# Research on the Value Creation Process of Investments in Defense Innovations

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**ABSTRACT**

Changes in the European security environment after 2022 have reinforced the need to view defense innovation not only as the creation of technological solutions, but also as a coherent process of investment, institutional coordination, testing, and practical application. This topic is relevant due to growing defense funding, an increasingly active defense technology sector, and the need to ensure that investments in innovation generate real operational, strategic, and economic value. The research problem arises because, in emerging defense innovation ecosystems, the stages of funding, technology development, testing, validation, and practical application are not yet sufficiently integrated into a cohesive value creation process. Due to institutional fragmentation, insufficiently clear end-user involvement, and a limited transition from prototype to pilot procurement, some innovations risk failing to overcome the "valley of death" and failing to achieve actual use in the defense system. The aim of the study was to provide recommendations for improving the value creation process of investments in defense innovation within the defense innovation ecosystem and to develop a conceptual management model of this process for the defense industry sector. The main objectives of the study were to analyze the scientific literature on innovation management, value creation processes, and the specifics of defense innovation ecosystems; to assess the structure of the value creation process for investments in defense innovation, determine its main stages, and identify key problem areas that affect investment effectiveness and the practical application of innovations; to present a conceptual model for managing the value creation process of investments in defense innovation and directions for its application. To achieve the research objective, methods such as scientific literature analysis, process analysis, expert assessment, in-depth interviews, and comparative analysis were employed, enabling the integration of theoretical insights with practical expert evaluation. The research results showed that the defense innovation ecosystem is characterized by growing activity, but the value creation process for investments in defense innovation remains fragmented: the stages of funding, testing, validation, end-user involvement, and procurement are not sufficiently integrated into a coherent chain. Data from the expert study revealed that the greatest problem areas arise during the transition from prototype to practical application; therefore, it is necessary to strengthen institutional coordination, pilot procurement mechanisms, testing infrastructure, and funding continuity at TRL stages 6–9.

**Keywords:** value creation, value creation process, innovation, innovation process, defense innovations.

## 1 Introduction

Changes in the European security environment following Russia's 2022 aggression against Ukraine have revealed that defense capabilities depend not only on the size of the budget or the quantity of armaments, but also on institutional capacity to rapidly develop, fund, and implement innovations (European Commission, 2026). Lithuania's response to the changed security environment is manifested in the strengthening of defense and security industry policy, growing defense funding, and increased activity in the defense technology sector (Kazlauskas & Mankevičienė, 2026; NATO, 2025). The European Defence

Fund, the NATO Innovation Fund (NIF), and the Defence Innovation Accelerator for the North Atlantic (DIANA) provide additional opportunities for funding, acceleration, testing, and technology development for participants in the defence innovation ecosystem (Ministry of Economy and Innovation, 2024; NATO, 2025). However, legal changes and financial resources alone do not guarantee that investments in defense innovation will be effectively converted into strategic, military, or economic value. Researchers analyze the creation of innovation value as a process inseparable from institutional maturity: coordinated funding mechanisms, a clear distribution of responsibilities, and the ability to manage the transition of innovations between development stages (Chesbrough, 2024; Tidd & Bessant, 2021). In the defense context, the so-called "valley of death" problem is particularly relevant—a structural gap between early-stage innovation development and its transition to practical military application. In more recent studies, this problem is linked not only to a lack of funding but also to the ability of defense institutions to ensure the transition of innovations from the prototype stage to deployment, testing, procurement, and actual use within military structures (Giesener & Mayer, 2023; Defense Innovation Board, 2023). Lithuania offers an opportunity to study the value creation process of defense innovation in a context where institutional mechanisms are still taking shape, and financial resources are growing faster than the ability to integrate them in a coordinated manner into a coherent innovation management process. Furthermore, the innovation pathway—from idea to product and its military application—remains undefined and structurally unsecured.

Research Problem. State institutions, the military, scientific organizations, the private sector, and investors are increasingly active participants in Lithuania's defense innovation ecosystem; however, these actors operate on different planning cycles (budgetary, capability planning, R&D, product development, and return on investment), decision-making speed, and performance criteria—administrative efficiency, operational applicability, scientific novelty, and commercial potential (Kazlauskas & Mankevičienė, 2026; Civitta, 2024). This creates a risk that the stages of technology development, testing, financing, and practical application are not sufficiently integrated into a cohesive value creation process.

Analytical sources indicate that measures to promote defense innovation in Lithuania often remain limited in scope and short-term, and some of the prototypes developed fail to overcome the "valley of death" between TPL levels 6–9 and do not reach the stage of mass production or practical use (Kazlauskas & Mankevičienė, 2026; Civitta, 2024). Therefore, the study raises the following question: how should the process of investing in defense innovation in Lithuania be organized so that funding is linked to the identification of military needs, technology development, testing, validation, and practical application within the defense system, ensuring consistent value creation.

Research Object. The value creation process of investments in defense innovation within the Lithuanian defense innovation ecosystem.

