Foresight and Active Forecast Potential for Improving Defense Capability

Ilya VARZHANSKIY
PhD student, Igor Sikorsky Kyiv Polytechnic Institute, Ukraine &
The University of Edinburgh, Scotland, UK
iD *0000-0002-4041-4772*
i.varzhanskyi@sms.ed.ac.uk

Anatolii MELNYCHENKO
PhD, professor of the Department of management theory and practice, Igor Sikorsky Kyiv Polytechnic Institute,
Ukraine
iD *0000-0002-3474-8477*
melnichenko@kpi.ua

Serhii NAIEV
PhD student, Igor Sikorsky Kyiv Polytechnic Institute, Ukraine
iD *0009-0001-5386-6401*
s.naiev@kpi.ua

Oleksandr KAPUSTYNSKYI
Dr., Vilnius Gediminas Technical University, Lithuania
iD *0000-0001-9321-6449*
o.kapustynskyi@vilniustech.lt

Abstract

This paper examines the significance of foresight and active forecasting as integrative frameworks for strengthening defense capability. Using Ukraine as an illustrative example, the study demonstrates how these approaches provide a nuanced understanding of current security challenges and enable the anticipation of future scenarios – both essential for effective strategic planning and state-level decision-making.

The influence of foresight on the formation of self-defeating prophecies in the context of active forecasting and its role as a management tool capable of public policy adjustment are considered. Examples of NATO Strategic Command and DARPA leadership experience of improving the effectiveness of defense plans using this methodology are considered.

The authors discuss various approaches to the use of foresight in the field of defense, including open and confidential options, as well as their possible outcomes in a confrontational international environment. Particular attention is paid to the need to take into account the disinformation factor. The study confirms that foresight as an active forecast is a powerful tool that can significantly improve the state's defense capability and provide a strategic advantage in a rapidly changing international security situation.

---

1. Introduction

Ukraine and the contemporary Western world have in recent years faced challenges that have shaken the global security architecture established over decades. The Russian invasion of Ukraine in 2022 invalidated numerous expert prognostications regarding the prospects of war initiation, intensity, and the nature of combat operations. Some scientifically grounded forecasts proved inadequate, despite being formulated by authoritative agencies. Moreover, many examples of abrupt changes at the end of the 20th century, which could not be calculated using a linear forecast, led a number of scientific schools to single out the concept of "foresight" as an alternative to the traditional forecast. In the literal sense, foresight is a representation of the future, which cannot be interpreted as an ordinary continuation of the past, because this future takes on fundamentally different forms and structures (Zgurovsky, 2022; Barry et al., 2019). However, in this work we will use a narrower, applied meaning of the term foresight as a set of tools, methods, and approaches aimed at a systematic analysis of future opportunities and risks in order to support strategic decision making. At the same time, it includes not only qualitative and quantitative research methods, but also the participation of stakeholders in the process of discussing and shaping the future. By defense capabilities, we understand the ability to protect national interests in the internal and external environment, and foresight can be used to solve all the problems that government entities face in ensuring defense capability. Here are only some complex problems in the area which often change with breaks in monotony, meaning that strategic planning in these areas requires foresight approaches:

- technological progress,
- information and cyber-attacks,
- terrorism and hybrid conflicts,
- economic sanctions.

Building future scenarios with the help of a universal system analysis methodology makes it possible to simultaneously foresee many aspects, such as technological innovations, changes in military doctrine, and political shifts. Foresight can be used for risk management and preparation for previously unknown threats. Thus, the use of foresight in matters of defense capability can provide valuable transparency and predictability for decision-making at the state level.

Norbert Wiener, one of the founders of cybernetics, explored feedback systems where information about expected outcomes can be fed back to the system and influence its future state. In 1948, Robert Merton coined the concept of self-fulfilling prophecy in sociology, where a prediction, or expectation, can influence reality in a way that makes such outcome more likely. This is an example of how forecasts can influence people's behaviour and therefore change future events. In 1977, the Soviet scientist Sergei Mikhailovich Vishnev proposed a division of the forecast into two types: active and passive. A forecast is called passive if it cannot affect the object of forecast, and if the impact of the forecast on the forecasted object cannot be neglected, then it is called active forecast (Vishnev, 1977). In the field of defense, absolutely passive forecasts are rare, since this category is more related to objects and processes that are beyond the control of people and organizations, for example, the forecast of solar activity. International relations, on the contrary, are characterized by a constant research of the military capabilities and plans of other countries, especially those that are likely adversaries, in order to adjust one's own defensive or offensive capabilities. Thus, a significant part of the foresights

prepared by authoritative expert groups, the results of which are transferred to government bodies or published in the public domain, are active forecasts by definition. This is manifested in the fact that if the leadership of the state whose development was predicted trusts the foresight results and uses them in management activities, this changes the probability distribution of possible scenarios in favour of the optimistic scenario. Another option involves forecasting scenarios for the socioeconomic development of another state, in particular, the adversary state. Such a forecast is passive to a certain extent if it is prepared and communicated to the military-political leadership with the observance of secrecy measures and, accordingly, active if its results are made public at some stage. It should be noted that it is not always possible to determine which category the forecast belongs to – passive or active, for example, if the adversary secretly got access to the foresight results. However, there is every reason to assert that foresight is most often prepared as a tool of management activity, that is, it must take into account the consequences of its use as an active forecast.

The *aim* of this work is to characterize the research potential of foresight and active forecasting as integrative frameworks, and to elucidate their interplay in enhancing defense capability.

