

NATIONAL MODELS OF MANAGEMENT AND DEVELOPMENT OF THE MILITARY-INDUSTRIAL COMPLEX: RECOMMENDATIONS FOR UKRAINE

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Usually, in developed countries, the place of the defense industry (military-industrial complex, hereinafter referred to as MIC) is determined in an isosceles triangle, where the two "lower" corners – MIC and MTC (military-technical cooperation, hereinafter referred to as MTC) – form the base for the "top", where the DEFENSE POTENTIAL OF THE STATE is located. That is, the MIC and the MTC are the shoulders on which the military strength of the state, its exceptional combat capabilities, should rely.

For a long time, essentially from gaining independence until the beginning of 2023, the Ukrainian authorities as a whole ignored this most important principle of developing defense potential. Subsequently, during the war, efforts were made to increase the defense potential and combat capabilities of the army (in a broad sense)¹. However, the shortcomings of the "extra effort" period of the state revealed mistakes in the administration of the MIC and the MTC – precisely the improvement of the management model of the MIC-MTC is dedicated to this work. In connection with this, there is an urgent need for correction and improvement of the state's military-technical policy (MTP) and overall administration of the MIC. This issue is extremely important and relevant, as in the temporal dimension, it goes far beyond the territorial decoupling of Ukraine and aims to ensure a long-term confrontation with Putin's Russia – at least for the next decade. Ukraine's long-term goal is to achieve technological superiority over Russia (including with the help of Western partners). Moreover, Ukraine

¹ Usually it is meant the Forces of defense of state, which are created from two blocks. The force block includes Armed Forces with Forces of territorial defense (TD), National Guard, State Border Guard Service, National Police, as well as special units of the Security Service of Ukraine, Main Directorate of Intelligence of the Ministry of Defense, Special Operations Forces, National Guard of Ukraine. The non-force block includes the Security Service of Ukraine, intelligence (Main Directorate of Intelligence of the Ministry of Defense, Special Operations Forces, State Border Guard Service, Ministry of Internal Affairs), cyber structures (State Cyber Protection Center of the State Service of Special Communications and Information Protection of Ukraine), structures of information counteraction (i.e., counteraction of information-psychological operations and implementation of own information-psychological operations).

must rid itself of critical dependence on foreign states in ensuring resistance to the Russian Federation. If for 10 years of war Ukraine remained a vulnerable target for Russia, then together with technological breakthrough, the state must transform into an impregnable, maximally protected fortress.

Some elements of foreign models in the management of the MIC

In general, the best experience of foreign states in the MTP and in the management of the MIC may involve the application of two fundamental things: the state regulates the MTP through orders for its own security and defense sector and issues licenses for foreign trade activities. However, alongside key levers, there are numerous related ones. For example, how the military accepts defense products into service or how the state assists in concluding contracts by lobbying for the production on the international arena or how it invests in the establishment of new production facilities. To familiarize ourselves with the best global practices, let's consider some examples that may be relevant to Ukraine.

The principles of Israel are extremely suitable for Ukraine because we have long been involved in a similar continuous war for survival. The development of the nation in this country is directly based on the development of the army: people with military experience enter the MIC and create cutting-edge military technology – a significant part of the MIC is in state ownership. A small country with 9 million inhabitants spends almost 50 billion on defense. Moreover, Israel has de facto become a specialized military economy.

The key feature of the country's way of life is that Israel lives in a state of deep cultural militarism. Since 1982, there has been no major war between Israel and Arab countries, and one of the key reasons experts cite is the recognition by neighbors of Israel's military superiority². For Ukraine, this is a very weighty argument to focus on technological breakthroughs. However, in addition, the security model of Israel is directly related to guarantees from the United States, which include not only financial assistance but also joint developments – this is no less important for Ukraine in terms of the need to achieve technological superiority over the adversary-neighbor. For example, Israel, in collaboration with the United States, developed the advanced Arrow-2 missile defense system, and later the state-of-the-art Arrow-3³. Israel participates in the joint F-35 Joint Strike Fighter project with the USA and has already ordered a significant batch of F-35s for its army⁴. Significantly, that Israel not only became the first among foreign operators of this fighter, but also will receive

² <https://www.pravda.com.ua/articles/2022/12/9/7379947/>

³ In this case, the United States covers about half of the annual expenses for the development of the system, and the overall U.S. contribution has already exceeded 3.5 billion dollars. The Arrow program is managed by Boeing and Israel Aerospace Industries. Since 2008, the United States has allocated over 1.1 billion dollars for the joint development of the Arrow-3 upper-tier system designed to intercept medium-range ballistic missiles with nuclear warheads.

⁴ 12 planes out of the 50 ordered have already been received by the IDF.

25 F-35 fighters from the USA as assistance, and moreover, with a very substantial discount⁵ – that is regarding the feasibility and effectiveness of the Israeli model of security guarantees. Another example illustrates the pace, quality, and security of defense production lines: in the last days of October 2023, exactly 22 days after the start of the HAMAS attack in the new war, the local company Elbit Systems received a contract to establish a factory for the production of artillery ammunition⁶. The term for completing the work is extremely tight – within two years. However, the company's management has stated that it has unprecedented experience covering the entire cycle of ammunition production – from design to service and after-sales support. Elbit Systems builds and manages ammunition production plants and production lines at several facilities, so even the onset of large-scale military operations did not prevent the company from accepting orders. This serves as a lesson for Ukraine, whose government, over eight years of war, has not managed to build an enterprise of this profile, despite a queue of willing investors. When the defense industry receives internal investments from the state, external investments often follow.

