Absorptive Capacity and Institutional Environment as Determinants of Defence Industry Transformation

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Abstract. *The contemporary geopolitical landscape is characterised by a growing nexus between national security and technological sovereignty, underscoring the imperative for nations to transform their defence industries. Despite the considerable financial resources that are frequently allocated to this sector, the outcomes of such investments exhibit significant variation across countries. The present study addresses the critical research problem of why some nations successfully transition from being technology importers to those which are globally competitive in terms of exports, whilst others remain in a state of prolonged technological dependence despite making substantial expenditures. The central thesis of this article is that a country's successful transformation from an importer to an exporter of defence products is determined not by the volume of financial resources available to it, but rather by the effectiveness of its institutional environment and the implementation of a coherent, long-term state policy. In order to test this hypothesis, a conceptual framework is developed and subsequently applied through a comparative analysis of two cases: the Republic of Korea and the Kingdom of Saudi Arabia. The results of the analysis indicate that the key differentiating factor is the institutional environment. The South Korean success is attributed to the establishment of robust, centralised state agencies and the consistent implementation of a strategic import policy with a focus on technology absorption, which systematically nurtured a dynamic innovation ecosystem. Conversely, Saudi Arabia's trajectory exemplifies the inefficacy of institutional fragmentation and a policy of direct, "off-the-shelf" procurement in fostering domestic innovation capabilities, resulting in diminished absorptive capacity and a dependent industrial base. The core finding is that a robust innovation ecosystem is not a prerequisite for development; rather, it is a deliberately constructed result of effective institutions. The research outlines how the massive influx of Western technology can be converted into a sustainable, export-oriented defence industry through targeted institutional reforms, a focus on enhancing national absorptive capacity and the strategic development of technological competencies.*

Keywords: *absorptive capacity, defence industry, innovation ecosystem, institutional development, institutional environment, technology transfer.*

JEL Classification: *O33, F52, P16*

1 Introduction

The beginning of the twenty-first century has marked the dawn of a new era of geopolitical competition, where full-scale conflicts, particularly the war in Ukraine, have elevated the importance of national security and technological sovereignty. In this context, the defence industry has evolved from a mere military instrument to a pivotal component of economic strategy and a catalyst for national innovation. While this sector is responsible for the generation of hundreds of billions of dollars in global trade, its true strategic value lies in a nation's ability to innovate and develop its own technological capabilities.

However, despite considerable attention being paid to this topic, the mechanism for transforming financial resources and imported technologies into domestic innovative capabilities remains insufficiently researched. Consequently, the question of why some nations successfully build an export-oriented defence industry, while others, even with significant procurement, remain caught in a trap of technological dependence, still lacks a comprehensive explanation.

The importance of investigating innovation activity and economic relations within the defence sector is substantiated by the mounting attention this subject has garnered from the academic community.

Contemporary studies have noted a global trend towards greater openness and collaboration, with strategic alliances being identified as key to the absorption and dissemination of innovation (Honig et al., 2006). One of the main instruments for such collaboration is offsets, which are regarded as a central mechanism for obtaining technological advantages during the import of armaments (Anicetti, 2024).

Concurrently, research underscores the emergence of a complexity paradox, whereby the most valuable technologies for development are concurrently the most arduous to transfer. It is widely acknowledged among scholars that the key role in resolving this problem is played by the "absorptive capacity" of the recipient party (Winkelbach & Walter, 2015). However, the efficacy of this process is contingent upon the effectiveness of the institutional environment. As demonstrated by the analysis of the Ukrainian case, even with external support, problems such as weak inter-agency coordination, bureaucratisation and the inadequacy of the legal framework for wartime conditions become critical obstacles to economic development (Tsyrfa et al., 2024).

The purpose of this article is to demonstrate that a country's successful transformation from the status of an importer to an exporter of defence industry products is determined not by the volume of financial resources, but by the effectiveness of its institutions and state policy.

In order to achieve the stated objective, the research addresses several tasks. Firstly, a conceptual framework is formulated, which explains the concepts of absorptive capacity and innovation ecosystems based on new institutional economics. Secondly, the global market for defence industry products is analysed using statistical data. A comparative analysis of the innovation trajectories of the Republic of Korea and the Kingdom of Saudi Arabia is finally conducted. This analysis allows for the formulation of conclusions regarding the key determinants of defence industry transformation, and the development of strategic recommendations.