2. Literature Review

Academic publications from researchers worldwide highlight the challenges of applying foresight and active forecasting frameworks to enhance defense capability. Several significant articles have been published in the international journal Foresight, which is one of the leading publications for futurists and foresight practitioners.

For instance, in their 2016 study, Brazilian researchers C.R. Correa and C.H. Cagnin proposed in their study a model, based on strategic simulation and scenario planning, to enhance the process of decision-making in the realm of defense in Brazil. Specifically, their publication discusses an innovative approach for Brazil involving the engagement decision-makers team (representatives of the Ministry of Defense, executive and legislative branches; political and strategic advisory team (civilian representatives with a broad understanding of the national and international contexts) and experts (experts in fields of interest to national defense, comprising representatives of several sectors and broad areas of knowledge, including scholars, scientists, politicians, military, industry, among others) (Correa, 2016).

In turn, Turkish researchers attempted to assess the enduring effects of technology foresight on the defense sector and identify the critical factors contributing to its successful impact (Burhan, 2021).

An important study correlating with the focus of our scientific interest is the publication by Spanish researchers S. Vicente Oliva and A. Martinez-Sanchez. The researchers conducted a content analysis of the publicly available Spanish Defense National Foresight Exercise and conducted a study aimed at examining the influence on the defense technological and industrial base. The authors pay special attention to the role of defense and security foresight studies in enhancing competitiveness and fostering the development of advanced technologies in the future (Vicente Oliva and Martinez-Sanchez, 2018).

In the study by B. Nemeth, N. Dew, and M. Augier, the Hungarian experience of application strategic foresight for the Hungarian Ministry of Defense. In the article, these authors proposed a three step diagnostic method of foresight processes. This research becomes particularly

interesting when viewed in light of the ongoing Russian aggression against Ukraine, as the findings derived in 2013-2014 by experts from the Ministry of Defense of Hungary accurately anticipated the identification of potential threats and opportunities for the period of 2015-2030. It was within this study that the overarching trends that ultimately led to the European migration crisis and Russia's increasingly confrontational foreign policy were predicted (Bence et al., 2018).

Of particular interest to the study of applying foresight and active forecasting in defense strengthening is the work of Czech researchers from the Center for Security and Military Strategic Studies at the University of Defense, Brno, Czech Republic: J. Fučík, J. Kolkus, J. Melichar, and J. Procházka. It is noteworthy that their proposed concept of alternative futures correlates with the notion of scenarios used in foresight methodology. Furthermore, the steps to implement the Alternative Futures Methodology Framework (AFMF), as supported by the authors, effectively replicate the research actions taken in foresight applications. It is about 10 following steps: (1) identification of key focus areas and potential drivers of their change, trends and shocks; (2) environmental scanning, (3) determination of uncertainties and their polarities, (4) ranking uncertainties, (5) development of alternate future framework, (6) writing alternative futures, (7) communicating and validating, (8) identifying and assessing military implications, (9) identifying signs - indicators, and (10) monitoring – assessing – updating (Fučík et al., 2017).

We cannot overlook research that supports the role of foresight and scenario analysis in public administration or political science. For instance, American researchers N. Barma, B. Durbin, E. Lorber, and R. Whitlark argue that scenario analysis is a valuable experimental and problem-solving method for political science, offering both scientific and pedagogical value. Addressing the essence of scenarios as the core of foresight methodology, these authors somewhat ambiguously propose its definition, suggesting that scenarios are plausible and textured narratives that help envision how the future political-economic world may differ from the past, thereby emphasizing political challenges (Barma et al., 2016). In our view, such an interpretation of scenarios lacks explanation regarding the methods for constructing scenarios.

In 2019, a group of experts from the International Institute for Strategic Studies (IISS) published a report titled "Defending Europe: scenario-based capability requirements for NATO's European members." A notable aspect of this report was its examination of scenarios for defending Europe in the event that the United States withdraws from NATO. Although such a situation may seem unlikely, it is crucial to note that analysts identified the Russian Federation as a key threat to Europe. Despite the scenarios proposed not being implemented, the report demonstrated a systematic approach to scenario construction. In addition to exploring potential political and military decisions, researchers considered challenges related to enhancing defense capabilities and the associated costs of implementing the proposed scenarios (Barry et al., 2019). Based on scenario construction, the authors concluded on the preservation of the United States' key role within the NATO bloc. As evidenced, the widespread Russian invasion against Ukraine only underscored this conclusion.

Furthermore, following the onset of Russian aggression against Ukraine in 2014, an international research group proposed four scenarios for the future relationship between the EU and Russia. These scenarios – Shared Home, Common Home, Broken Home, and Divided Home – were designed to model the potential future relations between the EU and its eastern neighbours. Interestingly, in this study, it is notable that when constructing scenarios centered around Crimea, the authors did not consider its return to Ukraine as a possibility (Friedrich-Ebert-Stiftung, 2014).

It is also worth mentioning the Dahrendorf Foresight project, whose results were edited by Monika Sus and Marcel Hadeed. The attempt to demonstrate scenarios for European security until 2030 appears to us quite systematic and well-founded. Moreover, the authors clearly differentiate between the concepts of foresight (scenario construction) and forecasting. The project, which covers a wide range of societal spheres and links them to European security, is unique and, as far as we know, a distinctive characteristic of this endeavor (Sus et al., 2019).

