring collective security against future threats. Establishment of institutions such as the European Coal and Steel Community in 1951 laid the groundwork for economic integration and cooperation, setting the stage for broader defence collaboration among European nations.

The onset of the Cold War heightened security concerns across Europe, leading to the formation of military alliances such as NATO in 1949. While NATO primarily focussed on collective defence against the Soviet bloc, it also served as a catalyst for defence industry cooperation among its member states, laying the foundation for future collaborative endeavours. Following the end of the Cold War, major crises such as the Kosovo War of the later 1990s forced Europe to integrate the security structures of the Western EU into the EU's institutional structures. This integration led to the creation of what then was called the European Security and Defence Policy, now known as the CSDP. The 2003 Iraq War facilitated the formulation of the EU's first programmatic document in security and defence, the European Security Strategy, which was followed in 2004 by the establishment of the EDA. Since its creation, the EDA's main purposes were to support members states in the improvement of European military

[8] Csernatoni, 2019, pp. 119–140.
[9] Fiott, 2015, pp. 542–557.

capabilities, boost the continent's dormant defence industry and market, expand collaboration among member states on defence issues, and rationalise research and development in defence technologies.[10] With consolidation of the policy, institutional, and strategic frameworks in the European Security and Defence Policy (now CSDP), EDA, and European Security Strategy, the political focus in Europe shifted towards capability development for such frameworks, as well as collaborative defence industrial projects and research-and-development initiatives. However, even though the European Security Strategy helped the EU articulate its normative and strategic goals and role in the world, and the EDA's creation responded to member states' need to address military capability shortfalls through closer cooperation, the EU still lacked proper coordination and harmonisation of the security and defence industrial and research efforts.[11]
The Treaty of Lisbon, which entered into force in 2009, provided a legal framework for enhanced defence cooperation within the EU. This paved the way for the establishment of PESCO in 2017, marking a significant milestone in European defence integration. PESCO facilitates joint defence projects, fosters interoperability among armed forces, and promotes defence industry collaboration among participating EU member states.

In 2019, the EU launched the EDF as part of its efforts to strengthen the continent's defence industrial base and promote innovation in defence technologies. The EDF provides financial support for collaborative research-and-development projects, as well as for the acquisition of defence capabilities, thereby bolstering Europe's strategic autonomy and resilience in an increasingly uncertain security environment.

Recognising the growing importance of the defence sector in Europe's strategic agenda, the EU established the DG DEFIS in 2021. This dedicated body within the European Commission aims to coordinate and promote EU policies related to the defence industry, procurement, and space activities, underscoring the EU's commitment to nurturing a competitive and innovative defence industrial base.

These key moments illustrate the evolution of the defence industry within the EU, marked by milestones in cooperation, integration, and innovation aimed at strengthening Europe's defence capabilities and safeguarding its security interests.

[10] Csernatoni, 2016, pp. 119–140.
[11] Oikonomou, 2023, pp. 178, 181.

8. Current Technological State in Defence

Analysis of the current technological status of the defence sector is paramount in understanding the evolving landscape of military capabilities, strategic priorities, and security challenges facing nations worldwide. As technology continues to advance at an unprecedented pace, its integration into defence systems and operations has become increasingly vital for ensuring national security and maintaining military superiority. In this examination, we delve into the latest trends, innovations, and developments shaping the defence sector's technological landscape. From breakthroughs in artificial intelligence and cyberwarfare to advancements in aerospace and unmanned systems, the defence industry is undergoing a profound transformation driven by rapid technological advancements.

Moreover, with the emergence of new threats such as hybrid warfare, terrorism, and asymmetric conflicts, there is growing emphasis on leveraging cutting-edge technologies to enhance situational awareness, decision-making capabilities, and operational effectiveness on the battlefield. This analysis aims to provide insights into the key technological trends and challenges confronting the defence sector today. By understanding the current technological status, policymakers, military leaders, and defence industry stakeholders can better anticipate future needs, opportunities, and risks, thereby ensuring that defence capabilities remain aligned with evolving security dynamics in an ever-changing global landscape.