The subject of this study was the value creation process of investments in defense innovation within the defense innovation ecosystem. The objective of the study was to provide recommendations for improving the value creation process of investments in defense innovation within the defense innovation ecosystem and to develop a conceptual management model for this process in the defense industry sector. The main research tasks were to analyze the scientific literature on innovation management and value creation processes in the defense industry sector; to assess the structure of the value creation process for investments in defense innovation and identify the main problem areas; to present a conceptual management model for the value creation process of investments in defense innovation. To achieve the research objective, the following research methods were applied: analysis of scientific literature, process analysis, expert assessment, in-depth interviews, and comparative analysis.

## 2 Literature Review

Innovation management is described in the scientific literature as a sequential process in which an idea is transformed into value beneficial to the consumer or society through funding, development, and commercialization (Tidd & Bessant, 2021; European Commission, 2026). Contemporary research emphasizes that effective innovation management cannot be confined within a single organization—it is based on the logic of open innovation, in which flows of knowledge and technology cross organizational boundaries (Chesbrough, 2024; Bogers, Chesbrough, Heaton, & Teece, 2019). This approach implies that innovation value is created not within a single project, but through the interaction of different ecosystem participants—research institutions, companies, the government, and end-users— . This nature of interaction poses a fundamental management challenge: value becomes a real benefit only when it is not only created (value creation) but also captured (value capture) and implemented in practice (Majchrzak et al., 2023). It is precisely in this chain—from idea to actual implementation—that most structural gaps arise. The stages of innovation development proceed at different speeds, are funded by different entities, and responsibility for the transition between stages often remains unclear. Recent studies emphasize that it is a lack of coordination, rather than a lack of resources, that most often determines the failure of innovation development in complex ecosystems (Holgersson, Dahlander, Chesbrough, & Bogers, 2024). In the defense sector, these challenges are even more pronounced. The innovation journey does not end with commercialization—it continues through testing, certification, integration into military capabilities, and operational deployment. Value is measured not only in economic terms but also in terms of strategic and operational capability (Csernatoni, 2024). Therefore, the logic of innovation management becomes inseparable from the ability of defense institutions to ensure continuity throughout the entire cycle, from idea to implementation.

Value creation in the context of innovation has traditionally been analyzed from the perspective of the value chain, in which different parts of value are created at different stages of the process, while structural gaps between stages reduce it (Porter, 1985). This foundational model remains analytically useful, but contemporary researchers emphasize that in innovation ecosystems, value is no longer created in a linear manner but rather in a networked way—through the coordinated interaction of many participants (Adner, 2017; Majchrzak et al., 2023). This means that the effectiveness of the value creation process is determined not by the efficiency of individual stages, but by the alignment of participants in terms of funding, priorities, and timing. In the defense context, this logic takes on an additional dimension. Value in defense innovation manifests itself at three levels: (1) economic—job creation, export revenue, and added value; (2) strategic—strengthening industrial capacity and technological sovereignty; (3) operational—innovation is integrated into the actual military system and used in operations (Csernatoni, 2024; Fiott, 2023). These three forms of value cannot be separated: technology that does not reach operational use creates neither strategic nor long-term economic value, even if its development is funded. A recent McKinsey (2025) analysis notes that the maturation cycle of critical defense technologies suffers systemic losses when ecosystem participants act in an uncoordinated manner—this confirms that institutional coordination is no less important than technological readiness. In the Lithuanian context, this issue is particularly relevant. The growing defense budget and the emerging defense technology sector create a significant supply of innovation, but the realization of value depends on whether these resources are transformed into a coordinated value creation process. This naturally leads to a fundamental challenge in defense innovation management—the structural gap between technology development and its military application, known in the literature as the "valley of death" phenomenon.

The "valley of death" is a fundamental problem in defense innovation management, first conceptualized by Auerswald and Branscomb (2003) as a structural gap between technology development and its commercial and practical application. The initial version of this concept focused primarily on the funding gap in the intermediate stage. However, recent research has significantly expanded this concept. Antón

(2022) and the U.S. Defense Innovation Board (2023) emphasize in their report "Terraforming the Valley of Death" that the problem stems not from an absolute lack of funds, but from the quality of their utilization: inflexible funding cycles, unclear mechanisms for transitioning between stages, and cultural and procedural barriers between innovators and military structures. This new interpretation is significant because it shifts the focus of analysis from the size of financial resources to the institutional capacity to use those resources in a coordinated manner. Recent studies by the RAND Corporation (Kotila et al., 2023) and an analysis by the Boston Consulting Group (Giesener & Mayer, 2023) note that countries that have successfully overcome the "valley of death" share three common characteristics: (1) clear end-user involvement from the early stages; (2) structured testing and validation infrastructure mechanisms; (3) clearly defined pathways from prototype to procurement. For small states, the "Valley of Death" problem is particularly acute due to limited domestic markets and smaller administrative capacities. However, small states also have an advantage—the speed of decision-making and closer ties between the state, the military, and the private sector, which are often lost in large bureaucracies. Lithuania's case is similar in nature—a small ecosystem, growing resources, and close ties with Ukraine—but the institutional capacity to transform these advantages into a systematic value-creation process remains uncertain. Overcoming the "Valley of Death" is no longer understood today as the solution to isolated problems—it is perceived as a matter of the entire coordination model of the innovation ecosystem. This leads to another theoretical layer—mechanisms at the NATO and EU levels that have been taking shape in recent years precisely as a response to this structural problem.