3. Methodology

In this article, both theoretical methods and the results of empirical research are used. The methodological basis is a systematic approach to the study of the problem. The main research methods are the analysis of scientific literature, scenario modelling, and expert assessments. The analysis of scientific literature allows the authors to assess the current state of research in the field of foresight methodology and defense research, as well as to identify the main theoretical approaches and concepts used in this area.

Scenario modelling is used to represent various possible future scenarios and evaluate their consequences. This method takes into account a number of variables and their interaction, which makes it especially useful for the analysis of complex and dynamic systems, such as the sphere of national defense. The method of expert assessments makes it possible to take into account the professional experience and specialists' expertise in the field of defense and forecasting.

In this research, the authors use both primary and secondary data sources. Primary sources include official documents and reports, as well as data obtained directly from experts. Secondary sources include scientific articles, books, and other publications related to the research topic.

An important aspect of the methodology is the consideration of possible disinformation. The authors are aware that information obtained from open sources or from experts may be distorted or incomplete, and therefore, they use cross-validation and cross-checking of data to ensure the validity and accuracy of their results.

4. Restricted Access Foresight

Let us consider the use of foresight in the field of defense, prepared in compliance with the requirements of secrecy, that is, when the probability of obtaining its results by the adversary is minimized. Such a foresight is a managerial tool for analyzing and adjusting state policy regarding the development of international relations, intelligence, the armed forces, the military-industrial complex, and related areas of the economy. The deep state defense foresight will also include a broader socio-economic context, including such important areas as education and science, healthcare, the financial sector, industrial logistics, and telecommunications. Long-term combat operations must rely on the uninterrupted support of the civilian rear, both through traditional funding mechanisms from the state budget, and through a broad volunteer movement, as the experience of the war in Ukraine shows. Therefore, the classical general

socioeconomic foresight is quite relevant as an auxiliary material for preparing an analysis of the state's defense capability.

As an example of a system for assessing defense capabilities, we will consider the elements of the NATO Defense Planning Process (NDPP). NDPP is a system of national defense and NATO defense plans alignment to ensure timely training and movement of forces and assets necessary to achieve the agreed security and defense objectives of the Strategic Concept. It determines NATO's current and future requirements of forces and assets, allocates them to each Ally as target indicators, and tracks the progress. According to the NATO Defense Planning Process (2021), the main directions of planning include air and missile defense; aviation planning; armaments; civil preparedness consultation, command and control; cyber defense; force planning; intelligence; logistics; medical; nuclear deterrence; resources; science and technology; and standardization and interoperability.

The NDPP methodology is regularly revised, in the 2016 edition the process is divided into a four-year cycle consisting of five stages, and planning periods are classified as short-term (0-6 years), medium-term (7-19 years) and long-term (20 years or more). The first stage, Establishing Political Guidance, assumes that the political leadership sets the overall goals and objectives for NATO and determines the number, scale, and nature of operations that the alliance should be able to conduct in the future, as well as the qualitative requirements and priorities associated with them. During the second phase, Requirements Determination, and NATO's Minimum Capability Requirements are determined every four years by the two strategic commands, Allied Command Operations, and Allied Command Transformation. The process of expert analysis is strictly regulated. The third phase, Targets Apportion, involves ACT Strategic Command developing fair minimum targets for all allies with assigned priorities and time frames. After a series of approvals, the proposals are sent to the North Atlantic Council for adoption, after which they are implemented into national defense plans. During the fourth stage (Implementation Facilitation), NATO provides support to the members of the alliance in meeting the established requirements as needed. We will separately consider the fifth stage, Results Review, since it gives a holistic view of the assessment of the country's defense capability according to NATO standards. First, NATO International Staff with support from the Strategic Commands prepares its analysis of the achieved targets in relation to the established political goals and plans of the Allies. The Defense Planning Capability Survey is conducted every two years to collect data on national political and military plans, the state of the armed forces, associated capabilities, defense spending, and R&D. A Suitability and Risk Assessment is also carried out, that is, a search for possible shortfalls in NATO plans or the current situation. After that, The Defense Policy and Planning Committee prepares the NATO Capability Report, which is approved by the North Atlantic Council and the ministers of defense of the allied countries.

The classical foresight methodology has the same origin as NDPP. According to the researchers, scenario modelling as one of the key components of foresight was first used in its modern form by Herman Kahn in the 1950s, when the researcher worked at the RAND Institute. The Delphi method also has a military origin. It was proposed in 1944 by the General of the US Air Force, Henry H. Arnold, to assess the impact of technological developments on changing the principles of warfare, and it was also further developed at the RAND Corporation in the 1950s. Therefore, it will not be an exaggeration to say that, historically, the primary purpose of foresight comes down to the analysis of defense capabilities. For example, its methodology naturally fits into the procedure of expert evaluation of the minimum requirements for the capabilities of the NATO armed forces, in particular, at the "Requirements Determination" stage of the NDPP. As in the classic socioeconomic foresight, during the research process,

NATO specialists analyze potential threats, develop various future scenarios, and determine the requirements for the military capabilities of allies for each scenario. To do this, they use a wide range of methods and tools, including modelling, simulation, expert surveys, and discussions with stakeholders. At the first stage of the NDPP, "Establishing Political Guidance", scenarios of intervention or non-intervention in certain political processes are developed with the help of expert assessments based on the long-term interests of the Alliance.