In general, the consolidation of efforts among allied or friendly countries in the creation or production of weapons has long been a modern trend in the MTP for many developed countries. Of course, it is easier to do within military-political or at least economic alliances. For the MTP of NATO countries, the formation of "clubs" or international industrial consortia for the development and production of high-tech modern weapons has been an integral part of economic functioning for a long time.

With the beginning of the large continental war of Russia against Ukraine, this trend is only deepening. For example, in September 2023, the defense ministers of France and Germany expressed readiness for a joint project to create the next-generation tank. The Franco-German holding KNDS and the German defense concern Rheinmetall will participate in this project⁷. There is such a tradition in the countries of Southeast Asia and the Russian Federation. In particular, the Russian Federation, together with India, has a whole range of projects, among which the creation and localization of BrahMos missiles in India can be mentioned: the BrahMos anti-ship missile is a version of the Russian P-800 "Oniks" and is produced at a joint Indian-Russian enterprise⁸.

⁵ https://defence-ua.com/army-and-war/izrajil_otrimaje_25_vinischuvachiv_f_35_vid_ssha_u_viglijadi_dopomogi_ta_sche_j_iz_duzhe_vagomoju_z_nizhkoju-12086.html

⁶ https://defence-ua.com/weapon_and_tech/zavod_z_virobnitstva_bojepripasiv_za_dva_roki_i_135 mln_dolariv_izrajiljska_elbit_otrimala_novij_ko_ntrakt-13322.html

⁷ The start of negotiations is planned for 2024. After that, other European countries wishing to participate in the development of the new Main Ground Combat System (MGCS) project can join. <https://www.defensenews.com/global/europe/2023/09/22/germany-france-eye-new-partners-for-next-gen-tank-in-2024/>

⁸ <https://timesofindia.indiatimes.com/india/brahmos-aerospace-set-to-bag-2-5-billion-cruise-missiles-order-from-indian-navy/articleshow/98586561.cms>

Very illustrative example became the ammunition industry of Europe. As an example, in Nammo, which provides up to 25% of the European artillery ammunition market. In October 2023, the company noted that they would receive investments from the state in the amount of about 75 million Norwegian kroner – this is about 6.725 million dollars, but it is not more than 0.5% of the actual investment needs in the production of artillery ammunition⁹. At the same time, directly at Nammo, they have been investing 5-10 times more than usual for the past year and have depleted their resources. Therefore, according to the company's estimates, today it is necessary to invest 70 billion Norwegian kroner (6.277 billion dollars) in expanding production capacities, of which Nammo's share may amount to up to 20 billion (1.79 billion dollars). NATO member countries in Europe take good care of collective security.

South Korea's military-technical policy is aimed at continuously increasing arms exports, taking into account the needs of its own army first and foremost. For decades, the South Korean government has consistently increased financial assistance and investments in key technologies in the aerospace and defense industries, ensuring the growth of the defense industry through technology exchange with leading foreign companies. South Korea's military-technical policy is based on state investments in heavy industry, information technologies, and substantial investments in research and development¹⁰. Such an approach allowed South Korea to create not only very powerful and high-tech versions of its own missiles and self-propelled artillery¹¹, but in June 2023, even a state-of-the-art missile defense system, the Long-range Surface-to-Air Missile (L-SAM) with a maximum interception altitude of up to 200 kilometers, was introduced¹²; Koreans claim that it is better than the American Patriot, the media called it "Korean THAAD". Almost a miracle of a time breakthrough – work on the L-SAM complex began in 2019, and the first known tests became known in 2022. At the ADEX-23 exhibition in October, a sample of L-SAM in its final version for serial production was already demonstrated. That is, the creation of the new air defense system L-SAM was carried out by the South Korean Defense Development Agency in four years. Whereas previously, the development cycle in the world usually lasted about seven years, and for such highly complex systems like L-SAM – up to 10 years. Taking into account that the development was in response to the North Korean ballistic missile arsenal buildup, this fact probably determines the priority of the work for the country. By the way, in March 2023, a sensational news broke: the export of weapons from South Korea for the year 2022 increased by 140% and reached a record \$17.3 billion¹³. This can be more than in the Russian Federation, which has probably dropped out of the top five arms exporters due to the

⁹ <https://www.stortinget.no/no/Hva-skjer-pa-Stortinget/Horing/horingsinnspill/?dnid=36468&h=10004922>

¹⁰ Hyun Ji Rim. Emerging Technologies: New Threats and Growing Opportunities for South Korean Indo-Pacific Strategy. Journal of Indo-Pacific Affairs, Air University Press. April 1, 2022. <https://www.airuniversity.af.edu/JIPA/Display/Article/2979680/emerging-technologies-new-threats-and-growing-opportunities-for-south-korean-in/>

¹¹ https://defence.ua.com/weapon_and_tech/korejska_sau_k9_otrimaje_avtomat_zariadzhanija_skilki_groshej_ta_chasu_na_tse_potribno-12084.html

¹² <https://en.yna.co.kr/view/PYH20230601168000315> ; <https://www.shephardmedia.com/news/landwarfareintl/south-korea-displays-l-sam-at-seoul-adex-for-first-time/>

¹³ <https://www.nytimes.com/2023/03/05/world/asia/ukraine-south-korea-arms.html>

war in Ukraine. South Korea demonstrates the path to new technological leadership through the implementation of defense technologies – this is facilitated by military danger. And there is a great similarity with Ukraine in this.