Following Russia's 2022 aggression against Ukraine, NATO and the EU began to more rapidly develop a multi-layered system for funding and coordinating defense innovation, focused on strengthening the process of innovation development, testing, and practical application. DIANA and the NATO Innovation Fund (NIF) are considered among the key elements of this system: DIANA provides access to a network of test centers and accelerators, while the NIF, with a portfolio valued at €1 billion and funded by 24 NATO member states, focuses on later-stage investments (NATO, 2025; Martín García, 2023). At the EU level, the EU Defence Innovation Scheme (EUDIS) and the Hub for EU Defence Innovation (HEDI), together with the European Defence Fund (EDF), form a multi-layered structure for funding and innovation development (Möhring, 2024). In the literature, these mechanisms are often analyzed as tools designed to mitigate the "valley of death" problem, as they aim to link early-stage innovation development with opportunities for testing, validation, and subsequent funding. However, recent studies show that the effectiveness of such instruments depends not only on their existence or the volume of financial resources, but also on the national-level capacity to ensure a coherent process of innovation development and integration (Martín García, 2023; Csernatoni, 2024). Since DIANA, NIF, or EUDIS function as complementary instruments for accelerating innovation, their practical value depends on whether the national ecosystem is capable of ensuring a continuous transition between the stages of innovation development, testing, financing, and practical application. For this reason, international mechanisms are more often viewed in the literature not as standalone solutions, but as instruments that complement national innovation systems. This principle is also relevant in the Lithuanian context. Lithuania is one of the 24 NATO Innovation Fund partner countries, and the DIANA regional center in Tallinn, opened in Estonia in May 2024, has become the closest hub of this accelerator for innovators in the Baltic region (NATO, 2024). At the national level, a tripartite agreement was signed in 2024 between the Innovation Agency, the Lithuanian Armed Forces, and the Defense Resources Agency, initiated by the Ministries of Economy and Innovation and National Defense. Based on this agreement, the Lithuanian Defense Innovation Competence Center "Miltech Lab" was established within the Innovation Agency, and the subsidy measure "Defense Innovation Vouchers" was launched (Ministry of National Defense, 2024; Ministry of Economy and Innovation, 2024). Nevertheless, the scientific literature emphasizes that the existence of individual initiatives does not in itself ensure a consistent flow of innovation throughout the entire value chain; therefore, their mutual interaction and the effectiveness of institutional coordination remain a relevant

empirical question. In summary, it can be stated that the scientific literature analyzes the value creation of investments in defense innovation not as an automatic result of funding, but as a complex process of institutional coordination. The literature emphasizes that the value of innovation can be realized when mechanisms exist that ensure a seamless transition from idea development to operational application, while integrating the economic, strategic, and operational dimensions of value. The expansion of the "Valley of Death" concept and the evolution of NATO and EU defense innovation mechanisms indicate that one of the most significant contemporary challenges is not only the availability of financial resources but also national institutional capacity to manage the innovation development process in a coordinated manner.

## 3 Research Methodology

This study employs a qualitative research methodology to analyze the value creation process of investments in defense innovation in the Lithuanian context. This methodological choice is based on the nature of the research subject—the development of defense innovation involves multi-level institutional processes involving government agencies, the military, scientific organizations, investors, and the private sector. For this reason, the study aims to analyze not the volume of investments, but how investments are transformed into economic, strategic, and operational value. To this end, it is important to assess not only formal processes but also practical experiences in coordination, decision-making, and innovation development. The analytical framework of the study is based on the aspects of innovation management, value creation, and the "Valley of Death" discussed in the theoretical section. Taking into account the main problems identified in the theoretical section, the study analyzes three interrelated dimensions: the consistency of the innovation management cycle, value realization mechanisms, and "Valley of Death" management. The first dimension focuses on whether there is a coherent transition between the different stages of innovation development in Lithuania's defense innovation ecosystem—from idea generation to testing and practical application. The second dimension relates to the creation and realization of economic, strategic, and operational value in the defense sector. The third dimension focuses on structural barriers hindering the transition of innovations between the stages of technological development and practical military application. The study employs an analysis of the scientific literature, process analysis, expert assessment, and comparative analysis. First, an analysis of the scientific literature is conducted, which allows for the identification of the main problems in defense innovation development, investment management, and value creation, as well as the formation of the study's theoretical foundation. This is followed by a process analysis, during which the main stages of the value creation process for investments in defense innovation in the Lithuanian context are identified: innovation initiation, technological maturity development, testing, end-user integration, practical application, and value realization. The analysis of these stages allows for the identification of key coordination barriers and structural gaps between the parts of the process. The empirical study is conducted using the semi-structured in-depth interview method. This method was chosen to gather practical insights from participants in Lithuania's defense innovation ecosystem regarding investment, innovation development, and institutional coordination processes. Experts are selected using purposive sampling. The selection criterion is direct professional experience in the fields of innovation management, investment, defense technology development, military capability planning, or innovation policy. The 20 experts who participated in the study were selected through purposive sampling, including representatives from government institutions, the Lithuanian Armed Forces, the defense technology industry, innovation and funding organizations, venture capital, the scientific community, and the dual-use technology sector who possess direct experience in the processes of defense innovation development, funding, testing, validation, procurement, or practical application. The sample size is based on the principle of thematic saturation (Guest, Namey, & Chen, 2020), where additional interviews no longer reveal new significant themes, and sufficient representation is ensured by proportionally representing all segments of the quadruple helix. Respondents are segmented according to the quadruple helix model of innovation ecosystems, encompassing government agencies, the military as the end-user, the defense industry and investors, and the academic community. This segmentation allows for the integration of perspectives on