The foresight methodology is also widely used within the Defense Advanced Research Projects Agency (DARPA) to develop new technologies and projects that can give the US a strategic advantage. The agency strives to anticipate and implement technological breakthroughs. Foresight helps in identifying new areas of research and predicting the possible consequences of introducing new technologies. DARPA uses systematic and structured methods to predict and represent the future, including scenario modelling, horizon scanning, and the Delphi method (Safeguarding the Bioeconomy, 2020). For example, DARPA successfully used the foresight approach in creating the ARPANET project, the forerunner of the modern Internet. In this case, they predicted a future in which networks of computers could provide fundamentally new opportunities for information sharing and collaboration. As another example, DARPA has used the foresight approach to develop artificial intelligence programs, including projects on machine learning and autonomous systems (DARPA looks to predict future real-world events with AI, 2019). This provided the basis for modern AI technologies, which are now widely used in many fields. The agency also attracts interested communities to work in the field of security, bringing together the efforts of various stakeholders: academia, representatives of government and commercial organizations, and ordinary users (DARPA. Creating Technology Breakthroughs and New Capabilities For National Security, 2019).

Investment in the development of unmanned aerial vehicles (UAVs) since the 1960s, when the concept was not yet popular in US military circles, is also one of the results of DARPA's foresight methodology (TEAL RAIN, 2019). In the same period of time, in 1960, the first Soviet developments in this direction appeared in the Tupolev design bureau - the Tu-123 unmanned reconnaissance vehicle. In the post-Soviet space, in the absence of systematic and centralized work similar to DARPA approaches, promising developments are still most often carried out by individual research institutes. For example, in 2006, Kyiv Polytechnic Institute, in agreement with the State Border Guard Service of Ukraine, began developing an unmanned aerial system for the tasks of protecting the state border. The development plan of the Science Park "Kyivska Polytechnica" for 2007-2011, which provided for the design of a series of Ukrainian UAV's during 2008-2009, was approved by the decision of the Cabinet of Ministers of Ukraine No. 760-p of 19 September 2007. Unfortunately, in the course of many years of cooperation between scientists from the Kyiv Polytechnic Institute and the Department for the Development and Procurement of Arms and Military Equipment of the Ministry of Defense of Ukraine, this project and other promising developments for dual and special purposes were not brought to the implementation stage. After the start of the anti-terrorist operation in eastern Ukraine in 2014, the scale of the fighting made the critical need for the production of domestic UAV's obvious. In the autumn of 2014, the State Commission for Military-Technical Cooperation, during negotiations with stakeholders, including representatives of the Ministry of Defense and Ukrainian scientific institutions, organizations, and enterprises that developed UAV's, came to the conclusion that one of the main reasons for the impossibility of their implementation were overestimated operational and tactical requirements alongside with difficulties in developers' access to the documentation. After establishing coordination through the state concern Ukroboronprom, in 2015 it was reported that Ukraine had begun mass production of several UAV samples, including the Spectator unmanned aerial system developed at Kyiv Polytechnic

Institute (Unian.ua, 2015). However, when the full-scale Russian aggression started in 2022, the Ukrainian army had not reached an acceptable number of reconnaissance and strike UAVs of the operational and strategic level, and MAVs were practically not represented at the tactical level, which forced the Armed Forces of Ukraine to massively use civilian drones. This emphasizes the need to use the foresight methodology to predict and timely coordinate the development and implementation of relevant military technologies in the context of the continuous evolution of combat strategies.

An important aspect of foresight preparation in the field of defense, which distinguishes it from forecasting in civil spheres, is the disinformation factor. Disinformation can be spread in open sources, or it can be passed on to intelligence through double agents or disclosed technical channels of information leakage. One of the examples of such disinformation is the case when American intelligence agencies recruited specially trained Soviet double agents in 1986-1994 due to the betrayal of Ames Aldrich. Dozens of analytical reports, prepared by the CIA on the basis of the disinformation from double agents, were submitted to make major government decisions by three US presidents. By some estimates, this led to billions of dollars being spent on developing military technology to counter the likely non-existent Soviet analogues, and made it much more difficult to understand the processes that took place in the USSR before its collapse (Fischer, 2015). Therefore, when preparing a foresight in the field of defense, it is important not only to ensure cross-validation of information, but also to independently double-check all possible initial data.

5. Foresight as an active forecast

Consider the main aspects that are related to the differences between passive and active forecasting:

1. Active forecasts include an element of feedback. This means that forecasts not only convey information about the future, but can also change that future by influencing the actions of people or organizations.
2. As mentioned, active predictions can lead to self-fulfilling or self-discarding prophecies. This is when predictions change people's actions in such a way that either confirms the prediction (self-fulfilling) or leads to its non-fulfillment (self-discarding).
3. The level of confidence in the forecast can play an important role in its active or passive nature. If people are confident in the prognosis, they can take more action to maintain or prevent the outcome. If the prediction is uncertain, it may cause less change in behavior.
4. Active predictions can have significant ethical and social implications, especially if they affect the behavior of large numbers of people or key aspects of society. For example, forecasts of an economic crisis can cause panic in the markets, which in turn can lead to a real crisis.