Some elements of the Poland's MTP seem very significant and worthy of attention for Ukraine. It is worth starting with defense spending and spending directly on weapons. In 2023, Poland has become the absolute leader in NATO in terms of defense spending - they reached 4% of GDP, or 27.2 billion dollars¹⁴ (even the USA in 2022 had expenses of 3.47%, although in absolute figures, it's as much as 822 billion dollars). But the purchase of the latest weapons in Poland is seen as a way to develop advanced technologies and stimulate the defense industry. At the same time, with the start of the Russia's war against Ukraine, Warsaw will stick to the course so that the strengthening of defense capability will drive the entire country's economy. For example, during the implementation of the truly colossal project of creating the Wisla air defense system¹⁵, Poland has obtained approval for the localization of the production of one of the modules for the Patriot air defense system¹⁶. But such Poland's MTP has effectively become an integral part of rearmament. In 2023, new decisions emerged: to localize the production of American ATGM Javelin (despite the existence of production of Israeli ATGM Spike-LR)¹⁷; obtaining 96 American Apache helicopters involves establishing a service center based at the WZL-1 plant in the city of Bydgoszcz¹⁸; acquisition of about 500 M142 HIMARS MLRS involves the integration of domestic achievements. In the middle of the 23rd year, the purchased M142 HIMARS rocket artillery system was presented on the national wheeled chassis Jelcz¹⁹. Overall, within the agreement to purchase 486 M142 HIMARS launcher systems, Poland will receive the technology for the production of precision missiles, as well as the localization of the production of many components of the American M142 HIMARS launcher systems²⁰. In this case, Poland decided to simultaneously increase the localization of production for the Korean K239 Chunmoo MLRS, and almost

¹⁴ <https://www.dw.com/uk/polsa-zbilsit-oboronni-vitrati-do-rekordnih-4-vidsotkiv-vvp/a-64558033#:~:text=%D0%A3%202022%20%D1%80%D0%BE%D1%86%D1%96%20%D0%BD%D0%B0%20%D0%BE%D0%B1%D0%BE%D1%80%D0%BE%D0%BD%D1%83,%2C42%20%D0%B2%D1%96%D0%B4c%D0%BE%D1%82%D0%BA%D0%B0%2C%20%D1%96%D0%BD%D1%84%D0%BE%D1%80%D0%BC%D1%83%D1%94%20dpa.>

¹⁵ In June 2023, the United States approved the sale of Patriot systems to Poland for 15 billion dollars. The Polish government has requested the purchase of a set of six Patriot PAC-3 missile defense system batteries as part of the second stage of the Wisla air and missile defense project, <https://www.dsca.mil/press-media/major-arms-sales/poland-integrated-air-and-missile-defense-iamd-battle-command-system-0>

¹⁶ In 2022, the Military Electronics Works (Wojskowe Zakłady Elektroniczne), which is part of the Polish Armaments Group, signed an agreement with the American conglomerate Raytheon Integrated Defense Systems. This agreement allows the production of one of the modules for the Patriot air and missile defense system.

¹⁷ The agreement was reached between Polska Grupa Zbrojeniowa and the joint American venture Javelin (Raytheon та Lockheed Martin), [https://defence.ua.com/weapon and tech/polscha lokalizuje virobnitstvo amerikanskij javelin i tse popri vlasne virobnitstvo spike lr-12771.html](https://defence.ua.com/weapon%20and%20tech/polscha%20lokalizuje%20virobnitstvo%20amerikanskij%20javelin%20i%20tse%20popri%20vlasne%20virobnitstvo%20spike%20lr-12771.html)

¹⁸ It is anticipated that at the Polish aviation plant Wojskowe Zakłady Lotnicze № 1, they will service Longbow radars and Hellfire missile guidance systems, which are equipped on Apache helicopters, https://twitter.com/MON_GOV_PL/status/1706374430778159392?s=20

¹⁹ A prototype was presented at the stand of the company PGZ (Polska Grupa Zbrojeniowa SA) at the MSPO-2023 defense exhibition.

²⁰ <https://mil.in.ua/uk/news/polshha-zamovyla-486-himars/>

simultaneously with the American one, the first prototype of the missile system was installed on a Polish Jelcz chassis. Additionally, the deliveries of the Krab self-propelled howitzer to Ukraine also have a "license trail" – the manufacturer, Huta Stalowa Wola, reached a situation where the self-propelled artillery system received a tracked chassis under a Korean license, and the 155mm gun became a modification of the British AS90 howitzer²¹. In addition to what has been said about Poland's experience, it is also worth mentioning that Poland is extremely serious about solving the issue of ensuring security by all possible means, in particular, along with really insane spending, it creates allies in the MTC by obtaining loans. As a result, in November 2023, it became known that five banks of South Korea are considering the possibility of providing Poland with a loan in the amount of \$22.7 billion for the purchase of missile and artillery systems and destroyers²². The application involves the purchase of 1000 tanks, 600 howitzers, over 280 long-range Chunmoo missile systems (dual-caliber MLRS, developed on the principle of the American HIMARS), and 48 light combat aircraft FA-50.