2 Conceptual Framework for Defence Industry Transformation

The central problem to be addressed in this research is to explain the divergence in the innovation trajectories of different countries. The question that arises is why some nations, while actively importing foreign technologies, subsequently transform themselves into powerful exporters, whereas others, despite significant financial investment, remain permanently caught in a trap of technological dependence.

The observed discrepancy can be attributed not to external conditions of the agreements themselves, but rather to a nation's inherent capacity to capitalise on the opportunities they offer. This phenomenon is underpinned by the theoretical concept of "absorptive capacity," which refers to an entity's (be it a firm or a state) capacity to discern the significance of novel external information, to assimilate it into its own systems, and to apply this knowledge to achieve commercial or strategic objectives (Hafeez et al., 2023).

In the context of the defence industry, absorptive capacity is not an abstract concept; rather, it is based on three components. The primary factor to be considered is the availability of human capital, that is to say, a sufficient number of qualified engineers, technicians and scientists who are capable of understanding, adapting and applying complex technologies. Moreover, the existence of a domestic innovation infrastructure is imperative. Another factor that must be considered is prior technological experience, since countries with an existing industrial base find it easier to integrate new defence technologies.

It has been demonstrated that a high level of absorptive capacity enables organisational ambidexterity, which is defined as the ability to combine the efficiency of existing processes (exploitation) with the search for new knowledge (exploration) (Hamblin et al., 2024). However, it should be noted that the presence of absorptive capacity is a necessary condition for an innovative breakthrough, but not sufficient on its own. In order for knowledge and technology to circulate freely, it is essential that these components interact within a supportive environment. This environment is known as an "innovation ecosystem".

The efficacy of an innovation ecosystem is determined not by the mere presence of its actors, but rather by the density and quality of the links between them. For instance, is there a well-functioning mechanism for commercialising developed technologies? The present study seeks to ascertain whether the state fosters collaboration between defence giants and small, innovative companies. Nevertheless, the very existence and effectiveness of such a complex system of interconnections is contingent on the effectiveness of institutions that establish "the rules of the game" for all participants.

The subject of New Institutional Economics is precisely these rules. The founder of this field, Nobel laureate Douglass North, defined institutions as the humanly devised constraints that structure political, economic and social interaction (North, 1990). These factors are divided into two categories: formal (laws, constitution, property rights) and

informal (traditions, norms of behaviour, the level of trust in society).

It is important to acknowledge that the establishment of an innovation ecosystem is contingent upon the presence of an effective institutional environment. The following elements are of particular significance: the protection of intellectual property rights, the efficiency of the judicial system in resolving commercial disputes, and the presence and authority of specialised state agencies responsible for defence policy and procurement. Informal institutions, encompassing business culture, attitudes towards entrepreneurial risk and the level of corruption, are also of significant importance.

As Zavazhenko (2023) argue, one of the functions of institutions is to reduce transaction costs and the level of uncertainty. Consequently, when investors and innovators are confident that their property rights are protected and contracts will be honoured, they are more willing to make long-term capital investments in risky but potentially ground-breaking projects. Institutions, therefore, are the foundation for both absorptive capacity and the innovation ecosystem as a whole. Robust protection of intellectual property has been shown to stimulate R&D, while a low level of corruption and the rule of law create the trust necessary for collaboration between universities, startups and industry. Concurrently, institutional and regulatory issues, notably the inadequate coordination between state and regional financial institutions, the volatility of the regulatory environment, and the absence of transparency in regulatory decisions, have a deleterious effect on innovation activity (Burykh, 2025).

3 The Empirical Landscape of the Global Defence Market

As illustrated in Figure 1, the dynamics of defence product exports by manufacturing countries for the period 2013–2024 are presented. The sample that was analysed includes countries that are among the world's largest exporters and importers during the period under review.

It is imperative to acknowledge that the data presented in Figure 1 is measured in TIV (Trend-Indicator Value), a unique unit of measurement developed by the Stockholm International Peace Research Institute (SIPRI) for the analysis of the volume of international arms transfers. The utilisation of TIV is imperative due to the confidentiality of the financial values of contracts, the inclusion of supplementary services (e.g., training and maintenance) and the nature of military aid, which renders direct financial comparisons erroneous. In contrast, this indicator is based on an assessment of the military capability of each weapon system and is expressed in constant 1990 US dollars, thus facilitating accurate comparison over time and between countries.