As mentioned above, the classic foresight methodology, which includes scenario modeling, involves the further use of research results for management activities, meaning it is an active forecast that takes into account the impact on the audience for which the foresight is being prepared. Let us assume that as a result of foresight preparation a basic trend was revealed, then its results can be summarized in the form of the following set of conditional scenarios: optimistic scenario - decision-makers take into account foresight and adjust the policy, which accelerates development or leads to a change in negative trends, pessimistic scenario – decision-

makers do not take into account foresight and the trend remains relevant. However, if we are modeling a confrontational situation, then the foresight results can be accessed by a subject interested in lowering the accuracy of the forecast in order to reduce the adversary's defense capability. For example, having studied the results of a foresight about the greatest probability that the adversary will attack the country from the east, the same adversary will decide to attack from the north. Consider a public defensive foresight that is highly likely to be learned by the adversary as an example of an active forecast.

The research group of the World Data Center for Geoinformatics and Sustainable Development (WDC-Ukraine), drawing on the experience of DARPA and RAND in the field of foresight, applied this approach in 2021 to identify priority areas for the development of Ukraine's defense capability in order to prevent external aggression (Zgurovsky et al., 2021). In this case, the methodology, based on the principles of strategic planning, is designed to help the authorities and the defense industry of Ukraine better understand which technologies, policies, and trends can be most important for the defense of the country. The study included 9 stages:

1) selection of a group of experts
2) formulation of the purpose and time frame of the foresight
3) definition of sustainable (balanced) development of the military-industrial complex
4) formation of a "foresight glossary"
5) development and analysis of foresight indicators
6) system modeling (identifying trends and their interconnections)
7) suggesting innovations
8) building scenarios and strategies for the development of the national military-industrial complex
9) search for consensus in real conditions and the adoption of appropriate management decisions.

The study uses the Delphi method, SWOT analysis, scenario modeling, and strategy building methodology. It is assumed that the structure of the future military-industrial complex of Ukraine, consisting of separate clusters and their tactical and technical characteristics, will be based on a combination of technologies of the fifth and sixth technological modes. Thanks to this, according to experts, the military-industrial complex will be in demand and effective not only in the domestic arena, but also useful for the international collective security system, through which Ukraine will be able to ensure the implementation of its own military doctrine and national security strategy in the medium and long term. It should be noted that when preparing the foresight, the researchers proceeded from a number of pessimistic scenarios of changes in the international situation regarding Ukraine, in particular, the likelihood of a full-scale military aggression by the Russian Federation. As a result of the study, the following clusters were identified in order of priority, necessary for the asymmetric deterrence of external aggression until 2030:

1. Missile program of Ukraine, high-precision weapons, anti-ship missile systems
2. Systems of electronic warfare, electronic intelligence, cybersecurity systems, and air defense systems, the latest technical means for special operations forces
3. Unmanned aerial, land, and sea mobile vehicles (reconnaissance and strike drones and their clouds, strike drones with "smart" bombs, "kamikaze" drones, universal combat mobile robotic platforms and demining platforms controlled by artificial intelligence systems)
4. A unified automated system for managing the country's security, technologies for automating the control of troops and weapons, technologies for the Internet of things, and artificial intelligence tools

5. Space reconnaissance facilities (constellation of satellites for remote sensing of the earth with high resolution)
6. High-precision anti-tank defense systems, high-precision small arms, anti-sniper systems
7. Mosquito marine fleet, a set of high-speed and maneuverable small warships, torpedo, patrol, missile, and other small boats, hydroacoustic systems for protecting the sea areas of Ukraine
8. Moving armored vehicles for general use
9. Transport aircraft and attack helicopters
10. Production of gunpowder, modern explosives, ammunition, cartridges, mines, and shells, chemical components, and substances necessary for the creation of nuclear warheads.

It should be noted that this foresight was presented to a number of representatives of relevant state bodies, and also, as part of the policy of the World Data Centers system of the International Scientific Council, it was published in the public domain on the WDC-Ukraine website. Let us assume that the government of Ukraine can implement (Scenario A) or refuse to follow the recommendations of the foresight on the development of the military-industrial complex (Scenario B). In Table 1, we consider the influence of some hypothetical consequences of presenting this foresight on the assessment of the accuracy of the forecast.

**Table 1. Influence of hypothetical consequences on the assessment of the accuracy of the forecast.**

	Scenario A	Scenario B
The adversary does not have access to foresight materials (conditionally passive forecast)	The adversary will not detect changes in the development of the military-industrial complex or will detect them through other channels too late to make adjustments to the plans for the preparation of aggression, which will maintain the accuracy of the forecast	Measures to prevent aggression will not be implemented, which corresponds to a pessimistic forecast scenario, but makes it difficult to assess the accuracy of the optimistic scenario
The adversary knows the foresight materials (active forecast)	The adversary will take measures to redistribute forces and means in preparation for aggression, which will reduce the accuracy of the forecast	If the adversary does not verify the information received through other channels, they will take measures to prepare for aggression based on unreliable information about the preparation of defense, which will increase the defense capability of Ukraine, thus, the foresight will act as a tool for disinformation of the adversary

Note: Own research

In this foresight, the following feature is also indicative: mentioning the need for Ukraine to create its own nuclear weapons increases the likelihood of discovering these materials in the public domain, and can also be considered a provocation. It is known that the possession of nuclear weapons is a deterrent, but the process of preparing for its creation, on the contrary, causes destabilization in international relations, like, for example, the Iranian nuclear program. Thus, immediately before the start of a full-scale aggression, representatives of the leadership of the Russian Federation repeatedly called plans to return the nuclear status of Ukraine "impossible not to react to" (Erman, 2022), and open sources such as foresight can be speculatively interpreted as confirmation of the existence of such plans. Since intelligence activities regarding the defense plans of opponents are rational and expected practices in most international conflicts, it is advisable not only to take into account the risks from the disclosure

or possible leakage of foresight, but also the possibility of deliberately preparing a false foresight to mislead the adversary.