Therefore, *based on the experience of the foreign MTP, important elements for Ukraine could be: domestic state investments in potential directions, organizing joint development and production with technologically and resource-powerful partner countries; offset programs (associated with purchases, which could involve establishing service centers, enhancing military equipment); purchasing or obtaining licenses, under different terms, for the production of military equipment or key components for the country's defense forces; acquiring advanced technologies during contract execution. Principled positions are important in this regard: adequate funding levels and a "fixed" approach to project execution (from enterprises and their associations to clearly defined authorities of ministries and agencies)*. Remarkably, ownership structure doesn't hold definitive significance. The US, where over 90% of the defense industry entities are private (effectively, except for companies involved in the nuclear cycle), effectively collaborates without hindrance with Israel's defense industry and Poland's, where there are mixed ownership forms.

Defense Industry Potential of Ukraine. Retrospective Analysis of Government Relations and the Defense Industry

It is widely accepted that Ukraine inherited approximately 30% of the Soviet MIC within its territory²³. The heritage has allowed Ukraine to become a potent participant in the global arms market. This led to the emergence of a peculiar, distinctly Ukrainian phenomenon – the development of individual segments of the defense industry against the backdrop of the

²¹ <https://novynarnia.com/2022/07/30/visim-polskyh-sau-krab-u-ramkah-kontraktu-gotovi-do-vidpravky-v-ukrayinu/>

²² <https://www.reuters.com/business/aerospace-defense/south-korea-lining-up-banks-help-finance-22-billion-arms-sale-poland-2023-11-03/>

²³ https://uk.wikipedia.org/wiki/%D0%9E%D0%B1%D0%BE%D1%80%D0%BE%D0%BD%D0%BD%D0%BE-%D0%BF%D1%80%D0%BE%D0%BC%D0%B8%D1%81%D0%BB%D0%BE%D0%B2%D0%B8%D0%B9_%D0%BA%D0%BE%D0%BC%D0%BF%D0%BB%D0%B5%D0%BA%D1%81_%D0%A3%D0%BA%D1%80%D0%B0%D1%97%D0%BD%D0%B8

absence of adequate responses to security and military challenges for the rearmament of the defense forces of Ukraine.

Throughout Ukraine's recent history, its MIC has been characterized by several national peculiarities.

Firstly, during the Soviet era, Ukraine almost did not produce final samples of armaments and military equipment (AME), and even by the end of 2010, their number, according to expert assessments, did not exceed 8-12% of the total volume of military and dual-use production. These included military transport aircraft, modern tanks and armored personnel carriers, some radar and reconnaissance systems, anti-tank missile systems, dual-purpose wheeled vehicles. Ukraine also had a fairly extensive production system for essential components (aircraft engines, gas turbines for military ships, combat modules, aviation missiles, etc.) and AME-related services – encompassing servicing, repair, and modernization of integral systems.

Secondly, the traditionally low level of state defense orders (or their absence) for an extended period prompted the predominantly export-oriented direction of most MIC enterprises. This created a pronounced imbalance between the development of certain sectors within the MIC and the equipment of the Armed Forces, as well as a noticeable imbalance within the MIC itself. As a result, out of approximately 250 pre-war enterprises (under various departments or privately owned), only about 30-40 enterprises, including private ones, had specific development strategies, engaged in the modernization of core assets, conducted research for new systems, and implemented new technologies into production.

Thirdly, Ukraine, due to its fairly extensive and powerful defense-industrial heritage, managed to establish itself in the global arms market. One can speak of a certain phenomenon – the development of several isolated segments or sectors of the defense industry – against the degradation and natural extinction of several others. Additionally, starting from 1999-2000 until the onset of the war in 2014, the export orientation of the MIC was somewhat stimulated by specialized exporters through the mobilization of circulating resources. During that time, new acquisitions appeared in certain states due to the investment of circulating resources by the State Concern "Ukrspetsexport" or the inclusion of research and development (R&D) works.

Fourthly, Ukraine's MIC during its recent history continued to function predominantly through the development or enhancement of Soviet technologies. However, some were significantly supplemented and developed by incorporating modern ideas and through aforementioned exports: updating the elemental base, programming achievements, using composite materials, etc. This formed the basis for the establishment of new domestic development schools of AME, which were previously never produced in Ukraine. For

instance, the school of manufacturing light armored vehicles, rocket-propelled artillery, unmanned systems, etc.

Fifthly, albeit slowly, certain niches in Ukraine started to be occupied by compact private enterprises – modern structures where internal investments in defense were, in most cases, only a part of their business. Only in some cases was there talk of converting intellectual property into capital. Thanks to the development of private structures and their sporadic involvement in fulfilling state defense orders, Ukraine achieved success in developing systems to counter precision weapons, some directions in radar, the creation of training systems, and other dual-use military products. While about 90% of Ukraine's MIC remained entrenched, inflexible state structures, it was the private entities that, through their activism, not only competed with state-owned enterprises but also stimulated their management to seek alternative development opportunities.

In April 2011, the Ukrainian government made the most massive attempt to create a vertically-integrated structure for Ukraine's MIC by subordinating over a hundred enterprises to the state concern "Ukroboronprom"²⁴.