Identifying key areas of technological development is essential for understanding the trajectory of innovation, anticipating future trends, and strategically allocating resources to drive progress in various industries. In this analysis, we explore the pivotal domains where technological advancements are shaping the present and future landscape of innovation. From artificial intelligence and machine learning to biotechnology, renewable energy, and beyond, the pace of technological evolution is unprecedented, offering both opportunities and challenges across sectors. By identifying the key areas of technological development, stakeholders can gain insights into emerging trends, potential disruptions, and areas ripe for investment and collaboration. This analysis aims to shed light on the most promising domains of technological advancement, considering their implications for industries, economies, and societies at large. By recognising these key areas of development, policymakers, business leaders, and

innovators can harness the power of technology to drive sustainable growth, address pressing challenges, and foster a more prosperous and resilient future.

9. Challenges Facing the Defence Industry

The defence industry in the EU faces myriad challenges that pose significant implications for security, innovation, and economic competitiveness. In this discussion, we explore the primary obstacles confronting the defence sector within the EU and their broader ramifications. From budget constraints and technological gaps to geopolitical uncertainties and regulatory complexities, the defence industry grapples with multifaceted challenges that demand strategic foresight and coordinated action. These hurdles not only impact the ability of EU member states to safeguard their national security but also influence the continent's role as a global player in defence and security affairs. Since the European Council declared in 2013 that 'defence matters' for Europe, the EU has gained new momentum in defence cooperation. After decades of reducing national defence expenditures in the post-Cold War era—a decline exacerbated by the global financial crisis of 2008—the EU and its member states found themselves under pressure to coordinate defence policy, spending, and procurement at the EU level. The current moment in European defence integration unfolds against the backdrop of growing geostrategic threats, increasing instability in the EU's neighbourhood, competition among major powers, a fierce global race in technological innovation, and (lately) repercussions of the coronavirus pandemic.[12] These structural challenges have created an opportunity for a new work ethos among EU institutions, security entities, industry, and member states, aiming for closer cooperation in security and defence in areas of grand policy.[13] This represents a significant shift from the EU perspective, as security and defence issues have traditionally been the exclusive prerogative of national sovereignty and operated within the intergovernmental decision-making process in the EU rather than within the supranational approach adopted in other areas.

Creating a more cohesive and integrated EU vision on security and defence is part of broader efforts to mitigate new security threats and hybrid challenges arising from an increasingly competitive geopolitical context and

[12] Csernatoni, 2020.
[13] James, 2018, pp. 18, 23.

evolving technological trends. The aim is to find practical solutions that enhance the EU's role as a security guarantor, both within member states and globally.[14] Various policy documents[15] have indicated that for the EU to become a more strategic global defence actor, it will need a stronger European defence industry and defence market that can address gaps in expected military capabilities as well as increased spending on research and innovation in border security and defence.[16] To safeguard Europe's independence as well as its "way of life and values"—whatever that phrase may signify in terms of normative identity—its strategic autonomy in security matters and defence technologies will be crucial. Since the early 2000s, the European Commission has been crafting a narrative legitimising this trend. It has underscored the benefits of pursuing a more coordinated security research programme at the EU level, encouraging Europe to leverage its technological assets and potential opportunities offered by new technological trends.

Civil, security, and defense applications increasingly rely on the same technological foundation, creating new synergies across different research sectors. Utilizing technology as a facilitator for creating a secure Europe requires cutting-edge branches of industry, robust knowledge infrastructure, adequate funding, and optimal resource utilization. Europe boasts high-quality research institutes and a significant and diverse industrial base that can meet technological requirements in the security domain. However, structural deficiencies at the institutional and political levels hinder Europe from harnessing its scientific, technological, and industrial potential. The division line between defense and civilian research, lack of detailed frameworks for security research at the EU level, limited cooperation among member states, and lack of coordination between national and European efforts exacerbate the lack of public funding for research and pose serious obstacles to delivering cost-effective solutions.[17]

This text is as relevant now as it was at the time of its publication in 2004. Ultimately, through "creating new synergies across different research sectors" and "between defence research and civilian research," earlier and current thinking has supported efforts to enhance civil-military innovation

[14] See European Commission, 2016a.
[15] See European Commission, 2016b; European Commission, 2019; European Defence Agency, no date; European Union External Action, 2016.
[16] Hill, 1993, pp. 305–328.
[17] See European Commission, 2004.

and deepen cross-border technological and industrial integration in European security and defence.[18] Such thinking would likely breathe new life into the European political project as it emphasises goal convergence. Member states are seeking political (and financial) investments at the EU level. Meanwhile, the European Commission has underscored greater efficiency and regulation of the market regarding security and defence expenditures. As mentioned earlier, this alignment of planets has occurred at a much-needed time for European security and defence initiatives.