In the 1960s, the Soviet scientist Vladimir Lefebvre coined the term "reflexive control" - the transfer of such information to the adversary, on the basis of which they will make the decision necessary for the manipulator. Analogues of this concept in the Western scientific tradition are perception management, deterrence theory, certain approaches to strategic communications, and some sections of game theory, although the idea of manipulating the adversary is inseparable from the entire history of military art. The theory of reflexive control offers the concept of "ranks", that is, the level of depth of manipulation and understanding of the adversary. An example of reflexive control of the first rank is an open declaration of readiness to use nuclear weapons or a test launch of a ballistic missile (clear threat), which can be suspected of being a bluff. An example of reflexive control of the second rank is the conduct of an operational combination, as a result of which adversary reconnaissance should come to the conclusion that covert preparations are underway for the use of nuclear weapons (pseudo-covert threat). A number of researchers through mathematical modelling came to the conclusion that, for sustainable information operations, the second rank is the maximum rank of reflexive control. Thus, within the framework of this theory, the active forecast model is an example of second-rank reflexive control technology: knowing that the object of influence is studying all available materials about the adversary's military-industrial complex, the subject can compose a false forecast about the development of their military-industrial complex, which will mislead the object's intelligence. Disinformation about defense capability is an integral element of the preparation and the armed confrontation between states itself; however, active forecasts (judgments about the future) have a number of properties that distinguish this technology from strategic deception about the current situation. The classic doctrine of "fluidity" in combat can be summarized in some simple examples: "Appear weak when you are strong, and strong when you are weak" or "pretend not to expect a blow where it will be struck - pretend to expect strike where it will not be struck". However, with the development of space and electronic intelligence, it becomes almost impossible to hide large military formations, so the bulk of military disinformation is shifting to areas that are more difficult to verify. By inverting the principles of SWOT analysis, we get a diagram of generalized directions of deception in the field of defense capability (Figure 1).

Figure 1. Generalized directions of deception in the field of defense capability
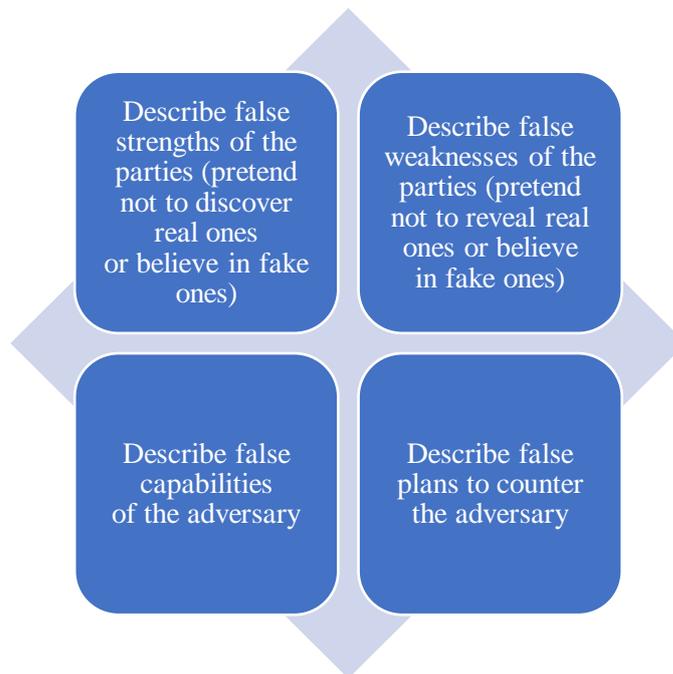
Note: Own research

To increase the credibility, a false foresight can be accompanied by demonstration and camouflage activities. Let us look at some historical examples of active defense predictions that were disinformation.

During the Greco-Persian War in 480 BC, shortly before the Persians entered the territory of Attica, the Athenians sent envoys to Delphi to ask the oracle about further events. The prophecies turned out to be gloomy and foreshadowed imminent death. However, the Athenian strategist Themistocles was able to freely interpret the vague wording of the prophecy, which convinced the Athenian people's assembly that in fact it was about a victory over the Persians and the mobilization of the entire male population, the evacuation of civilians, and some other emergency measures were necessary. In the same year, Themistocles implemented one of the most famous examples of disinformation in history, passing under the guise of a leak from a defector to the Persian king Xerxes a prediction that the Hellenes were going to flee, because they were in alarm at the absence of a ground force and were vulnerable in their current position. In fact, Themistocles was sure of the opposite, and with this active forecast he forced the battle of Salamis on the Persian army, in which the Greeks won, using the advantage of narrow straits. This is an example of describing the false weakness of a party to a conflict.

On May 14, 1941, Adolf Hitler wrote a personal letter to Joseph Stalin, in which he described his point of view on the future development of the conflict in Europe. He claimed that the UK planned to expand its military operations and draw "the whole world into war", apparently referring to the US. Hitler explained the deployment of 80 divisions on the borders of the USSR precisely by the need for covert preparations for the invasion of England, while recognizing that some German generals sought to frustrate his plans, and for this they could go on a "provocation" by attacking Soviet troops. In the letter, he asked Stalin to avoid responding to these provocations and even indicated the approximate date - June 15-20, 1941, when they were expected. There is a lot of historical evidence that Stalin believed this obviously false forecast and until June 22 gave instructions to refrain from reacting to the "provocations" of the German troops, and he regarded the reports of Soviet intelligence about the preparation of the

Wehrmacht invasion as British disinformation and even directly referred to the Fuhrer's statements in communication with Marshal Georgy Zhukov (Utkin, 2008). Hitler's letters can be considered an example of communicating false plans to counter the adversary.