The data demonstrate the dominance of the United States in the market, with its export volumes significantly exceeding those of any other country, reaching a peak of over 15 billion in 2023. Concurrently, intense competition for second place is ongoing. In 2024, France secured the leading position, overtaking China and Germany, which had surpassed it in 2023.

In order to gain a more profound understanding of the structural roles that different countries play in the global market, Figure 2 presents a visual representation of the ratio between their total export and import volumes over the analysed period. Firstly, a group of net exporters is evident, with the United States at the vanguard, where the export area significantly exceeds the import area. Secondly, a clearly defined group of net importers is evident, as illustrated by the orange areas. The most prominent examples of this phenomenon are India and the Kingdom of Saudi Arabia, whose total imports far exceed their export capabilities. Ukraine also falls into this category, reflecting the country's defence needs amidst a full-scale war. Thirdly, the graph illustrates an important group of countries with active two-way trade, such as Germany, the United Kingdom and Italy. The presence of substantial volumes of both imports and exports indicates their profound integration into global value chains, wherein they concurrently procure certain systems and components while exporting others. This finding is indicative of a high level of industrial specialisation.

A consolidating indicator that reflects a country’s position in the global trading system is its net export. Figure 3 presents the aggregate trade balance of defence industry products for the entire period under review, which allows for an assessment of each state’s status.

The data demonstrate the asymmetry of the global market. The United States is the undisputed leader in this field, as evidenced by its substantial positive balance, which confirms its status as the world's main supplier of defence technologies. Conversely, India and Australia function as the most substantial net importers, exhibiting considerable trade deficits in this domain, which signifies a pronounced structural reliance on external suppliers. The group of major net importers also includes the United Arab Emirates and Ukraine.

Consequently, the central hypothesis of the research can be formulated as follows: a country's

Country	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Australia	54	94	84	135	100	39	129	406	169	19	80	75
Belarus	269	101	142	152	52	79	84	59	111	58	45	
Belgium	54	10	12	7	17	21	62	29	95	146	39	40
Brazil	31	30	52	123	36	102	21	163	86	7	54	116
Canada	166	179	325	95	63	117	230	117	123	179	283	152
China	2 076	1 323	1 819	2 449	1 624	1 365	1 604	635	1 358	2 280	2 982	1 131
Czechia	41	26	151	153	90	92	19	26	6	163	106	134
Denmark	8	19	22	21	13	25	2		24	78	46	166
Egypt		7	21				8		41	41	4	2
Finland	69	95	26	54	28	39	25	12	15	40	49	27
France	1 887	1 758	2 252	2 185	2 319	1 897	3 738	2 384	3 836	3 123	2 150	2 272
Germany	729	1 822	1 815	2 509	1 841	1 085	950	1 163	813	1 489	2 472	2 049
India	18	40	42	49	56	47	20	153	54	7	41	25
Iran	2	33	9	23	24	9	9	15	1	83	289	226
Israel	412	404	570	1 236	1 193	1 147	392	380	711	1 050	1 281	1 026
Italy	890	688	671	620	704	534	372	809	1 650	1 711	1 364	1 379
Jordan	35	114	16	18	80	1	109	66	74	53	11	226
Netherlands	384	643	469	487	1 070	468	304	462	357	324	250	392
Norway	97	87	117	85	98	71	27	60	102	31	242	710
Poland	147	33	2	5	8	11	10	0	3	707	606	116
Russia	7 782	5 341	5 751	6 676	6 356	6 871	5 100	3 523	2 402	2 510	1 329	1 339
Singapore	7	12	80	77				24	72	36	11	
South Africa	113	63	49	82	95	87	106	120	102	68	58	27
South Korea	350	218	92	435	700	1 047	680	772	510	220	631	964
Spain	450	962	982	481	820	705	318	1 010	676	1 018	921	639
Sweden	386	343	181	255	79	139	125	266	239	83	375	381
Switzerland	208	347	490	220	175	243	218	145	105	176	63	33
Turkiye	139	157	225	243	177	248	274	265	482	589	699	332
UAE	108	88	143	98	103	117	128	195	58	18	65	117
Ukraine	687	632	303	461	384	318	168	122	181	102	29	23
United Kingdom	1 503	1 658	1 183	1 344	1 105	682	886	662	679	1 711	1 320	756
United States	7 724	9 505	9 743	9 426	11 409	9 255	10 534	10 024	10 960	15 351	11 102	13 512