administrative efficiency, operational adaptability, commercial potential, and scientific novelty. The selection process aims to strike a balance among these segments, ensuring a comprehensive analysis of the value creation process. The interview questionnaire consisted of four thematic blocks corresponding to the analytical dimensions of the study and allowing for a systematic assessment of the value creation process of investments in defense innovation. The questions were formulated so that experts could assess the state of the defense innovation ecosystem, the progress of innovation development and funding, the "valley of death" issue, and possible directions for process improvement. The first block of questions was dedicated to the assessment of the defense innovation ecosystem. The experts were asked: how they assess the current Lithuanian defense innovation ecosystem; what they see as the main strengths and weaknesses of this ecosystem; and how they assess cooperation between government institutions, the military, scientific organizations, and the private sector. The second set of questions focused on the innovation development and investment process. The experts were asked at which stages of innovation development the most problems arise in Lithuania; how they assess the continuity of funding as projects move from concept to practical application; and whether there is a clear process in Lithuania that allows innovations to progress from prototype to actual use. The third set of questions focused on the "valley of death" issue. Experts were asked whether the "valley of death" problem exists in Lithuania's defense innovation system and where it is most pronounced; how they assess the opportunities for testing, piloting, and validating innovations in Lithuania; and whether end-users, such as the military and operational units, are sufficiently involved in the innovation development process. The fourth set of questions focused on opportunities for process improvement. Experts were asked what mechanisms or capabilities the Lithuanian defense innovation ecosystem currently lacks the most; which NATO or EU practices Lithuania could most effectively adopt; and what, in their opinion, a more effective management process for investments in defense innovation in Lithuania should look like. Before the interviews began, the experts were briefed on the study's objective, with an explanation that the study aims to analyze the processes of defense innovation development, funding, testing, coordination, and practical application, as well as to identify key systemic problems and potential solutions for improvement. The experts were informed that the information they provided would be used solely for academic research purposes, and that in the final results, the data would be summarized and presented without disclosing specific individuals or sensitive information. The collected data is analyzed using thematic analysis according to the methodology of Braun and Clarke (2022). In the first stage of the analysis, deductive coding is applied, where experts' insights are grouped according to the analytical dimensions identified in the study. In the second stage, inductive coding is applied, allowing for the identification of additional themes and issues specific to the Lithuanian context that were not anticipated in the theoretical section. Additionally, a contextual comparison of Lithuania's defense innovation ecosystem with NATO and EU-level mechanisms (DIANA, NIF, EUDIS, HEDI) is conducted to identify potential directions for process improvement and best practices. The research results are integrated into a conceptual model for managing the value creation process of investments in defense innovation, focused on more effective institutional coordination and a more consistent transition of innovations from development to practical application.

## 4 Results and Discussion

An analysis of the scientific literature and a semi-structured expert study revealed that the value creation process for investments in defense innovation in Lithuania is rapidly evolving but remains fragmented and insufficiently integrated into a unified management system. The study analyzed the entire defense innovation value creation process—from identifying the need for innovation and developing the idea to financing, testing, validation, practical application, and value realization. In-depth interviews revealed experts' views on the strengths and problem areas of Lithuania's defense innovation ecosystem. Experts identified three main problems in the process: (1) insufficient coordination among institutions and a lack