This discussion aims to dissect the main challenges faced by the defence industry in the EU, shedding light on their origins, impacts, and potential pathways for mitigation. By addressing these challenges head-on, policymakers, industry leaders, and stakeholders can work towards fostering a more robust and resilient defence ecosystem capable of meeting the evolving security needs of Europe and beyond.

The analysis of security threats requiring new technologies is imperative for understanding the evolving landscape of global security challenges and developing innovative solutions. In this discussion, we delve into the pressing security threats facing nations worldwide and the corresponding need for advanced technologies to address them effectively. From cyberattacks and terrorism to geopolitical tensions and hybrid warfare, the spectrum of security threats is diverse and dynamic. Traditional approaches to defence and security are increasingly inadequate in the face of the emerging risks and evolving tactics employed by adversaries. As such, there is growing recognition of the necessity for novel technologies to bolster defence capabilities, enhance resilience, and safeguard national interests.

This analysis aims to explore the security threats driving the demand for new technologies, examining their nature, implications, and potential countermeasures. By identifying these threats and understanding their technological requirements, policymakers, military leaders, and industry stakeholders can prioritise research, development, and deployment efforts to address the most critical security challenges of the 21st century.

10. European Defence Ambitions

Presentation of the EU's defence goals within the context of European Defence Ambitions is crucial for understanding the collective aspirations

[18] Iraklis Oikonomou, 2012, pp. 179–181.

and strategic objectives of European nations in the realm of security and defence. In this presentation, we explore the overarching goals and aspirations of the EU in strengthening its defence capabilities and promoting stability in the region. Against the backdrop of evolving security threats and geopolitical dynamics, the EU has articulated ambitious defence objectives aimed at enhancing strategic autonomy, fostering greater cooperation among member states, and reinforcing Europe's role as a credible security actor on the global stage. These goals are encapsulated within the framework of European Defence Ambitions, which outlines the collective vision and priorities for European defence cooperation.

This presentation aims to elucidate the key elements of the EU's defence goals, highlighting their alignment with European Defence Ambitions and their significance in addressing contemporary security challenges. By articulating these objectives and aspirations, the EU seeks to forge a more secure and resilient Europe while advancing its interests and values in an increasingly complex and uncertain world.

The analysis of strategic defence documents within the context of European Defence Ambitions provides valuable insights into the overarching vision, priorities, and strategic objectives of the EU in the realm of defence and security. In this analysis, we delve into the key strategic documents that guide the EU's defence policies and initiatives, examining their alignment with the broader framework of European Defence Ambitions. As Europe confronts myriad security challenges ranging from traditional military threats to hybrid warfare, terrorism, and cyberattacks, the EU has articulated a comprehensive approach to bolstering its defence capabilities and safeguarding its interests. Central to this approach is the concept of European Defence Ambitions, which seek to enhance European strategic autonomy, strengthen defence cooperation among member states, and promote a more integrated and capable European defence.

Through the analysis of strategic defence documents such as the EU's Global Strategy, the Capability Development Plan, and European Defence Action Plan, we aim to elucidate how these documents contribute to the realisation of European Defence Ambitions. By examining the goals, priorities, and initiatives outlined in these documents, we can gain a deeper understanding of the EU's vision for defence cooperation and efforts to address the evolving security landscape in Europe and beyond.

11. Technological and Industrial Initiatives

In the context of the EU's defence ambitions and emergence of defence technological and industrial development, several specific projects and initiatives have been launched to bolster Europe's defence capabilities. These endeavours aim to enhance the EU's autonomy in defence technology and reduce its reliance on external actors. Here are some notable examples:

- EDF: EDF is a flagship initiative designed to support collaborative defence research-and-development projects among EU member states. It provides funding to consortia composed of companies' research institutions and defence agencies to develop cutting-edge defence technologies and capabilities. The EDF aims to foster innovation, strengthen industrial cooperation, and enhance Europe's defence industrial base.
- PESCO: PESCO is a framework for enhanced defence cooperation among EU member states that are committed to jointly developing military capabilities. Under PESCO, participating countries collaborate on various defence projects, including the development of next-generation weapons systems, cyber-defence capabilities, and strategic transport aircraft. PESCO aims to promote interoperability, improve efficiency, and increase the effectiveness of European defence efforts.
- European Defence Industrial Development Programme: This programme is a funding mechanism aimed at supporting the development of defence technologies and capabilities within the EU. It provides grants to projects that contribute to the advancement of key defence priorities such as cybersecurity, unmanned systems, and space-based assets. Further, this programme aims to strengthen Europe's defence industrial base, stimulate innovation, and enhance competitiveness of the European defence sector.
- EDTIB: The EDTIB initiative seeks to promote collaboration and integration within the European defence industry. It encompasses efforts to harmonise defence procurement policies, facilitate cross-border cooperation, and promote the sharing of defence research-and-development resources. The EDTIB aims to ensure the sustainability, resilience, and competitiveness of Europe's defence industrial base in the face of evolving security challenges.

- EDA Initiatives: The EDA plays a central role in coordinating and facilitating defence cooperation among EU member states. EDA oversees various initiatives aimed at enhancing defence capabilities, such as collaborative research projects, capability development programmes, and defence technology initiatives. The EDA works to foster synergy efficiency and innovation across the European defence landscape.

These projects and initiatives underscore the EU's commitment to advancing its defence technological and industrial development agenda, thereby strengthening Europe's ability to address emerging security threats and safeguard its strategic interests. By investing in innovation, collaboration, and capability development, the EU aims to build a more resilient and autonomous defence posture in an increasingly complex geopolitical environment.

International cooperation in the field of defence plays a crucial role in promoting security stability and peace among nations. Through collaborative efforts, countries can address common security challenges, mitigate threats, and enhance their defence capabilities. Here is an analysis of international cooperation in defence:

- Shared Security Challenges: Many security challenges that nations face today transcend borders and require collective responses. Threats such as terrorism, cyberattacks, proliferation of weapons of mass destruction, and transnational organised crime cannot be tackled effectively by individual countries alone. International cooperation allows nations to pool resources, expertise, and intelligence to address these shared challenges comprehensively.
- Alliance and Partnership Building: Alliances and partnerships are fundamental pillars of international defence cooperation. Formal alliances, such as NATO, and regional security arrangements, such as the ASEAN Defence Ministers' Meeting, foster trust, interoperability, and collective defence among member states. Bilateral partnerships between countries also contribute to mutual security interests through joint exercises, intelligence sharing, and defence technology collaboration.
- Peacekeeping and Conflict Resolution: International cooperation in peacekeeping missions is vital for resolving conflicts and promoting stability in regions affected by violence and instability. United Nations peacekeeping operations, often conducted with contributions from

multiple countries, help mitigate conflicts, protect civilians, and facilitate post-conflict reconstruction. Cooperation among regional organisations such as the African Union and EU further enhances peacekeeping efforts by leveraging regional expertise and resources.

- Arms Control and Non-Proliferation: Multilateral agreements and treaties play a critical role in arms control and non-proliferation efforts. Treaties such as the Treaty on the Non-Proliferation of Nuclear Weapons and Chemical Weapons Convention aim to prevent the spread of weapons of mass destruction and promote disarmament. International cooperation is essential for verifying compliance with these agreements through inspections, monitoring, and intelligence sharing.
- Defence Trade and Technology Transfer: Defence trade and technology transfer agreements facilitate the exchange of defence equipment, technology, and expertise among nations. These agreements strengthen defence industrial bases, promote innovation, and enhance interoperability among partner countries' armed forces. However, they also raise concerns about arms proliferation technology leakage and national security risks, necessitating careful regulation and oversight.
- Humanitarian Assistance and Disaster Relief (HADR): International cooperation in HADR operations is vital for providing timely assistance to countries affected by natural disasters, humanitarian crises, and emergencies. Military forces often play a significant role in these operations, providing logistical support, medical assistance, and disaster response capabilities. Multinational exercises and training enhance interoperability and coordination among military forces, enabling more effective HADR responses.

In conclusion, international cooperation in the field of defence is essential for addressing shared security challenges, promoting peace and stability, and enhancing collective security. By working together, nations can leverage their strengths, resources, and expertise to build a safer and more secure world for all.

12. Using Innovation in European Security

The discussion surrounding the impact of technological innovations on the effectiveness of European security activities is paramount in understanding

the evolving landscape of security challenges and responses within the EU. In this discussion, we explore how advancements in technology shape the capabilities, strategies, and outcomes of security efforts undertaken by European nations and institutions. From artificial intelligence and big data analytics to cybersecurity, surveillance technologies, and unmanned systems, technological innovations have revolutionised the way security activities are conducted and managed. These innovations offer unprecedented opportunities to enhance situational awareness, improve response times, and mitigate emerging threats in a rapidly evolving security environment.