Figure 1 Dynamics of defence industry exports by key manufacturing countries, 2013–2024 (in TIV million)

Source: compiled by the author based on data from (SIPRI, 2025)

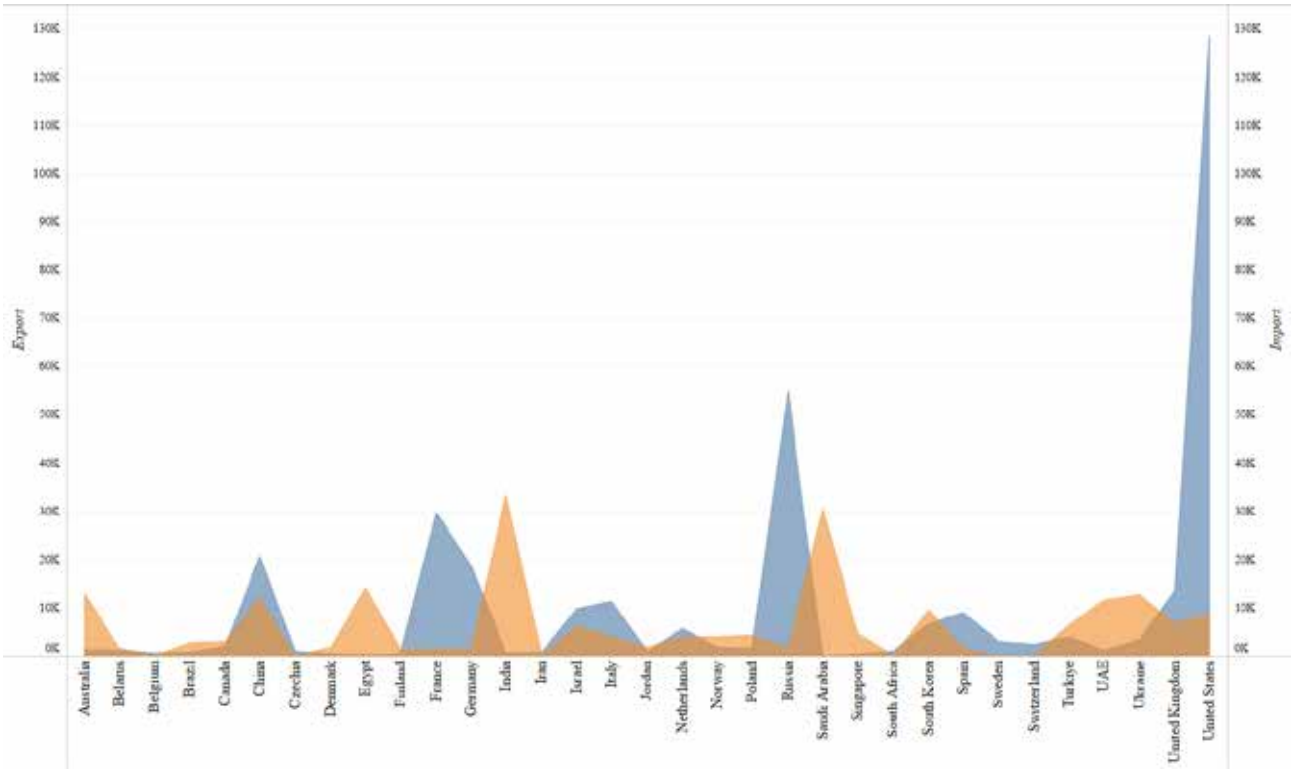

Figure 2 Ratio of total export (blue) and import (orange) volumes of defence industry products for key countries, 2013–2024 (in TIV million)

Source: compiled by the author based on data from (SIPRI, 2025)