of a clear center of responsibility, where different institutions operate through separate channels and not always in accordance with a common process logic; (2) an unclear innovation path from prototype to testing, pilot procurement, and practical use, particularly in TPL stages 6–9; and (3) limited end-user involvement, where the military's needs, feedback, and procurement plans are not linked early enough and consistently to innovation development.Expert assessment data indicate that the largest gap in value creation for investments in defense innovation occurs not in the early idea generation stage, but in the transition from prototype to actual application. Although there is a growing number of funding instruments, acceleration programs, testing initiatives, and institutional attention in Lithuania, experts emphasize that these measures do not always form a coherent chain. As a result, innovations may be funded and developed but fail to reach the stages of military validation, pilot procurement, commercialization, or export. These results suggest that the effectiveness of investments in defense innovation in Lithuania is determined primarily not by the volume of funding alone, but by the ability to manage the entire innovation pathway—from need to practical application—in a coordinated manner. The results of the expert study are presented in Table 1. They show that the main problems in the value creation process of investments in defense innovation in Lithuania are not related to the absence of individual measures, but to the failure to link them into a coherent chain. Critical problem areas emerge during the stages of needs formulation, testing, funding continuity, pilot procurement, and institutional coordination. This suggests that within Lithuania's defense innovation ecosystem, it is necessary to strengthen not only the volume of funding but also the management logic of the entire process—from military needs to practical application and value realization (Table 1).

**Table 1**: Summary of expert study results by stages of the value creation process for investments in defense innovation: identification of defense innovation needs and initiation of innovation (compiled by the authors)

| Process | Evaluation aspects | Results of the expert assessment |
|---|---|---|
| 1. Identification of the need for defense innovation | Formulation and Clarity of Military Requirements | All experts (20 out of 20; 100%) noted that the defense innovation process should begin with a clearly formulated need of the military or another end-user. Some experts (16 out of 20; 80%) emphasized that currently, needs are often presented through general priority areas, but these are not always sufficiently linked to functional requirements, acquisition plans, or practical usage scenarios. |
| | Early-stage end-user involvement | Most experts (19 out of 20; 95%) emphasized that the end-user must be involved not only at the end of testing, but already during the requirements, concept, and prototype development stages. Some experts (14 out of 20; 70%) noted that feedback from the military still often depends on the initiative of individual people rather than on a clearly institutionalized process. |
| 2. Initiating Innovation and Early-Stage Development | Funding for early TRL levels and idea selection | Most experts (15 out of 20; 75%) noted that early-stage funding instruments are increasing: innovation vouchers, acceleration initiatives, venture capital funds, hackathons, and other measures are in place. However, some experts (13 out of 20; 65%) noted that early-stage ideas are |

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| | | not always evaluated through the lens of actual military need, and that projects at low TRL levels lack a clear logic for selection, testing, and further development. |
| | Interaction between academia, business, and the military in the early stages | Some experts (12 out of 20; 60%) emphasized that academic institutions have the potential to participate in defense innovation, but their involvement is not yet sufficiently aligned with the military's needs. Several experts (8 out of 20; 40%) noted that the university incentive system is often focused on academic results rather than on product development, testing, or practical application. |

The results in Table 1 show that experts associate the start of the defense innovation process with a clearly defined end-user need. Although early-stage funding instruments are increasing, experts believe they are not always sufficiently linked to the military's actual needs, testing capabilities, and the path for further innovation development. This suggests that the most significant challenge at the start of the process is not merely a lack of ideas or funding, but rather a clearer formulation of needs and the early involvement of the end-user.

Table 2 below presents the results of the expert study related to funding continuity, testing, piloting, and validation.

**Table 2**: Results of the expert survey: funding continuity, testing, and validation (compiled by the authors)

| Process | Evaluation aspects | Results of the expert assessment |
|---|---|---|
| 3. Funding continuity | Adequacy and accessibility of funding instruments | Most experts (18 out of 20; 90%) noted that the number of funding instruments is increasing, but they do not always form a coherent chain. Some experts (14 out of 20; 70%) emphasized that the problem is not just the amount of money, but the ability to link funding to need, testing, pilot purchases, and final implementation. |
| | Transition from early-stage funding to the scale-up stage | All experts (20 out of 20; 100%) identified that the biggest gap arises when a prototype has already been developed but requires additional funding for production, certification, a pilot batch, commercialization, or export. Some experts (13 out of 20; 65%) noted that grants are no longer sufficient at this stage, while loans and venture capital become difficult to secure due to the uncertainty surrounding future purchases or the first customer. |

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| 4. Testing, Piloting, and Validation | Functioning of testing infrastructure and procedures | Most experts (18 out of 20; 90%) noted that testing opportunities are improving: test days are being organized, opportunities to use testing grounds are emerging, and institutions are becoming more open to business. However, some experts (15 out of 20; 75%) emphasized that the testing system is not yet sufficiently consistent, clearly communicated, or linked to the subsequent product development or procurement process. |
| | Using test results for further product development | Most experts (17 out of 20; 85%) emphasized that testing should not merely be a demonstration event, but a practical feedback mechanism. Some experts (14 out of 20; 70%) noted that companies need to receive clear information from the military or other users about what works, what doesn't, and what needs to be improved. |
| | Certification Opportunities | Several experts (9 out of 20; 45%) highlighted the issue of certification. In their view, there is a lack of a clear certification pathway or a national/regional certification infrastructure, which prolongs the time it takes for products to reach the market and be exported, and often forces companies to turn to foreign laboratories or institutes. |

The results in Table 2 reveal that funding instruments and testing opportunities exist, but they are not yet sufficiently integrated into a cohesive process of creating investment value. Experts particularly emphasized that testing should not be merely a demonstration phase, but a structured mechanism that provides feedback and a clear decision regarding further product development. These insights are directly related to the problem of transitioning a prototype to practical application, which is presented in more detail in Table 3.