There is evidence that in 1964, agents of the KGB and the Czechoslovak State Security (StB), through several channels, including a recruited one of the Indonesian ambassadors to Europe, passed to President Sukarno fake intelligence and false documents about the plans of the CIA (Bittman, 1985). In particular, one of the fake intercepts of British diplomatic correspondence spoke of a fictitious plan by the UK and the US to invade Indonesia via Malaysia. Another forgery claimed that the CIA was plotting to assassinate the President of Indonesia. The KGB and the StB succeeded in making Sukarno paranoid, and he began to make public statements highly critical of the US. Journalists working for the Soviet intelligence services used Sukarno's statements to exacerbate public sentiment in Indonesia, to the point of attacking US buildings in Jakarta. As a result, American influence in the country was significantly undermined, which was a direct result of the disinformation campaign by Soviet intelligence. This is an example of a false active prediction about the capabilities of the adversary.

Consider a situation where misinformation is a false active prediction. It is known that although the US intelligence community has provided an unprecedented number of accurate warnings about plans for a full-scale Russian invasion in 2022, many military experts were skeptical about Ukraine's prospects for repelling aggression. As Fox News reported, in early February 2022, the Chief of the US General Staff, General Mark Milley, said at a congressional briefing that a full-scale Russian invasion of Ukraine could lead to the fall of Kyiv within 72 hours, to the death of 15,000 Ukrainian troops and 4,000 Russian troops (Heinrich & Sabes, 2022). According to The Daily Beast, most of the CIA, Pentagon, and the White House officials also expected a quick capture of Ukraine, and after they were convinced otherwise, checks were carried out as to the reasons for such a significant misjudgment of the entire intelligence community (Brodsky, 2022). It is also clear that Russian officials have carefully studied the opinion of Western military experts regarding the prospects for such a conflict, and even in 2023 continue to refer to them as an authoritative opinion (TASS, 2023). Therefore, there is reason to believe that these pessimistic forecasts for Ukraine were one of the important factors that influenced the confidence of the Russian leadership in their own forces in preparing for a full-scale aggression. This is an example of a false active prediction about the opponent's strong side.

Thus, defense forecasts have been actively exploited to mislead the adversary throughout the history of mankind. On the one hand, preparing a reliable foresight is a time-consuming task, while a convincing false foresight requires even more resources and efforts. Also, if disinformation is exposed, the reputational risks for the organization or individuals involved in the preparation of the foresight can be devastating, which can cause disorientation among different target audiences. On the other hand, awareness of the importance of reflexive management and the obvious advantage in the persuasiveness of foresight compared to individual forecasts can justify the cost of preparing this kind of strategic disinformation.

One of the difficult matters for public administration, while facing the threat of an international conflict or going through it, is the search for a compromise for its settlement. It can be assumed that, due to the intensity of public opinion, neither open nor informal negotiations may be acceptable. In this case, the forecasts of reputable public or private organizations can be a tool for the tacit exchange of information. If we use the terminology of game theory, then, in a situation where there are more than one equilibria (paths of compromise conflict resolution), it is with the help of foresight as an active forecast that information can be transmitted about the

"focal point", that is, the equilibrium chosen by one side. Highlighting one of several equal options in the forecast greatly increases the likelihood that the second player will make a similar choice (Schelling, 1960).

6. Conclusions

In the course of the study, it was confirmed that foresight plays a significant role in strengthening the defense capability. This methodology provides a systematic analysis of the situation and possible scenarios for its development, which is critical for making strategic decisions at the state level. At the same time, the use of foresight in the field of defense is a unique challenge, since it requires taking into account the disinformation factor. This somewhat distinguishes it from forecasting for civil tasks and emphasizes the need for cross-validation of information and self-checking of all possible initial data.

Most often, foresight is a special case of active forecasting, which includes an element of feedback, so they can lead to self-fulfilling or self-discarding prophecies. This emphasizes the importance of taking into account the consequences of foresight in its preparation. Foresight as an active forecast is not just an auxiliary element of managerial activity, but also, to a certain extent, the very managerial act aimed at adjusting state policy, including the development and implementation of relevant military technologies and defense strategies.

In a confrontational international environment, there are two options for using foresight: open and classified. In the classified version, only the customer is provided with an access to the forecast, and when the results are published in an open form, one should expect them to be studied by the adversary. Thus, it is necessary to take into account the likelihood that the adversary, based on the data received, can correct their military plans. This probability can be used to mislead the adversary, although the preparation of a false foresight may not be rational in terms of the required effort and resources. In addition, open foresight can be used as an instrument of informal diplomacy in conditions where, for various reasons, direct negotiations are impossible.

Thus, foresight and active forecasting are powerful tools that can significantly improve the defense capability of the state, providing a strategic advantage in the complex and rapidly changing environment of the modern world.

References:

Barma, N.H., Durbin, B., Lorber, E. and Whitlark, R.E. (2016). Imagine a World in Which: Using Scenarios in Political Science. International Studies Perspectives, 17(2): 117-135.