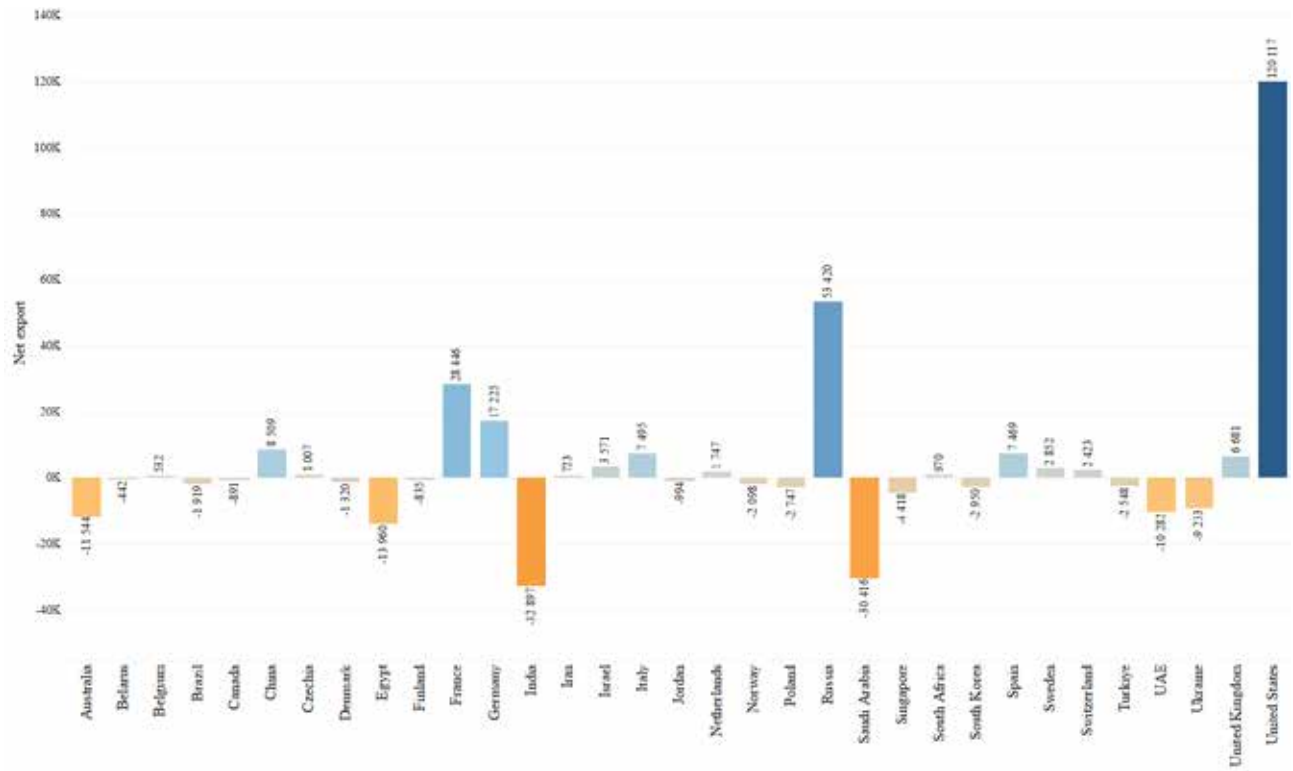

Figure 3 Net export of defence industry products for key countries, aggregate for 2013–2024 (in TIV million)

Source: compiled by the author based on data from (SIPRI, 2025)

transition from the status of an importer to an exporter of defence industry products is determined not so much by the volume of financial investment, but rather by the effectiveness of its national institutions and the presence of a consistent state policy aimed at developing its own innovation ecosystem.

4 Comparative Analysis of Innovation Trajectories

In accordance with the research objective, two countries representing divergent development trajectories were selected for the comparative analysis.

1. The Republic of Korea has been selected as the paradigm of effective transformation. This nation has undergone a substantial transition, transitioning from its status as one of the world's foremost importers of military aid during the latter half of the 20th century to its current standing as a leading global exporter of advanced weapon systems in the 2020s.

2. The Kingdom of Saudi Arabia, having been one of the world's largest arms importers for decades with virtually unlimited financial resources, has thus far failed to form a significant domestic manufacturing and innovation potential. This case study serves to test the central hypothesis of the research and to demonstrate that the availability of capital is not, in itself, a sufficient condition for technological development in the absence of effective institutions and a corresponding state policy.

