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DEFENCE INDUSTRY POLICY AND GREEN COMPETITIVENESS

The defence industry, as a key player responsible for implementing the strategic defence policy of the state, should be part of the broader discussions on sustainability and the green transition. Rapid environmental changes and high uncertainty in the global and national security sectors are heightening the urgency of such transformations. Implementing environmentally friendly approaches within the defence industry can significantly enhance national competitiveness. The paper aims to show the direction of transformations in defence industry policy during the process of green transition. This research hypothesizes that prioritising sustainability practices within defence industry policy has the potential to enhance both national security and economic competitiveness. This study combined qualitative and research methods, specifically a systematic literature review and case studies. Green practices in the defence industry policy may contribute to the resilience of the sector during periods of high-risk uncertainty and tight fiscal constraints by allocating public and private funds and improving efficiency. Russia's full-scale military invasion of Ukraine in 2022 involved our country in high-intensity warfare and required major shifts

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ОБОРОННО-ПРОМИСЛОВА ПОЛІТИКА ТА ЗЕЛЕНА КОНКУРЕНТО-СПРОМОЖНІСТЬ

Оборонна промисловість як ключовий гравець, відповідальний за реалізацію стратегічної оборонної політики держави, повинна бути частиною ширших дискусій щодо сталого розвитку та зеленої трансформації. Швидкі зміни навколишнього середовища та висока невизначеність у глобальному та національному секторах безпеки підвищують нагальність таких трансформацій. Впровадження екологічно дружніх підходів у оборонній промисловості може значно підвищити національну конкурентоспроможність. Мета дослідження – показати напрям трансформацій в політиці оборонної промисловості під час процесу зеленої трансформації. Висунуто гіпотезу, що пріоритетизація практик сталого розвитку в політиці оборонної промисловості має потенціал підвищити як національну безпеку, так і економічну конкурентоспроможність. У цьому дослідженні поєднано якісні та дослідницькі методи, зокрема систематичний огляд літератури та дослідження випадків. Застосування "зелених" практик у політиці оборонної промисловості може сприяти стійкості сектору у періоди високої невизначеності та жорстких бюджетних обмежень шляхом розподілу державних та приватних коштів і підвищення ефективності. Повномасштабне вторгнення росії в Україну у 2022 р. залучило нашу країну

in our defence and economic policies. In addition, the intensification of the European integration process requires the adjustment of our local practices to those in the European Union, including the Green Deal. Implementing green practices in Ukraine's defence industry can be equally beneficial for the national military sector (by cost- and resource-efficiency), and national economic growth (by encouraging innovation and creating jobs in new or related areas). The research highlights the importance of the implementation of greener defence plans for enhancing competitiveness by integrating the national economy into global aerospace and defence industry value chains. For Ukraine, facing existential challenges, it has the potential to create opportunities for defence industrial manufacturers and suppliers to enter the global financial market and allocate resources with higher efficiency. The relevant recommendations were identified in the paper, as well as critical issues for the defence industry's green growth.

Keywords: green transition, defence industry, resilience, industrial base, the European Green Deal.

до інтенсивних бойових дій і вимагало суттєвих змін у нашій оборонній та економічній політиці. Крім того, посилення процесу європейської інтеграції потребує адаптації наших місцевих практик до практик Європейського Союзу, зокрема до Зеленого курсу. Впровадження "зелених" практик в оборонній промисловості України може бути однаково корисним для національного військового сектору (шляхом підвищення ефективності витрат і використання ресурсів) та для економічного росту країни (шляхом стимулювання інновацій і створення робочих місць у нових або суміжних сферах). Дослідження підкреслює важливість впровадження більш екологічних планів оборони для підвищення конкурентоспроможності шляхом інтеграції національної економіки у глобальні ланцюги створення вартості аерокосмічної та оборонної промисловості. Для України, яка стикається з екзистенційними викликами, це має потенціал створити можливості для виробників та постачальників оборонної промисловості вийти на глобальний фінансовий ринок та більш ефективно розподіляти ресурси. У статті були визначені відповідні рекомендації, а також критичні питання для зеленого розвитку оборонної промисловості.

Ключові слова: зелений перехід, оборонна промисловість, стійкість, промислова база, Європейський зелений курс.

JEL Classification: H56, O38, O14.