The war initiated by Russia since 2014 has become a significant challenge for Ukraine's defense industry. There was a pressing need for substantial substitution of Russian components. In the An-178 aircraft, they comprised no less than 20-30%. In the Ukrainian aviation missile R-27 (the most authoritative high-precision munition for modern aircraft at that time), approximately 50% of components were of Russian origin.

However, Russia's war against Ukraine led to an explosive growth in the number of defense developments and defense production itself. For instance, in 2015, over 30 enterprises were involved solely in the problematic issue of creating and producing unmanned aerial vehicles (UAVs) in Ukraine. Overall, according to analytical organizations' estimates, the number of defense industry enterprises in Ukraine confidently exceeded three hundred, primarily due to private scientific-industrial structures (the quantity of state-owned enterprises remained almost unchanged, but their activity profile significantly expanded, showing signs of mastering the production of new military equipment, even establishing new areas of expertise—such as the DKKP "Luch," which proposed developments for SAMs and UAVs). In these circumstances, the then-president Poroshenko decided to preserve both the SC "Ukroboronprom" and the principle of "manual control".

The establishment of joint ventures with foreign partners was widely recognized as an effective means of attracting investments and creating modern technologically progressive types of armament. However, in practice, this matter saw no progress. Even when SC "Ukrspetsexport" reached an agreement in 2018 with the Turkish private company Baykar Makina to establish a joint venture called "Shield of the Black Sea" (the venture was intended

²⁴ <https://zakon.rada.gov.ua/laws/show/993-2011-n#n13>

for the joint production of ATGM "Skif" and Turkish drones Bayraktar TB2), the enterprise did not commence its operations. The prospects were significantly undermined due to the structural unpreparedness of Ukraine's defense industry and the Ukrainian government's incapacity to reform the state-owned sector of the MIC²⁵. The unusual personnel policy in the field of the defense industry and military-technical cooperation of President Poroshenko did not contribute to this before²⁶.

In general, the issue of personnel support in the defense industry became a real challenge for defense industry of Ukraine since 2010. The "manual control" of the defense industry during President Poroshenko's time led to negative outcomes in the development of most enterprises in the sector and, in some cases, to disastrous results. Specifically, the inclusion of the renowned enterprise "Antonov" into the structure of "Ukroboronprom" and the appointment of leaders with little connection to aerospace engineering resulted in "Antonov" not producing any aircraft since 2015 and losing several external projects.

Moreover, despite Russia's armed aggression, Ukraine remained an export-oriented country. For instance, as of 2018, it fulfilled a contract for tank deliveries to Thailand²⁷. That is, the modern tank, which has been in service with the Armed Forces of Ukraine since 2009, has not been supplied to the army. Only in 2020, the volume of state defense orders turned out to be larger than arms exports (about one billion dollars compared to 500 million).

After the change of government, the new head of state Zelensky in February 2020 issued decree No. 59/20, which provided for the reform of the management system of the MIC and the creation of a technology development system – through the Defense Technology Agency²⁸. In 2020, the Ministry of Strategic Industries of Ukraine (Minstrategprom) was established, along with the position of Deputy Prime Minister – "industrial" minister, who is the key figure in the government responsible for the defense industry. The establishment aimed to put an end to the chaos surrounding "Ukroboronprom"²⁹. However, due to the war of interests within President Zelenskyy's environment³⁰, until March 2023, the Ministry of Strategic Industries practically did not function.

Up to 2022, the MIC has developed a series of the AME that can be classified as modern. This includes precision weaponry such as the combat module "Shkval" with the anti-tank

²⁵ https://lb.ua/economics/2020/10/05/467404_gendirektor_ukrspetseksportu.html

²⁶ For example, from July 2014 to February 2018, according to the Decree of the President of Ukraine No. 569/2014, the General Director of the State Concern "Ukroboronprom" was Roman Romanov, previously an automobile dealer and deputy of the Kherson Regional Council from the "Front for Change" – a member of the Permanent Commission on Industry, Construction, and Housing and Communal Services. In other words, he had no experience in the defense industry.

²⁷ <http://uprom.info/news/vpk/kraynya-partiya-tankiv-bm-oplot-t-ta-brem-84-atlet-pribula-do-tavilandu/>

²⁸ <https://www.president.gov.ua/documents/592020-32541>

²⁹ For example, shortly before the dismissal in the summer of 2023, the CEO of "Ukroboronprom," Yuriy Husev, issued a promotional brochure, from which one can learn about the development by the state concern of four state programs and six legislative drafts, without having the right to legislative activity.

³⁰ https://lb.ua/news/2021/11/10/498177_ukrainska_oboronka_mizh_reformoyu.html

missile system "Barrier" for armored vehicles, the Barrier-V guided missile system for helicopters, the MLRS "Vilha", and the coastal complex of cruise missiles 360MC "Neptune".

The large-scale invasion by the Russian Federation fundamentally altered the customer-executor relationship format – the army needed literally everything that was available or could be rapidly produced. In Ukraine, even non-profiling agencies took the initiative in AME development: the achievements of the Ministry of Digital Transformation and the Security Service of Ukraine are not the result of a clearly planned state MTP, but rather the art of the possible. In July 2022, the Ministry of Digital Transformation, in collaboration with the Ministry of Defense, the General Staff of the Armed Forces of Ukraine, and the State Special Communications, within the fundraising platform UNITED24, announced the first fundraising for the "Army of Drones". Over the year, donations for drones for Ukraine were supported by donors from 100 countries. As a result, more than 200 units were equipped with drones. In 2023, the Drone Hackathon competition emerged – the first attempts to set tasks for the industry.