European defence industry consortia have played a leading role in influencing EU initiatives in developing capabilities and shaping the parameters of the EU's research-and-development policy in the field of security and defence.[19] This is not surprising, as states have long viewed the existence of strong and competitive defence technological and industrial bases as a strategic and military advantage in both peacetime and wartime. The challenge for the EU, and especially the European Commission, has been the Europeanisation of defence research and innovation, as well as regulation of the European defence industry market and technological base.[20] In particular, it would have to deal with the costs of defence "outside of Europe"—that is, the costs of operating at the national level rather than the European level.[21] It is estimated that the cost of "lack of Europe" in defence ranges from €130 billion (almost $148 billion) at the upper end to at least €26 billion (over $29 billion) in more conservative calculations.[22] Another challenge for EU member states is accepting the constraints of national industrial bases amid decreasing budgets for research, development, and public procurement, as well as ensuring global competitiveness through regional cooperation and cross-border armament collaboration.

With specialised knowledge, resources, and experience in close collaboration with EU member states and national supply chains, as well as a long history of European defence programmes such as the Eurofighter combat aircraft and A400M military transport aircraft, the European defence industry has recognised opportunities through cooperation. It is well-

[19] Akkerman, 2018, pp. 254; Karampekios, Oikonomou, and Carayannis, pp. 343.
[20] Renaud Bellais, 2018, pp. 104-107.
[21] See Ballester, 2013, pp. 117-121.
[22] Ibid.

prepared to translate security and defence goals and interests into policy outcomes in research and technological development at the EU level. This functional relationship is most evident in the work of the European Commission and major branches of the defence industry and arms manufacturers towards the establishment of European research programmes in the field of security and defence. One key structural issue for the European defence industry is that it currently does not invest enough in research and development in relative terms: aerospace and defence companies spend less on research and development as a percentage of revenue compared to software or technology firms. In 2017, Amazon became the global leader in research-and-development spending, surpassing Alphabet (Google's parent company) and Intel.[23] Alongside Apple and Microsoft, these companies spend billions of dollars on research and development. Amazon alone spends more on research and development than the entire global aerospace and defence industry. Over time, these changes could weaken the market position of the defence industry.

The workforce in the industry also poses a challenge for the future, as a significant portion of the defence contract workforce consists of older employees nearing retirement. This phenomenon, known as "segment reversal," is a common pitfall for mature industries where market leaders opt not to compete with new entrants in non-core segments.[24] The defence industry faces the risk of falling behind in new and emerging technologies and losing future market share. Young talent in the information technology and engineering fields is also more attracted to the civilian sector and technology platform companies, which offer higher salaries and a more stimulating work environment.

Overall, European Commission President Ursula von der Leyen has called for the establishment of a 'geopolitical commission'.[25] High Representative of the Union for Foreign Affairs and Security Policy and Vice-President of the European Commission Josep Borrell stated that the EU must 'learn the language of power' and create more strategic autonomy in defence to ensure industrial, technological, digital, and economic independence.[26]

[23] See Fox, 2021.
[24] See Gons et al., 2018.
[25] See European Commission, 2020.
[26] See Borrell, no date.

Moreover, as Europe grapples with diverse security challenges ranging from terrorism and organised crime to hybrid warfare and cyberattacks, the role of technological innovations becomes increasingly indispensable in safeguarding the continent's security interests. However, technological advancements also present ethical, legal, and societal implications that must be considered carefully to ensure responsible and effective security practices.

This discussion aims to explore the multifaceted impact of technological innovations on European security activities, examining both their potential benefits and challenges. By understanding the nexus between technology and security, policymakers, law enforcement agencies, and defence organisations can harness the power of innovation to bolster Europe's security resilience and uphold its commitment to peace, stability, and prosperity.

The exploration of successes resulting from new technologies in the field of defence provides invaluable insights into the transformative impact of innovation on military capabilities and strategic outcomes. In this discussion, we delve into notable examples of how technological advancements have yielded significant successes and advancements in defence operations and capabilities. From precision-guided munitions and unmanned aerial vehicles to advanced surveillance systems and cybersecurity solutions, new technologies have revolutionised the modern battlefield, offering enhanced precision, efficiency, and adaptability to military forces. These successes not only underscore the potency of innovation in enhancing defence capabilities but also highlight the imperative for continuous investment and integration of cutting-edge technologies into military strategies and operations.