Introduction

The implementation of green technologies in modern industrial processes transforms technological cycles and decreases the negative ecological impact. The defence industry is one of the largest pollutants in the economy, whose impact is complex to measure due to its nature. The changes are possible through the integration of green approaches into the industrial cycle in the defence sector. The concept of the green defence industry outlines the incorporation of sustainable decisions within organisations working in the defence sector.

The paper analyses the foundations of the green defence industry concept and the implementation of environmentally adjusted strategies aimed at solving key challenges. Basic strategic approaches and the institutional framework are considered in the paper. Projects focused on green practices in defence industries were analysed (infrastructure and capacity development). The positive outcomes for economic development through investments in green defence projects were highlighted. Ukrainian defence industry prospects in the green transition path were underlined.

Existing research shows that it is beneficial to understand the complex greening of all components of the defence industry as a continuous and purposeful process of fundamental introduction of new technologies,

technological, economic, organisational, information and other solutions that provide an intermediate opportunity to achieve the maximum possible balance of military, economic and environmental goals, ensure the protection of ecosystems and create conditions for their self-renewal, significantly increase the efficiency of the use of resources of all kinds and improve the quality of products and services (Zakharchenko et al., 2023). Wigell and Hakala (2022), argue that climate change represents a shaping threat by also framing the way it manifests itself. The move to renewables presents a significant challenge to the armed forces, but one to which they will need to adapt. At the same time, renewables and new technologies represent an opportunity in the way a greener defence approach may catalyse new capabilities.

Scientists are highlighting key challenges facing green defence: fuel consumption, reliability of energy supply, climate change, and defence spending (Vincorion, 2022). Then, the green defence industry is a sector that can provide the defence sector with the required goods and services for protecting states' territory and interests, and at the same time, is implementing agile systems and resilient processes for decreasing the potential negative impact on the environment.

In the green defence industry is necessary to reconcile circular economy and lean principles in the context of the defence industry, to create customer-oriented solutions that minimize resource consumption and improve added value for the end user (Reis et al., 2022). The process of implementation may be insufficient to change well-established approaches in the infrastructure and capabilities development without such integration.

In the European context, Pisani-Ferry and Tagliapietra (2024), advocate that it is in the EU's interest to push ahead with the green transition, for at least three reasons. First, global decarbonization is vital for the EU in its efforts to limit increasingly expensive climate damage in the future. Second, it will help the EU enhance its economic competitiveness and economic security. Third, it represents a clean-tech export opportunity for Europe. Reis et al. (2022), agree that circular economy policies in the EU defence industry focus on higher targets, which are aimed at extending the lifespan of defence products and their parts, as well as using and manufacturing smarter defence products.

Another research issue is related to the financial aspects of green defence policy implementation. Allocating this investment to the right priorities – including areas that link decarbonization and military spending – can also help address other critical EU security challenges, such as economic and energy security. A resilient industrial base is essential for a strong defence effort (Popov, 2024).

The current transformation of the Ukrainian defence industry could be intensified through the implementation of green principles. Current research in this area is limited due to a low level of integration of the defence industry into global value chains (Zakharchenko et al., 2022). In general, Ukraine's defence industry has a significant impact on the country's economy and plays a key role in ensuring national security. The low level of competitiveness of

domestic defence products can be a serious problem, but attracting young professionals can contribute to the development of innovations and improve this situation (Nikitchenko et al., 2024). Effective prioritization, relevant data, political enforcement, and social consensus are needed to transform defence industry and implement green practices into it. The paper aims to show the direction of transformations in defence industry policy during the process of green transition. The research problems, outlined in the paper: green defence industry – economic benefits and risks; green practices and national competitiveness.

This research hypothesizes that prioritizing sustainability practices within defence industry policy has the potential to enhance both national security and economic competitiveness.

This study combined qualitative and exploratory research methods, specifically a systematic literature review and case study research.

The paper is organized as follows: Section 1 outlines green transition and defence policy foundations. Section 2 analyses the development and deployment of the green defence industry principle, and Section 3 describes the implementation of green defence principles in Ukraine.

1. Green transition and defence policy

Green transition is an approach based on a range of concepts and ideas created in the second half of the 20th century and the early 21st century. The main aim of the green transition is to create a space and opportunities for adjusting the economic system to climate change and other environmental challenges. The changes were established in both public and business sectors. Governments have developed instruments based on strategies and policies, supporting the green transition. The business environment has developed and applied ESG (Environmental, Social, Governance) strategies aimed at assessing sustainability goals, including green transition.