On the other hand, the Security Service of Ukraine initiated the production of maritime unmanned surface vehicles (USVs), which Ukraine successfully used to attack the Crimean Bridge and Russian ships³¹.

During the course of the war, "Ukroboronprom" commenced serial production of "Soviet" munitions abroad in collaboration with the NATO country³².

An important change in the MIC in 2023 was the noticeable expansion of Ukraine's own production of weapons, primarily missiles, and various types of drones.

The large-scale war demonstrated that Ukraine is an exceptional country with remarkably successful designers, who even succeed in mysterious projects, such as the conversion of a practically obsolete reconnaissance drone Tu-141 "Strizh" into a guided missile or the conversion of an "old" anti-aircraft missile 5V28 from the S-200 air defense system³³. Ukrainians have successfully reconfigured Soviet Su-24 bombers for the deployment of British and French Storm Shadow and Scalp missiles.

However, the development of more powerful drones faced significant challenges in 2023.

Overall, there is evidence of non-systematic MIC, necessitating improvements in the administration of the development and production processes for new types of military and technical policy in accordance with the requirements of the Ukrainian military command. Additionally, there are issues within the Ministry of Defense regarding monitoring and

³¹ <https://edition.cnn.com/2023/08/15/europe/ukraine-crimea-bridge-drone-strike-video-intl/index.html>

³² https://lb.ua/economics/2023/05/02/553736_ukroboronprom-tse_lyudi_yaki_pratsyuyut.html

³³ https://defence-ua.com/weapon_and_tech/ukrajinski_raketi_na_750_1000_km_scho_tse_ta_skilki_chasu_neobhidno_na_pochatok_serijnogo_vir_obnitstva-13135.html

analysis of global best practices, as well as challenges within key authorized government structures, namely the Ministry of Strategic Industries and the Ministry of Defense, in terms of synergizing the potential of science, industry, and the military.

In 2023, there were indications of certain achievements in the MTC. The Armed Forces of Ukraine will be able to acquire new Turkish UAVs, Akinci, equipped with cruise missiles³⁴. State Enterprise "Antonov" and the French company Turgis & Gaillard have entered into an agreement for the production of the state-of-the-art combat drone Aarok MALE³⁵ with a payload capacity of 1.5 tons at the facilities of the Ukrainian company.

The first realized project from the USA has emerged – involving the modernization of two types of anti-aircraft missile systems for Western missiles³⁶. This experience proves the high technical level of national developers. The key problem in 2023 remained the administration of the MIC, more precisely, the choice of the optimal model. So, what are the main flaws and shortcomings of the MIC management system and what factors hindered its development?

The problem of defense funding. Primarily, the most significant flaw of the MIC until 2014 was the lack of investment in defense creation. Even with the onset of armed aggression, the situation did not change drastically – during the ongoing war, expenditures on weapons in the form of orders and developments before the start of the large-scale invasion did not exceed one billion dollars per year. That is, the army and its adequate rearmament were not a priority for the state leaders from 2014 to 2022. Considering the funding of the defense forces of Ukraine after the global invasion, it is not worth it, as the majority of weapons in 2022-2023 Ukraine received as material and technical assistance, and the weaponry procured from foreign countries and domestic MIC also largely involved the resources of foreign partners.

Organizational problems accompanied the MIC and the MTC throughout the entire period of Ukraine's recent history. Even in 2023, against the backdrop of certain achievements of the MIC and the MTC, there is an absence in the system of executive authorities of a single center for decision-making. Several examples of regulation in the field of the MIC can be cited, from which it is evident that decisions were made with significant delays. Only in March 2023 the government supported the implementation, within two years, of an experimental project for the procurement of domestic unmanned systems. And the situation with the State Audit Service is even more shocking. A letter from missile weapons manufacturers to the Office of the President requesting protection from the disgraceful actions of the State Audit Service arrived on August 28 (Special Service of Ukraine and Council for National Security and Defense of Ukraine were also among the recipients). However, only in November a draft

³⁴ <https://www.radiosvoboda.org/a/halyuk-bayraktar-interview/32617281.html>

³⁵ <https://www.epravda.com.ua/news/2023/10/4/705067/>

³⁶ <https://apnews.com/article/ukraine-russia-war-military-missiles-16c344bdba2e0695a2286a55d9614ff4>

government resolution was prepared to rescue the MIC flagships³⁷. Also only at the end of October 2023, the Cabinet of Ministers supported the resolution developed by the Ministry of Defense³⁸, which allows simplified approval for the operation and supply of unmanned aerial vehicles and electronic warfare means in the defense forces of Ukraine.

Unfinished reform. The State Concern "Ukroboronprom" remains incompletely reformed to this day. The law on corporatization of "Ukroboronprom" was adopted in July 2021. It was envisaged that 65 enterprises would form the basis for the creation of five specialized sub-holdings: armored vehicles, aviation maintenance, precision weaponry and ammunition, radar systems, and maritime systems. However, the reform was delayed, and with the Russian invasion, it came to a halt. Private defense enterprises, institutions, and organizations in industry and science, which accounted for over half of the state defense order in the years leading up to the global war within the framework of public-private partnerships, were not involved in the reform. Finally, in March 2023, the state concern "Ukroboronprom" was reorganized into a joint-stock company called "Ukrainian Defense Industry".