By examining concrete examples of successes stemming from new technologies in defence, we aim to elucidate the tangible benefits and strategic advantages afforded by innovation in the military domain. From improved situational awareness and decision-making to enhanced deterrence and operational effectiveness, these successes serve as compelling illustrations of the transformative power of technology in shaping the future of defence.

This discussion seeks to shed light on the profound impact of technological advancements on defence capabilities and outcomes, inspiring further exploration and investment in innovation to meet the evolving security challenges of the 21st century.

13. Conclusions and Future Prospects

The study delves into the EU's overarching objectives concerning the advancement of its defence capabilities, particularly within the realms of technology and industrial development. Central to these ambitions is the recognition that a robust defence infrastructure is vital for ensuring the security and sovereignty of EU member states. This entails reducing dependency on external sources for defence technology and equipment, thereby fostering greater autonomy and resilience in the face of emerging threats and geopolitical uncertainties. The primary focus is on fostering technological innovation within the EU's defence sector. Recognising the pivotal role of cutting-edge technology in modern warfare, there is a concerted effort to invest in research-and-development initiatives. By nurturing indigenous capabilities in defence technology, the EU aims to stay at the forefront of innovation, thereby bolstering its overall defence posture.
Moreover, the study underscores the importance of fostering industrial cooperation among EU member states. Collaborative ventures offer a pathway to pooling resources, expertise, and infrastructure, thereby enhancing efficiency and cost-effectiveness in defence production processes. This cooperation not only strengthens the industrial base but also contributes to fostering a sense of solidarity and mutual trust among EU nations.

Integral to achieving these objectives is the imperative of integration and coordination among EU member states. Standardisation, interoperability, and harmonisation of defence procurement processes are essential elements in this regard. By aligning their defence strategies and capabilities, EU nations can maximise synergies, streamline operations, and optimise resource allocation.

However, the study also acknowledges the challenges inherent in pursuing such ambitious defence ambitions. Budgetary constraints, varying national priorities, and divergent strategic interests among member states pose significant hurdles. Overcoming these challenges necessitates political will, compromise, and a long-term commitment to the collective defence agenda. Nevertheless, amidst these challenges lie ample opportunities for the EU to bolster its defence capabilities. Collaborative ventures offer economies of scale, enabling cost savings and resource optimisation. Furthermore, collective security arrangements provide a framework for

mutual defence and solidarity, thereby enhancing overall security of the region.

Looking ahead, this study envisions a dynamic landscape characterised by continued evolution in defence technology and strategy. Geopolitical developments, emerging threats, and technological advancements will shape the trajectory of the EU's defence agenda. Consequently, close collaboration, strategic foresight, and adaptability will be paramount in navigating these complexities and safeguarding European security in an ever-changing global environment.

In conclusion, as we look towards the future, there are several potential directions for the development of the defence industry within the EU. First, continued investment in research and development will be paramount to ensure that the EU remains at the forefront of technological innovation in defence. This includes advancing areas such as artificial intelligence, cyber-defence, and unmanned systems, which are likely to play increasingly significant roles in modern warfare. Furthermore, enhancing industrial cooperation and integration among EU member states will remain crucial. Collaborative ventures not only offer economies of scale but also foster a sense of unity and solidarity among European nations. This can be achieved through initiatives such as joint procurement programmes, shared defence projects, and standardised interoperability frameworks.

Moreover, the EU should prioritise efforts to address strategic challenges such as hybrid warfare, terrorism, and cyberthreats. This may involve strengthening intelligence-sharing mechanisms, enhancing resilience against cyber-attacks, and investing in capabilities for rapid response and crisis management. Additionally, the EU should continue to explore opportunities for international collaboration and partnerships in defence. Engaging with key allies and partners around the world can facilitate knowledge exchange, interoperability, and burden-sharing, thereby enhancing collective security.

Ultimately, future development of the defence industry within the EU will be shaped by a combination of technological advancements, geopolitical dynamics, and strategic imperatives. By embracing innovation, fostering cooperation, and adapting to emerging threats, the EU can position itself as a leading force in ensuring the security and stability of the region in the years to come.

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