Government-supported green transition instruments include carbon pricing, green subsidies, climate regulation, green innovation, green preferences, and green investments. Their macroeconomic effects vary by their scale and durability (*Table 1*).

Table 1

Macroeconomic effects of green transition instruments

		Impacts on output	Impacts on inflation
Transition drivers	Carbon pricing	Impact on output depends heavily on revenue recycling	Headline inflation moves up temporarily, while core inflation may be unaffected
	Green subsidies	Subsidised sector activity is likely to increase, while overall impact depends heavily on how subsidies are financed	Prices in subsidised sector are likely to fall, while impact on overall inflation is ambiguous
	Climate regulation	Some types of regulation can create stranded capital, temporarily lowering output	Adjustment costs, and hence prices, are likely to increase temporarily
	Green innovation	Higher productivity and knowledge spillovers can support output	May reduce costs and dampen inflationary pressures
	Green preferences	Reallocation across products and sectors, but uncertain impact on aggregate output	Green price premium and reduced-price competition via product differentiation affect relative prices

End of Table 1

		Impacts on output	Impacts on inflation
Other transition impacts	Increased green investment	Overall impact depends on whether investments are additional or redirected from other sectors	Potential volatility and upward price pressures from short-term imbalances in energy markets, critical minerals and labour skills
	Transition uncertainty	Higher climate policy uncertainty tends to lower aggregate investment and output, but has asymmetric impacts across sectors	Higher climate policy uncertainty can increase consumer prices

Source: (Network for greening the financial system, 2024).

According Eurostat calculations, the EU will require additional annual investments of about two percent of GDP between 2025 and 2030, comparable to EU R&D spending in 2022 – estimated at 2.2 percent of GDP (Pisani-Ferry & Tagliapietra, 2024). The cost of non-intervention into human-created environmental changes could be higher in the next decades, so it is necessary not to postpone decisions on green transition. The policy capacity level could be a crucial indicator for an accurate assessment of the government's ability to implement changes.

Defence alliances and government defence offices are also analysing the impact of environmental changes and developing corrective strategies, including the assessment of climate and other threats. For instance, NATO declares climate change as a "threat multiplier".

Climate change and political challenges are transforming the traditional approach to planning defence industry activities. The industry, operating in an over-regulated market and limited by market opportunities due to its dependence on contracts with governments, requires creative solutions and innovative approaches.

Therefore, defence sectors are facing a strategically sensitive issue to adapt at the same time to the modern high-intensity warfare and climate change. Green defence industries could provide proper green solutions that are suitable for existing legal norms.

The green defence framework was created by NATO in 2014 and contained no specific targets or demands for activities, instead highlighting a several initiatives capable of supporting or facilitating the development of green initiatives within NATO and in the member nations. Green defence was defined in a Framework as 'a multifaceted endeavour cutting across a wide range of activities, including operational effectiveness, environmental protection and energy efficiency (Knus Larsen & Center for Militære Studier, 2015). At the 2021 Summit in Brussels, NATO Heads of State and Government (HOSG) endorsed a Climate Change and Security Action Plan (CCSAP) and agreed that NATO should aim to become the leading organization when it comes to understanding and adapting to the impact of climate change on security (NATO, 2013, July 11).

Governments have developed an institutional framework for the green transition within the defence industry to outrun the green challenges (*Table 2*).

Table 2

Key strategic approaches and initiatives in implementing the Green Defence policy

Country	Strategy/Plan	Targets/Goals	Key Actions/Initiatives
Netherlands	Energy and Environment Strategy for the Defence Sector; Action Plan for the Energy Transition in the Defence Sector	Reduce fossil fuel use by 20% by 2030, 70% by 2050 (from 2010 levels); 50% energy from renewables by 2030; energy self-sufficiency by 2050	Setting targets for fossil fuel reduction and renewable energy generation
United Kingdom	British Ministry of Defence energy transition investigation	Net-zero emissions by 2050; Royal Air Force: carbon neutral by 2040	Thorough investigation of energy transition in defence sector
France	Energy Strategy for the Defence Sector 2020	Energy efficiency in procurement; hybrid demonstrator "Griffon" by 2025; energy-autonomous "Eco Camp 2025"	Hybridization of powertrains, biofuels for aviation, optimizing marine energy use, pilot training for fuel efficiency
United States	Defence Climate Risk Analysis and Climate Adaptation Plan; Sustainability Report and Implementation Plan; Plan to Reduce Greenhouse Gas Emissions	Address climate change; climate change mitigation strategies	Plans and measures focused on climate risk and adaptation

Source: our elaboration based on (Vincorion, 2022; International Military Council on Climate and Security, 2024).