**Table 3**: Results of the expert study: transition of the prototype to practical application and institutional coordination (compiled by the authors)

| Process | Evaluation aspects | Results of the expert evaluation |
|---|---|---|
| 5. Transition of the prototype to practical application | The "Valley of Death" problem at TRL stages 6–9 | All experts (20 out of 20; 100%) highlighted that the biggest gap arises when transitioning from the prototype to actual use. This problem is associated with the "Valley of Death" phenomenon: a prototype may be developed, but there is no clear path to testing, validation, pilot production, procurement, or export. Most experts (18 out of 20; 90%) emphasized that early-stage idea promotion is more effective than funding and |

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| | | practical application mechanisms for later TRL stages 6–9. |
| | Lack of a first customer and pilot batch | Most experts (17 out of 20; 85%) emphasized that the first customer or pilot procurement is particularly important for defense innovation. Without procurement by the national armed forces, a pilot batch, or at least clear validation, it is difficult for companies to attract capital, demonstrate product value, and export. Some experts (14 out of 20; 70%) suggested creating a separate financial instrument or budget line for the procurement of pilot batches. |
| 6. Institutional Coordination and Division of Responsibilities | Clarity of responsibilities among institutions | Most experts (19 out of 20; 95%) indicated that one of the main problems in the defense innovation ecosystem is institutional fragmentation. Many institutions operate within the system, but it is not always clear which institution is responsible for a specific stage of innovation development and who manages the entire process from need identification to procurement. |
| | The functioning of the "one-stop shop" principle | Some experts (11 out of 20; 55%) noted that the existence of multiple "one-stop shop" channels may increase rather than reduce confusion. It is not always clear to businesses where to turn, which channel is the primary one, and who coordinates the entire process. Some experts (10 out of 20; 50%) suggested having a single, clear external coordination point, while leaving coordination among institutions to internal management. |
| | The Need for Leadership and Strategic Management | Some experts (14 out of 20; 70%) emphasized that the ecosystem lacks clear leadership and a long-term strategic direction. Several experts (8 out of 20; 40%) noted that documents or measures alone do not guarantee results if there is no institutional mandate, clear allocation of responsibilities, and practical implementation. |

The results in Table 3 show that the critical point in the value creation process for investments in defense innovation is the transition from prototype to practical application. Experts associate this stage with the "valley of death" problem, which is exacerbated by the lack of an initial customer, pilot procurement, clear validation, and institutional coordination. This suggests that in the later stages of innovation development, not only additional funding is necessary, but also a clear process owner, accountability, and a decision-making mechanism.

Table 4 below presents the results of the expert survey related to the stages of procurement, commercialization, export, and value realization.

**Table 4**: Results of the expert survey: procurement, commercialization, export, and value realization (compiled by the authors)

| **Process** | **Evaluation aspects** | **Results of the expert assessment** |
|---|---|---|
| 7. Procurement and integration of innovations into capabilities | Linking innovations to procurement plans | Most experts (18 out of 20; 90%) emphasized that innovation funding must be linked to the military's actual needs, capability planning, and future procurements. Some experts (13 out of 20; 65%) stated that defense innovation is driven not only by grants or funds, but by actual orders and procurement signals. |
| | Application of Innovative and Pre-Commercial Procurement | Some experts (10 out of 20; 50%) noted that legal opportunities for innovative and pre-commercial procurement exist, but they are not fully utilized. Several experts (9 out of 20; 45%) noted that institutions often avoid risk, so they opt for safer, market-proven products. |
| 8. Commercialization, Export, and Value Realization | The path to product commercialization | Most experts (15 out of 20; 75%) noted that the defense innovation ecosystem lacks a clear path from prototype to commercialization. It is often not enough for companies to simply develop a technology—they need production capacity, a business plan, market understanding, certification, trade shows, sales channels, and initial sales. |
| | Conditions for Export and International Recognition | Some experts (12 out of 20; 60%) emphasized that approval by the national military or a trial purchase is particularly important for exports. It is important for foreign buyers to know whether the product has been tested, validated, or is in use by the national military ( ). If such approval is lacking, selling the product abroad becomes more difficult. |

The results in Table 4 reveal that realizing the value of defense innovations depends on the ability to link innovation development with procurement, commercialization, and export opportunities. Experts emphasized that an actual order or at least a trial purchase serves as an important signal to businesses, investors, and international markets alike. Therefore, the value of innovation should not be assessed solely based on the prototype created—what matters most is whether the solution achieves practical application, reaches the market, and generates operational, economic, or strategic benefits.