Issues in defining priorities for the development of AME and managing segments of the MIC and the MTC. Three AME programs were formally launched in Ukraine during the war: missile, drone, and ammunition programs. However, it remains unclear who coordinates them and who is responsible for their implementation. Similarly, the question of expanding international cooperation in the Ukrainian MIC and MTC is unclear. The relevant document regarding MTC was being developed in the Ministry of Strategic Industries, and the law on MTC in the country has not been adopted since the late 1990s, despite several prepared drafts.

The issue of technology development remains unclear – who is responsible, what are the methods and conditions, and what is the role of the state. Even with the establishment of the Innovation Development Accelerator in the Ministry of Defense and the universal platform Brave1 in the Ministry of Digital Transformation, the issue of creating weapon systems, especially the formation of consortia, if necessary, remains unresolved. Without this, making a leap in creating high-tech platforms will be impossible. Even after 20 months of the "great war", domestic agencies were only considering the proposed industrial technologies but had not started creating a new complex. This applies to the entire spectrum of weaponry.

The problem of reconstruction and modernization of MIC enterprises. As a result of the large-scale war with Russia starting from February 24, 2022, a significant portion of Ukraine's MIC (around 45 enterprises, as reported by "Ukroboronprom") lost substantial production capacities. Moreover, in many cases, MIC enterprises required modernization or the creation of new production capacities through technology transfer from partner countries.

³⁷ <https://www.ukrinform.ua/rubric-economy/3781371-minoboroni-pidgotuvalo-proekt-postanovi-so-pidverdzhue-pravo-pidpriemstv-vpk-na-pributok.html>

³⁸ <https://www.mil.gov.ua/news/2023/10/21/prishvidsheno-dopusk-do-ekspluataczii-i-postachannya-bpla-ta-zasobiv-reb-u-vijska-uryad-pidtrimav-rozroblenu-minoboroni-postanovu/>

If we find out that Russian "Lancets" are manufactured on equipment from Japan and Korea³⁹, or a machine from the German manufacturer SPINNER for the Russian Defense Enterprise "Serov Mechanical Plant" – to implement a program for increasing the production of fragmentation-impact shells for Russian tanks⁴⁰, or machines from the American corporation NSH⁴¹, then we realize that the adversary is rapidly modernizing its core assets. Ukraine needs to rapidly expand its production, and moreover, carry out modernization with the assistance of partners who possess such technologies. Currently, the Ministry of Economic Development is engaged in this, but the issue of overall coordination will prove to be not superfluous in improving the management model of the defense industry.

The Ukrainian Choice for Defense Industry Development

There is no doubt that the foundation of Ukraine's MTP should be the implementation of a course towards a high technological level of the Armed Forces' weaponry, surpassing the technological level of the adversary both today and in the future. Different models can be considered, but given that the process of improvement must take place in the midst of a global war, it should involve relatively straightforward mechanisms that do not disrupt the existing capabilities of the MIC.

Another direction for implementing the MTP should be the creation of a continuous training system for personnel to meet the needs of the MIC.

Based on the overview provided above of the main elements and issues of Ukraine's MIC, we propose that the government take a series of administrative steps that we consider significant for strengthening the capabilities of the domestic MIC – and in 2024, they remain more than relevant.

Firstly, the Ministry for Strategic Industries should transform into the main coordination center for the MIC's activities in the country (this has already been done de jure, but a clear distribution of powers has not been implemented). The Ministry of Strategic Industries exclusively performs regulatory functions and does not interfere with the economic activities of defense industry enterprises. From under the "roof" of the legal successor of State Concern "Ukroboronprom" – JSC "Ukrainian Defense Industry" enterprises of the aviation and rocket industry should be brought under the direct management of the Ministry of Strategic Industries, as well as the rocket-building enterprises of the State Space Agency of Ukraine should be brought under the direct management of the Ministry of Strategic Industries. Under the leadership of the Ministry of Strategic Industries of Ukraine, the reform of the state MIC

³⁹ https://lb.ua/world/2023/08/22/570940_verstati_kamikadze_rosijski.html

⁴⁰ https://t.me/NAZK_gov_ua/2484

⁴¹ <https://www.youtube.com/watch?v=1iilUoVFNbY>

sector must be completed as a matter of urgency – enterprises become joint-stock companies or limited liability companies.