The strategies and action initiatives mostly include targets in the energy transition in the analysed countries. It is necessitated by high fuel consumption levels and emissions of pollutants, including air defence, marine, and other types of forces.

Defence companies Airbus, Safran, GE, Rolls Royce, Dassault, Boeing and Pratt & Whitney committed to reaching net zero carbon emissions for civil aviation by 2050 (Pugnet, 2023, July 17).

The European Union, as one of the leaders in the green transition, has approached the framework aimed at the creation of a general system of norms and stimulating instruments for enterprises working in the green defence industry (*Table 3*).

Table 3

The institutional framework of the European Union, shaping green defence practices

Document	Main tasks	Defence sector impact
Green Deal	The EU's growth strategy. Launched in 2019, it consists of a package of policy initiatives, which set the EU on the path to a green transition, with the goal of reaching climate neutrality by 2050	The European Defence Fund Regulation allows funding topics for defence-oriented solutions contributing to energy resilience and the reduction of the defence environmental and carbon footprint

End of Table 3

Document	Main tasks	Defence sector impact
Circular Economy Action Plan	The Circular Economy Action Plan (CEAP), aimed at fostering a sustainable and resilient economy by transitioning from a linear to a circular model	Electronics, batteries, and materials management are targeted by the CEAP. Defence organisations may voluntarily adopt aspects of the CEAP to enhance sustainability, improve operational efficiency, and align with broader EU environmental goals
Critical Raw Materials Act	The Critical Raw Materials Act is aimed at ensuring a secure, sustainable, and resilient supply of critical raw materials (CRMs)	Member States shall not be required to submit information regarding certain strategic stocks when such information could compromise its defence and national security. In this case, it shall present a justified notice." (Article 22)
Eco-design for Sustainable Products Regulation	A framework to set eco-design requirements for specific product groups to significantly improve their circularity, energy performance and other environmental sustainability aspects	Products whose sole purpose is to serve defence or national security shall be excluded from the product group" (Article 5)
EU Strategy for Sustainable and Circular Textiles	It aims to make the textile industry more sustainable by promoting durable, reusable, and recyclable materials while reducing waste and pollution	this strategy can be applied by designing and procuring sustainable uniforms and gear, implementing waste reduction and recycling programs, and minimizing the use of hazardous chemicals
The Strategic Compass	The Strategic Compass, the EU's military strategy, also spelt out that armed forces and operations must participate in the green transition	The aim is to develop full spectrum forces that are agile and mobile, interoperable, technologically advanced, energy efficient and resilient. Defence Innovation Hub within the European Defence Agency is responsible for technological solutions
The ReArm Europe Plan/Readiness 2030	Plan proposes to leverage over EUR 800 billion in defence spending through national fiscal flexibility, a new EUR 150 billion loan instrument (SAFE) for joint procurement, potential redirection of cohesion funds, and expanded EIB support	Prioritizing defence R&D: enhances military preparedness through cutting-edge technology; strengthens the competitiveness of European industries in high-tech sectors; and drives economic growth by supporting innovation ecosystems

Source: our elaboration based on (European Defence Agency, n. d.; European Defence Agency, 2024; Pugnet, 2023, July 17; Popov, 2024; AeroSpace and Defence Industries. Association of Europe, 2022; European Parliament, 2025).

The developed institutional framework can be considered as a support infrastructure aimed at increasing the number of green initiatives in the EU defence sector.

At the same time, the requirements for the green transition are rather demanding for civil and defence industries and require investments to fuel strategic actions and technological innovation.

When it comes to financing defence, non-regulatory constraints introduced voluntarily by financial-market participants out of reputational concerns are likely to matter more than regulatory constraints. Draghi (2024, September 9) argued that access to financing for EU defence companies is partly hindered by the way financial institutions *interpret* EU sustainable finance rules (Merler, 2023).