A salient point of congruence between the two nations is that they are both regarded as strategic allies of the United States, with a long-standing history of importing substantial quantities of American military technology. However, despite the similarities in their initial conditions with regard to access to technology, the results obtained by the two groups have been diametrically opposed. This comparison facilitates the analysis of the pivotal role of internal factors in determining their innovative future.

The Republic of Korea has been confirmed as a paragon of successful innovation, as evidenced by an analysis of its trade data. As demonstrated in Figures 1–3, the country's trade trajectory over the past decade shows a sustained positive dynamic. An analysis of its export dynamics (see Figure 1) reveals growing volumes, indicating the strengthening position of Korean products in the competitive global market. The ratio of trade flows (Figure 2) demonstrates the maturity of its defence industry, which is active in two-way trade, importing specific high-tech components while simultaneously exporting its own complex systems. Nevertheless, the pivotal indicator of success is the consistent positive net export (see Figure 3). This figure firmly establishes the Republic of Korea's status as a successful net exporter that has achieved a high level of technological and industrial self-sufficiency.

The basis for the transformation of the Korean defence industry is the synergy of institutional aspects and economic strategy. In contrast to countries where defence procurement is fragmented and opaque, in 2006 Seoul established the Defence Acquisition Program Administration (DAPA). This step constituted a pivotal institutional reform, as DAPA centralised within a single body the entire process from R&D planning and procurement to testing, certification and export promotion. The existence of a unified professional centre enabled the state to engage in negotiations with foreign suppliers and ensure the consistency of its industrial strategy. The Republic of Korea has also adopted advanced methodologies for the management of its defence resources. It is noteworthy that the Planning Programming and Budgeting Execution Evaluation system, which was adopted from the USA, is utilised to regulate and control all processes from planning to the execution of defence programmes. This ensures the rational allocation of resources and increased efficiency (Lee & Park, 2020).

The institutional framework thus established facilitated the implementation of a series of key policies. Firstly, a policy of intelligent importation is recommended. During the 1980s and 1990s, when procuring American military technology (Park, 2012), Korea received not just a finished product but also a licence for its production. A paradigmatic example of this phenomenon is the KF-16 fighter programme, which enabled Korean engineers to accrue substantial experience and technological competencies. Secondly, a strict and effective offset policy was implemented, whereby foreign companies selling their products to Korea were obliged to reinvest a portion of the contract's value into the Korean economy, primarily in the form of critical technology transfers or the creation of joint R&D projects. Concurrently, the state made substantial long-term investments in its own scientific research through the Agency for Defence Development. This resulted in the formation of a scientific potential capable of absorbing and adapting foreign technologies acquired (Kwon, 2023).

The result of these actions was the formation of one of the world’s most effective defence innovation ecosystems, characterised by the close integration of its key participants. Large industrial

conglomerates, or "chaebols", play a central role, including Hanwha Aerospace, Hyundai Rotem and Korea Aerospace Industries. At the same time, a dense network of thousands of small and medium-sized enterprises has emerged around the chaebols. These enterprises act as suppliers of components and specialised solutions, ensuring the flexibility and resilience of the entire system. Government support for projects with high development potential facilitated the inflow of capital, technology, equipment and experience (Nebrat, 2022).

The most compelling evidence of this ecosystem's efficacy is provided by its products, which have gained global recognition and achieved export success. These include the K9 Thunder self-propelled howitzer, the contemporary K2 Black Panther tank and the T-50/FA-50 Golden Eagle supersonic trainer and light combat aircraft.

However, the Kingdom of Saudi Arabia is perceived to be in direct opposition to the Korean perspective. As demonstrated by the data (see Figures 2–3), the country is among the world's foremost net importers of defence industry products. The import volumes illustrated in Figure 2 are found to be predominant, while export volumes are virtually non-existent throughout the entire decade under consideration. Consequently, the Kingdom of Saudi Arabia exhibits a profoundly negative net export balance (see Figure 3), signifying a substantial reliance on foreign suppliers to satisfy its security imperatives. This has resulted in a paradoxical situation, whereby the kingdom possesses substantial financial resources derived from oil exports and has been acquiring the most advanced weapon systems for many years, yet it has been unable to leverage its purchasing power to enhance its own industrial and innovation capabilities. The explanation for this paradox lies not in the volume of finances, but in the institutional environment and the nature of its state policy.