Table 5 below presents the main areas for improving the value creation process of investments in defense innovation identified by experts.

**Table 5**: Results of the expert study: areas for improvement in the value creation process for investments in defense innovation (compiled by the authors)

| Process | Evaluation aspects | Results of the expert assessment |
|---|---|---|
| 9. Areas for process improvement | Need for a coherent innovation development chain | All experts (20 out of 20; 100%) directly or indirectly suggested establishing a coherent chain from military needs to practical application: needs identification, early-stage funding, prototype development, testing, validation, pilot batch, procurement decision, scale-up, and export. |
| | Need for a Sandbox / Experimentation Space | Some experts (11 out of 20; 55%) recommended creating a MilTech sandbox or DIU-type mechanism where the military, business, academia, and funding institutions could come together. Such a space should serve not only as an administrative hub but also as a practical infrastructure for testing, experimentation, feedback, and solution selection. |
| | Pilot procurement and bridge financing mechanisms | Most experts (17 out of 20; 85%) emphasized that one of the most important areas for improvement is the mechanism for procuring pilot batches. This would allow a company to secure its first order, the military to test the product under real-world conditions, and investors to receive a clearer signal about the product's potential. Some experts (13 out of 20; 65%) also highlighted the need for bridge financing, which would facilitate the transition from prototype to production or wider deployment. |

The results in Table 5 show that the areas for improvement suggested by experts are focused not on the creation of individual measures, but on integrating the entire process. The most frequently emphasized points are the importance of a coherent innovation development chain, pilot procurement, bridge financing, and a space for experimentation. This underscores the need to develop a conceptual process management model in which investment, testing, end-user feedback, and procurement mechanisms are linked from the initial idea through to practical application and the market.

Expert assessments have shown that the value creation process for investments in defense innovation in Lithuania already has a solid foundation—political attention is being directed toward it, funding instruments are emerging, and the involvement of business and academia is growing. However, the process still lacks clearer leadership, a defined distribution of responsibilities, and more consistent coordination among institutions. There is also a continuing need to more clearly define the path from military need and technological solution to testing, funding, and practical implementation.

Expert insights suggest that investment measures alone are not sufficient. A clear chain is necessary for value creation: identification of needs, technology selection, practical testing, expert evaluation, funding, and integration of the solution into the defense system. Therefore, it is advisable for Lithuania to strengthen a defense innovation process model based on leadership, accountability, and cross-sectoral cooperation.