Defence industries are facing difficulties in attracting financial resources during periods of fiscal constraints and social challenges. On the one hand, the defence expenditures are increasing significantly in numerous countries; on the other hand, the possibilities to accumulate additional resources are restricted due to the factors highlighted above (*Table 4*)

Table 4

Military expenditures, 2022–2024, USD billion

Rank	Country	2022	2023	2024
1	USA	877	916	997
2	China	292	296	314
3	russia	86.4	109	149
4	India	81.4	83.6	86.1
5	Saudi Arabia	75.0	75.8	80.3
6	United Kingdom	68.5	74.9	81.8
7	Germany	55.8	66.8	88.5
8	France	53.6	61.3	64.7
9	South Korea	46.4	47.9	47.6
10	Japan	46.0	50.2	55.3
11	Ukraine	44.0	64.8	64.7

Source: Stockholm International Peace Research Institute (2023, 2024, 2025).

The russian aggression against Ukraine has intensified the discussion concerning the defence capabilities of the states. The military expenditures are now associated with the necessity, not the option, due to the transition state of the world order and its institutional characteristics. We can see an increase in military spending, including European Union member states and Ukraine, in this rating. Governments are investing in a wide range of weapons, ammunition, and communication systems to strengthen their defence level.

2. Development and deployment of green defence industry principles

The European defence technological and industrial base (EDTIB) consists of large multinational companies, mid-caps, and over 2 000 SMEs. The Commission estimates its annual turnover at EUR 70 billion, with substantial exports amounting to EUR 28 billion in 2021. The European defence industry is dominated by companies based in France, Germany, Italy, Spain, and Sweden. However, 23 Member States are home to the prime manufacturers of the 46 most urgently needed items, according to the Defence Joint Procurement Task Force's industry mapping. The EDTIB is also a major employer with around 500 000 people employed in the sector (European Defence Agency, 2024).

The Portuguese case of developing green defence industry principles could serve as a model for other countries. The Portuguese DTIB is highly segmented (+20 segments), and with a representation of more than

380 organizations, the Portuguese Ministry of Defence decided to create a consortium called "AuxDefense". At the same time, high-level defence projects were developed in parallel, such as the ACU (Advanced Combat Uniform) and SCS (Soldier´s Combat System) led by CITEVE (Technological Centre for Textile and Clothing Industries). The AuxDefense consortium and ACU/SCS projects are operated within the scope of the triple helix, bringing together the Portuguese Armed Forces (Army and Air Force), Universities (e.g., University of Minho), Technological Platforms (e.g., Fibrenamics), and Centres (e.g., CITEVE), as well as several private companies (e.g., LMA–textiles). This technological centre developed multilayer textiles with innovative auxetic structures, using fibrous materials and advanced structures with high mechanical properties, used in the manufacture of clothing components, aiming at high performance. Before being produced on a large scale for the Portuguese Army, under the qualification system for military systems or equipment, the BDUs received the Army Tested/Combat Proven certificate (Reis et al., 2022).

To sum up, establishing a comprehensive planning system and integration of businesses, universities, technological centres, and armed forces can transform traditional approaches in developing goods for the defence sector and lead to increased resilience, environmental responsibility, and cost-efficiency.

We can find other examples of effective cooperation between the business sector, academic institutions, and armed forces in the advancement of infrastructure and capabilities (*Table 5*, *6*).

Table 5

Projects focused on green practices in defence industries (infrastructure development)

Project/ Organisation	Focus	Key Actions/Solutions	Outcomes/Benefits
AECOM and BAE	Decarbonisation of air and maritime estates	Energy efficiency projects, improved insulation, plant replacement, high efficiency air source heat pumps, solar PV, battery storage, new heat network, heat recovery plant	Onsite power generation, increased energy security, reduced operational costs, 50% reduction in operational carbon emissions
Cardno-AECOM - Pacific Joint Venture	Installation Energy Roadmap (IER)	14 MW solar facility, 70 MWh battery storage, renewable energy, grid reliability, electrification of fleet vehicles, carbon off-setting, sustainable carbon sinks	Net-zero carbon emissions Navy base by 2035, improved resilience, decarbonisation and resilience mutually supporting
QinetiQ	Naval Fuels analysis	Analysis of oil fuel depots, infrastructure options, fuel demand, interdependencies, risks and benefits	£166 million capital savings, reduced fuel demand and storage, reduced carbon emissions, meets capability, efficiency and financial goals
Rolls-Royce	Microgrids project for Strat Com Efficiency	mtu microgrid, 2MW reliable power, CHP plants, battery storage, standby generators, renewable integration	99.9% power reliability, security of supply, flexibility, resilience, cost efficiency, used in U.S. military bases
CeraPhi	Geothermal Systems	CeraPhiWell deep geothermal, pumps cold water, heats underground, returns hot water	Significant ROI, low maintenance, supports self-sufficient bases, humanitarian/refugee support
Newcastle University	ViTAL Living Lab RAF Leeming	High risk/gain experimentation, decarbonising tech, renewable power, operational efficiency	Supports RAF Net Zero, proven operational results, upscaling possible

Source: our elaboration based on (UK Ministry of Defence, 2021).