Barry, B., Barrie, D., Béraud-Sudreau, L., Boyd, H., Childs, N. and Giegerich, B. (2019) Defending Europe: scenario-based capability requirements for NATO's European members. IISS Report, 10th May 2019. Available from: https://www.iiss.org/blogs/research-paper/2019/05/defending-europe

Bence, N., Dew, N. and Augier, M. Understanding some pitfalls in the strategic foresight processes: The case of the Hungarian Ministry of Defense, Futures, Volume 101, 2018, pp. 92-102, Available from: https://doi.org/10.1016/j.futures.2018.06.014.

Bittman, L. (1985). The KGB and Soviet Disinformation: An Insider's View. Washington D.C. Pergamon Press. 216 p.

Brodsky, S. This Is How the U.S. Totally Misjudged the War in Ukraine. Daily Beast. 28 Nov 2022. Available from: https://www.thedailybeast.com/this-is-how-the-us-totally-misjudged-the-war-in-ukraine?ref=home

Burhan, M. and Cakir, S. (2021). Impact assessment of Vision 2023 defense technology foresight, Foresight, Vol. 23 No. 3, pp. 367-383. Available from: https://doi.org/10.1108/FS-05-2020-0049

Correa, C.R. and Cagnin, C.H. (2016). Prospective games for defence strategic decisions in Brazil, Foresight, Vol. 18 No. 1, pp. 4-23. Available from: https://doi.org/10.1108/FS-07-2014-0047

DARPA looks to predict future real-world events with AI. (2019) Available from: https://sociable.co/technology/darpa-predict-future-ai/

DARPA. Creating Technology Breakthroughs and New Capabilities for National Security (2019). Available from: https://www.darpa.mil/attachments/DARPA-2019-framework.pdf

Erman. Может ли Украина вернуть себе ядерное оружие? И во что это ей обойдется? BBC News. Русская служба. 22 февраля 2022 года. Available from: https://www.bbc.com/russian/features-60483270

Fischer, B.B. (2015). Doubles Troubles: The CIA and Double Agents during the Cold War. International Journal of Intelligence and CounterIntelligence, 29(1), 48-74. https://doi.org/10.1080/08850607.2015.1083313

Friedrich-Ebert-Stiftung (2014) The EU and the East in 2030: Four Scenarios for Relations between the EU, the Russian Federation, and the Common Neighbourhood. Berlin: FES. Available from: https://library.fes.de/pdf-files/id-moe/11088.pdf

Fučík J., Kolkus J., Melichar J. and Procházka J. (2017). Military technology evolution assessment under growing uncertainty and complexity: Methodological framework for alternative futures, 017 International Conference on Military Technologies (ICMT), Brno, Czech Republic, pp. 682-689, Available from: doi: 10.1109/MILTECHS.2017.7988844.

Heinrich, J., Sabes, A. (2022). Gen. Milley says Kyiv could fall within 72 hours if Russia decides to invade Ukraine: sources. Fox News. Available from: https://www.foxnews.com/us/gen-milley-says-kyiv-could-fall-within-72-hours-if-russia-decides-to-invade-ukraine-sources.

NATO Defence Planning Process. Available from: https://www.nato.int/cps/en/natohq/topics_49202.htm

Safeguarding the Bioeconomy. Washington (DC): National Academies Press (US); 2020 Jan 14. 6, Horizon scanning and foresight methods. Available from: https://www.ncbi.nlm.nih.gov/books/NBK556423/

Schelling, T. (1960). The Strategy of Conflict. Cambridge: Harvard University Press, 1960. – p. 328

Sus, M. and Hadeed, M. (eds.) (2019) European Security 2030: The Results of the Dahrendorf Foresight Project. Available from: https://www.dahrendorf-forum.eu/wp-content/uploads/2019/09/Dahrendorf-Foresight-Report.pdf.

TASS. Russian news agency. Lavrov lauds US general's remark on Ukraine as first step toward understanding reality. 28 May 2023. Available from: https://tass.com/politics/1624029

TEAL RAIN. (2019) Available from: https://www.globalsecurity.org/intell/systems/teal-rain.htm

Unian.ua "Укроборонпром" поставить армії безпілотник Spectator, розроблений студентами КПІ. УНІАН. 28 грудня 2015 року. Available from: https://www.unian.ua/society/1224842-ukroboronprom-postavit-armiji-bezpilotnik-spectator-rozrobleniy-studentami-kpi-foto.html

Utkin (2008). Письмо Сталину. О чем писал Адольф Гитлер советскому вождю накануне вторжения. Российская газета. Available from: https://rg.ru/2008/06/20/stalin-gitler.html

Vicente Oliva, S. and Martinez-Sanchez, A. (2018). Technology roadmapping in security and defence foresight, Foresight, Vol. 20 No. 6, pp. 635-647. Available from: https://doi.org/10.1108/FS-12-2017-0074

Vishnev, S.M. (1977). Fundamentals of Complex Forecasting. Moscow, Nauka. 289 p.

Zgurovsky, M.Z. (2002). Scenarious analysis as system methodology of prevision System Research & Information Technologies, 1. p. 9 Available from: http://journal.iasa.kpi.ua/article/view/176641/176437

Zgurovsky, M.Z. et al., (2021). Форсайт розвитку оборонно-промислового комплексу України на часовому горизонті 2021–2030 роки. Київ: КПІ ім. Ігоря Сікорського, Вид-во «Політехніка», 148 с. Available from: http://wdc.org.ua/sites/default/files/KPI-WDC-IADT_FORESIGHT-2021-UA.pdf