Historically, the procurement process in the kingdom was fragmented among various security agencies, which made it impossible to form a unified, long-term industrial strategy. In contrast to the centralised Korean agency, DAPA, the Kingdom of Saudi Arabia had not previously had a single organisation responsible for the strategic planning and technological development of its defence industry.

The General Authority for Military Industries was established in 2017 as part of the ambitious "Vision 2030" programme, which aims to diversify the economy, reduce geopolitical risks, and enhance the kingdom’s global status (Chaziza & Lutmar, 2025). The main objective of the authority is to localise over 50% of defence expenditure by 2030. This step was no accident, but a response to existential challenges such as the risk of exhausting oil export potential, unsustainable domestic energy consumption, and vulnerable infrastructure (Hassan, 2020).

However, this reform has encountered inertia from its previous development trajectory. For decades, the Kingdom of Saudi Arabia's dominant policy was the strategy of "off-the-shelf" procurement. The focus was on swiftly acquiring the most advanced Western systems to address immediate security concerns rather than fostering long-term industrial growth. Although the country had offset programmes, unlike their Korean counterparts, they proved largely ineffective. The absence of a robust regulatory body and a domestic private sector with the capacity to absorb technology meant that offset investments were frequently channelled into non-strategic sectors or failed to result in the establishment of sustainable, high-tech production facilities.

The consequence of this policy has been a fragmented innovation ecosystem that is incapable of generating complex technologies independently. Unlike the Korean model, which is dominated by powerful private chaebols, the Kingdom of Saudi Arabia's defence industry has historically been dominated by state-owned companies. Despite the ambitious goals of Saudi Arabian Military Industries, a newly established entity, its current focus remains predominantly on the establishment of joint ventures for the licensed assembly and maintenance of foreign equipment, as opposed to the pursuit of independent R&D initiatives.

Furthermore, the greatest barrier to development is the shortage of skilled workers. Despite significant investment in overseas education, the country is facing a shortage of qualified engineers and scientists who are capable of not only operating, but also developing and modernising, complex systems. Dependence on foreign specialists and technical personnel is the most striking evidence of the economy’s low absorptive capacity.

The consequence of this is the absence of iconic, indigenously developed products that could be compared to the Korean K9 Thunder howitzer or the FA-50 aircraft. Innovation activity is confined to local adaptation, and positive technology "spillovers" into civilian sectors are negligible.

5 Conclusions

The analysis confirmed the hypothesis that a country’s transition from importing to exporting defence industry products is determined by the effectiveness of its institutions and state policy, rather than the volume of financial resources. The Republic of Korea's case study demonstrated

that a deliberate strategy of smart import, focused on technology transfer and creating an effective institutional environment, is a decisive factor for success. Conversely, the Kingdom of Saudi Arabia's experience demonstrated that substantial financial investments alone are inadequate for fostering sustainable innovation potential, underscoring the necessity for targeted policy implementation. Consequently, the analysis demonstrates that an innovation ecosystem is the result of a deliberate policy, rather than a prerequisite for it. Successful countries do not wait for an innovation ecosystem to emerge; they proactively establish one through state investment in R&D, supporting links between science and industry, and creating a favourable business climate. Consequently, the trade balance of the defence industry is a clear external indicator of the health of this 'internal' ecosystem.

The findings of this research are particularly relevant to Ukraine in the context of the ongoing war and subsequent recovery efforts. The country's unique experience and the substantial influx of Western technologies present an opportunity for significant progress. Every piece of Western equipment arriving in Ukraine should be considered a source of technology. The primary focus should be on the localisation of repair and maintenance, with subsequent emphasis placed on the production of components and joint modernisation. Concurrently, the allocation of state support should be directed towards sectors in which Ukraine has already demonstrated unique, world-class competencies, such as unmanned systems, electronic warfare and cybersecurity, and towards their integration with Western platforms.

It is important to acknowledge the limitations of the research conducted. Consequently, a promising avenue for future research is to conduct a quantitative econometric analysis on a large panel of countries to statistically verify the identified relationships between the effectiveness of institutions, R&D expenditure and the defence industry trade balance. A further point of interest would be the study of hybrid development models (as in the case of Israel) and the role of venture capital in the financing of modern defence startups.

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