A significant portion of projects was concentrated on finding green solutions to improve energy efficiency in the defence sector. Projects, realized by AECOM, BAE, Cardno, QinetiQ, Rolls-Royce, CeraPhi, and Newcastle University, were aimed at transforming current energy systems by increasing their resilience, sustainability, and independence. The outcomes included a reduction in operational carbon emissions, the construction of a net-zero carbon emissions Navy base, reduced fuel demand and storage, security of energy supply, and geothermal systems that support self-sufficient bases. As follows, it is preferable to analyse the positive effects of the implemented projects and disseminate the results in the defence sector. The infrastructure development investments could not only have energy efficiency effects but also be cost-efficient in the medium and long terms.

Table 6

Projects focused on green practices in defence industries (capabilities development)

Project/ Organisation	Focus	Key Actions/Solutions	Outcomes/Benefits
BAE and AIRBUS Typhoon	Typhoon decarbonisation	Synthetic training simulators, high-fidelity simulators, Gladiator synthetic environment	80% synthetic training by 2040, saves 9.6 tonnes carbon per flight, 75 million litres fuel saved, 184 000 tonnes carbon saved
MBDA/QinetiQ/ Leonardo	Dragonfire high energy laser systems	Laser Directed Energy Weapon, high power laser, reduced logistics chain, sustainable power potential	Reduced emissions from transport, future trials to reduce size/weight/power, logistics pressure reduction
Abrams hybrid tank	Hybrid-electric main battle tank	Hybrid-electric drive, 50% more fuel efficient, lighter weight, unmanned turret, AI-driven C2	Reduced resupply, improved survivability, silent watch/mobility, reduced logistics burden, supports modernization
Frazer-Nash	Synthetic environments case study	Simulation for robotic autonomous systems, 3D models, ground platform dynamics, SE for testing	Reduced experimentation cost, faster equipment service, test tech for efficiency or alternative power

Source: our elaboration based on (UK Ministry of Defence, 2021).

The capability development is another essential element of the defence sector's strategic development. The focus was on aircraft decarbonization, the development of high-energy laser systems, the construction of a hybrid-electric main battle tank, and simulation for robotic autonomous systems. Solutions that prioritize green initiatives in the capability and infrastructure development are increasing optionality and variability for productive defence decision-making.

3. The implementation of green defence principles in Ukraine

Ukraine's path to sustainable development and green transition is challenged by russia's full-scale invasion of Ukraine in 2022 and ongoing war, which, among other negative factors, is consuming limited financial and intellectual resources and narrow policy and business options for implementing green defence industry principles. Nonetheless, restricted access to resources is forming opportunities for creative and innovative decisions in the defence sector.

In the EU integration process, green transition is a key to national resilience. It is crucial to modernize the main industries by adopting EU-aligned emissions trading, circular economy practices, and green finance tools. Investments in clean technologies, such as hydrogen, electrification, and resource efficiency, must be secured to rebuild a resilient and competitive industrial base (Stockholm Environment Institute, 2025, June 26).

Here are some key areas in which Ukraine is developing its defence industry:

artillery and heavy ammunition: the development of the production of artillery shells and armoured vehicles, in particular NATO standard ammunition, increases the combat effectiveness of the Armed Forces of Ukraine and their ability to operate in a modern combat environment;