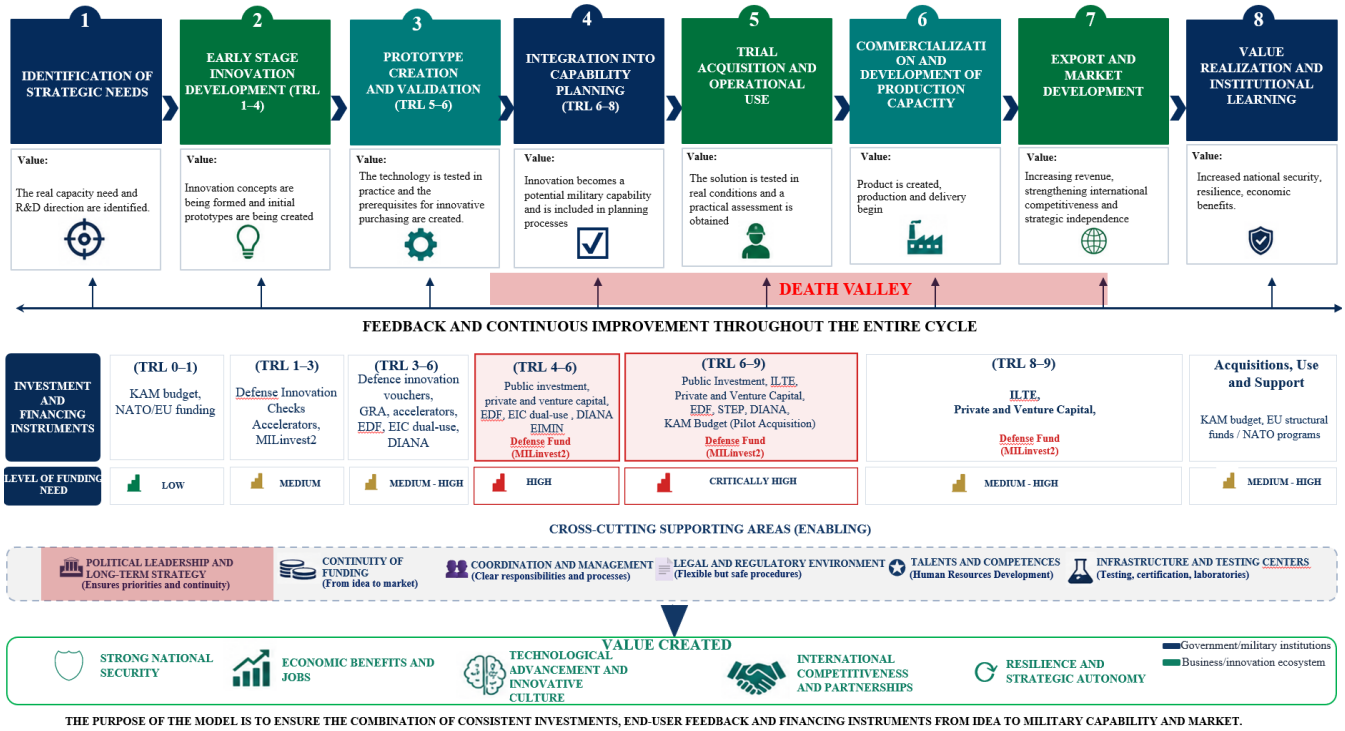


**Figure 1:** Conceptual model for improving the value creation process of investments in defense innovation (compiled by the authors)

The presented conceptual model of the value creation process for investments in defense innovation summarizes the main problem identified during the study—insufficient integration between individual process stages, funding instruments, end-user feedback, and practical application. The model demonstrates that investment value is created not in isolated stages, but in a sequential chain ranging from the identification of strategic needs to technology development, testing, pilot procurement, commercialization, export, and the realization of final strategic and operational value.

The study's results suggest that the critical point in the process is the transition from prototype development and validation to integration into capacity planning, pilot procurement, and operational use. This part of the model highlights the "valley of death" problem, where the technology is already sufficiently developed but does not yet have a clear path to testing, the first order, practical use, or wider implementation. Therefore, the model highlights the need for a " " to ensure feedback throughout the entire cycle, so that at each stage it can be assessed whether the innovation meets the end-user's needs and whether it is worth moving it to the next stage of the process.

The model also reveals that funding instruments must be aligned with levels of technological readiness and actual funding needs. In the early stages, innovation vouchers, accelerators, and R&D funding are most important, while in later stages, the acquisition of pilot batches, bridge financing, venture capital, the development of production capacity, and the promotion of exports take on the greatest significance. This logic helps mitigate the risk that innovations will be funded only up to the prototype stage but will not reach practical application or the market.

In summary, the conceptual model links the problem areas identified during the study with practical directions for process improvement. Its purpose is to ensure a coherent linkage of investment, end-user involvement, testing, financing, and procurement mechanisms from the idea stage through to military capability and the market. Such a model creates the conditions for increasing the effectiveness of the defense innovation ecosystem, reducing institutional fragmentation, and ensuring that investments in innovation generate not only technological prototypes but also operational, economic, and strategic value.

## 5 Conclusions

An analysis of the scientific literature has shown that the value created by investments in defense innovation cannot be assessed solely on the basis of the amount of funding or the number of prototypes developed. In the defense innovation sector, value is created when an innovation goes through the entire process—from identifying a need, through technological development and testing, to practical application, commercialization, and strategic benefits for the state. The key condition for value creation is not the volume of resources, but the institutional capacity to ensure a coordinated transition between the stages of this process. Therefore, it is proposed that investments in defense innovation be viewed as a coherent process in which it is important not only to fund ideas but also to ensure their transition to the stages of testing, validation, pilot procurement, and practical use, with a clear responsible entity and criteria for transition to the next stage defined at each stage.

The expert study revealed that the defense innovation ecosystem is developing rapidly but operates as a collection of separate initiatives. The main problem areas are insufficiently clear leadership and the distribution of institutional responsibilities, the formulation of military needs, the alignment of funding instruments with procurement plans, the testing and validation process, and the "valley of death" problem in TPL stages 6–9. These areas are not isolated problems—they constitute the interaction of three systemic gaps: structural (no institutional owner), procedural (insufficient linkage between military requirements, testing, and procurement), and financial (no transitional funding bridge). Therefore, it is proposed to address these gaps not separately, but systematically—through a single coordination model.

Based on the study's results, a conceptual model for managing the value creation process of investments in defense innovation has been developed, integrating eight stages of value creation, technology readiness levels (TRL), funding instruments, and a feedback loop. Based on the model, specific recommendations are proposed for each gap: for the structural gap—to consider creating a coordinated entity that would, under a single leadership, combine the needs of the armed forces, research, innovation acceleration, and export promotion; financial – allocate a fixed portion of the defense budget to R&D and pilot batches, and create defense innovation vouchers operating on a rolling basis, for which applications could be submitted year-round; Process-related – strengthen the MilTech sandbox-type testing infrastructure and the bridge financing mechanism, in which the Lithuanian Armed Forces would play a key role in formulating requirements, participating in testing, and providing continuous feedback. The value of the model lies in its ability to transform a fragmented ecosystem into a managed process, where investments consistently translate into strategic, economic, and operational benefits.

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