Secondly, the Ministry for Strategic Industries should establish an Advanced Technologies Agency, which develops and implements mechanisms to stimulate technology development – both within the framework of the MTC and the acquisition of licenses from foreign companies, as well as in collaboration with "open areas" such as the Sikorsky Challenge (Igor Sikorsky Kyiv Polytechnic Institute), individual private companies, and their associations. The state should have two levels of financing for new technologies for defense needs: through the Ministry of Defense – for urgently needed purchases for the Armed Forces (today), and through the Advanced Technologies Agency of the Ministry for Strategic Industries – for the development of future technologies (tomorrow). The question of whether it is possible to form the mentioned structure for the development of advanced technologies based on Brave1 is valid but subject to discussion. There are already positive examples of the platform's work, including on international platforms in the context of future MTC projects⁴². At the same time, as long as there is a perception (including considering the decree of the President of Ukraine No. 59/20) that the key issues of creating (developing) new technologies and armaments in the state should be related to the sphere of the Ministry of Strategic Industries' authority. As well as the creation, within the MTC of new industries such as the production of titanium, lithium, and others. Partially, the issue of delineating responsibilities in 2023 was resolved – after the establishment of the Ministry of Defense's Accelerator and the implementation of a joint system for evaluating new technologies with the General Staff of the Armed Forces⁴³. However, at the same time, a technology development system was not established – *assessments are being made, and continue to be made, exclusively on the innovative solutions proposed by developers and manufacturers; a system for the development of new systems under state coordination (taking into account the principles of public-private partnership) has not been created.*

Third. Procurement programs for armaments and military equipment (AME) should be formulated by the commanding branches and arms of the Armed Forces of Ukraine, clearly coordinated (and clarified) with the military command of the Armed Forces of Ukraine in terms of priorities (partially addressed in 2023; however, nothing is known about authorized managers, i.e., heads of programs for the creation and production of AME by domestic MIC and within the framework of the MTC).

Fourth. A unified plan for the transformation of specialized exporters into state investment companies should be developed for implementation within a year. The issue of their coordination may be debatable, but legislative changes are necessary to improve their status

⁴² <https://www.diu.mil/latest/diu-hosts-ukraine-and-the-future-of-unmanned-aerial-systems-forum-in-warsaw>

⁴³ The Ministry of Defense of Ukraine defines and employs "samples of a high level of technological readiness" (Technology readiness levels (TRL) - at the same time, the method of assessing the maturity of technologies is measured on a scale from 1 to 9, where 9 is the most mature development), and it refers to an indicator from "7 » and above, then the decision-making period is up to 45 days. <https://armyinform.com.ua/2023/06/09/u-minoborony-rozpochnyave-diyaty-akselerator-innovacijinogo-rozvytku/>

in new conditions. Additionally, it is important to consider that the activities of such enterprises fall within the competence of the presidential branch of power – as part of international activities.

Fifth. To organize collaboration with involved agencies from the Ministry of Defense, the opportunities of the Government Interagency Commission on MIC issues can be utilized, or resort to the creation of a Government Committee on Defense. In the first case, it is worth enhancing the status of the head of the Government Interagency Commission on MIC issues by elevating the Minister of Strategic Industries to the level of deputy prime minister. In the second case, it is necessary to elevate the Minister of Defense to the level of deputy prime minister. The first option seems closer to optimal, as the Ministry of Defense deals with receiving material and technical assistance and procurement of AME for the current needs of the army, while the Ministry of Strategic Industries aims to achieve technological advantages for the next 5-10 years, both through the achievements of its own MIC and through the MTC. Issues related to the consideration and determination of the most priority technologies (projects of the MTC) should fall within the competence of the Ministry of Strategic Industries, and within the interagency structure in the government, the procedure for conducting tests, using equipment (test sites), and other working aspects can be determined. The work of this commission/committee should primarily simplify the process of adopting AME (certain steps in this direction have already been mentioned above) and stimulate the development of public-private partnerships through the introduction of joint projects.

Sixth. To organize control over the activities of the MIC, it is advisable to establish a State Military-Industrial Commission under the President (or transform the existing Interagency Commission on the Policy of Military-Technical Cooperation and Export Control under the President of Ukraine by increasing its level of authority). It is proposed that the President of Ukraine be the Chairman of the commission, and its two deputies be the Commander-in-Chief of the Armed Forces of Ukraine (the key figure in the military) and the Minister of Strategic Industries (the key figure in the defense industry). Thus, the emergence of advanced technologies and state-of-the-art weapons in the country will be associated with the person and activities of the head of state. This is logical, as the lion's share of such technologies and weapons Ukraine is supposed to receive from Western partners through joint projects (joint production) and licenses. This is in accordance with the Constitution of Ukraine, which considers the key part of the international activities of the President of Ukraine to be ensuring the defense capability of the state.

Seventh. To organize conditions for the adoption and implementation of optimal decisions in the development of new AME, it is worth forming the institution of chief designers (authorized – in areas where there are no clear contours of new scientific and production schools, such as in the creation and production of unmanned platforms, electronic warfare). The chief designer (authorized manager) should bear full responsibility for the creation

(organization of production, compilation of the final list of AME) of certain technologies (AME), including financial decisions. In specific cases, the introduction of project management methods from the customer (Ministry of Strategic Industries or Ministry of Defense) side using MBA (Master of Business Administration) methods may be possible – especially when it comes to the formation of fairly large consortia, such as in the creation of a group of reconnaissance satellites or similar large-scale projects.

Moreover, it is advisable to establish a Scientific and Technical Committee at the Ministry of Strategic Industries (or a Scientific and Technical Council on MIC issues as a permanently operating advisory and advisory body for considering scientific recommendations and conducting professional consultations or discussions on the choice of certain technologies or defense systems). It should include leading scientists – project leaders of fundamental research, renowned designers of weapons and military equipment, heads of profile institutes of the Ministry of Defense, General Staff of the Armed Forces of Ukraine, and major enterprises responsible for the development and serial production of specific new models of AME.

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