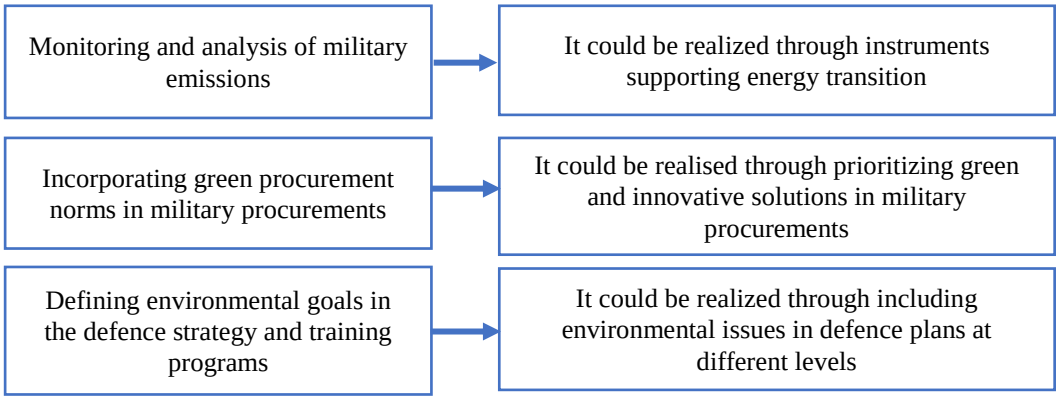
armoured vehicles: the increase in the production of armoured personnel carriers contributes to the increased mobility and protection of Ukrainian troops on the battlefield;

drones: the development of the production of unmanned aerial vehicles and ammunition for them allows the Ukrainian army to have an effective means of reconnaissance, monitoring and striking potential threats;

electronic warfare: the development and production of electronic warfare systems is an important element for protecting Ukrainian troops from modern technological threats, in particular from drones (Nikitchenko et al., 2024).

It is essential to continue the adaptation of the European institutional framework for the green transition in the defence sector with a deep understanding of local limitations and opportunities. This work remains in progress despite the ongoing challenges. For instance, Ukrainian military ecologists completed training in Belgium on assessing war-damaged soils, and it helped them. They also acquired advanced expertise and best laboratory practices, as well as protocols for soil sampling and conducting laboratory analyses (Ministry of Defence of Ukraine, 2024, April 3).

Based on the previous analysis and current difficulties facing the Ukrainian defence sector due to the current war and limited access to resources, it is advisable to start the green transition of the defence industry in key directions, including operational effectiveness, environmental protection, and energy efficiency (*Figure*).



Recommendations for the implementation
of green defence industry principles

Source: our elaboration based on (Nadarajah, 2025, August 12; International Military Council on Climate and Security, 2024).

The defence industry has the potential to become a driver of Ukrainian economic competitiveness. Companies (private and government-owned), representatives of the sector, could increase their global presence based on the current level of investments and technological potential. Nevertheless, further expansion could be limited due to the absence of ESG strategies. The development of ESG strategies can open the international investment markets and partnerships with global industry players. The Ukrainian government's priorities could be concentrated on the implementation of the European Union's institutional basis, devoted to the green transition.

Conclusions

Green transition practices can reinforce the foundations of the defence industry and correct the direction of defence industry transformations. The realization of such practices lies in rethinking strategic approaches in infrastructure and capabilities development. The paper contributes to a deeper understanding of the green transition and defence policy foundations, the development and deployment of the green defence industry principle, and the implementation of green defence principles in Ukraine.

The results of the research serve to confirm the hypothesis that prioritizing sustainability practices within defence industry policy has the potential to enhance both national security and economic competitiveness. The green defence policy has the potential to enhance countries' competitiveness in the global economic landscape, which is shifting to higher uncertainty and risk. Prioritizing sustainability practices within defence industry policy has the potential to strengthen both national security and economic competitiveness. But it could be possible if the government, as the main purchaser of the defence industry products and services, creates a space and mechanisms for constant communication and cooperation between itself, industry representatives, and academia.

Ukraine, facing an unconventional threat, could analyse the experience of the partner countries in the implementation of environmentally adjusted defence solutions and adapt them to the local wartime conditions. For instance, energy-efficient solutions for the Armed Forces of Ukraine can remarkably decrease energy dependence on other countries. The sector, equipped with effective green solutions, is more resilient during periods of military, financial, and political uncertainty. Ukrainian enterprises have already been a party to the European procurement plans in the defence efforts. It is essential to intensify the process of the Ukrainian legislation adjustment to the European one in green transition (European Green Deal, Critical Raw Materials Act, The Strategic Compass, etc.) for expanding opportunities and multiplying competitive benefits for the economy.

Further research should focus on the analysis of the medium-term and long-term efficiency of the strategies that embed green solutions into the defence sector. Also, future studies should concentrate on the identification of factors that hinder the green solutions, particularly in the infrastructure and capabilities development.

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