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Challenges and Commercialization Pathways for Startups in the Swedish Defence Industry

A descriptive case study on the defence landscape

Master's thesis in Quality and Operations Management

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Division of Supply and Operations Management**

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Abstract

The Swedish defence industry is undergoing change as a result of geopolitical uncertainty, increased defence spending and the NATO-membership. Additionally, ongoing conflicts such as Russia's invasion of Ukraine showcase the use of innovation and new tactics in modern warfare. The Swedish authorities have expressed the need for defence innovation and that startups play a crucial role in developing innovation. Despite this, startups face multiple challenges when attempting to commercialize in the defence industry. This thesis explores challenges related to five dimensions: value and customer need, funding, commercialization pathways, innovation and system integration, and regulation and permits. This is explored through a qualitative, descriptive case-study approach and by conducting interviews with startups, established organizations, authorities and other relevant stakeholders. Additionally, secondary data is gathered through a literature review which is used to explain and analyze the empirical data. The study suggests that adopting a dual-use strategy has the potential of addressing challenges related to all dimensions but may introduce regulatory complexity. Furthermore, four key methods of addressing the identified challenges are presented, namely: iterative stakeholder mapping, defining and narrowing the value proposition to signal value, validating the solution through different tests, and choosing a suitable commercialization path based on validation opportunity and access to complementary assets. Additionally, the authors propose that startups develop an early prototype to signal capability. Challenges related to funding, regulation and permits are not explored as extensively as the others. Nonetheless, the thesis suggests that startups should balance an ambitious narrative with realism as well as build early awareness regarding regulatory aspects and permits. The thesis contributes by providing an overview of the challenges that startups face and proposing methods to address the identified challenges.

Keywords: Defence, Innovation, Dual-Use, Commercialization, Startup, Swedish Defence Industry.

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Joakim Gustafsson & Victor Ingebrigtsen, Gothenburg, June 2026

List of Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

AI	Artificial intelligence
B2B	Business to business
B2G	Business to government
CE	Conformité Européenne
CEO	Chief executive officer
CMIP	Civil-Military Innovation Program
CVC	Corporate venture capital
DIANA	Defence Innovation Accelerator for the North Atlantic
DOTMLPF	Doctrine, organization, training, materiel, leadership and education, personnel, and facilities
EDF	European Defence Fund
EU	European Union
FHS	Försvarshögskolan (Swedish Defence University)
FM	Försvarsmakten (Swedish Armed Forces)
FMV	Försvarets Materielverk (Swedish Defence Materiel Administration)
FOI	Totalförsvarets forskningsinstitut (Swedish Defence Research Agency)
GDP	Gross domestic product
GPS	Global Positioning System
IP	Intellectual property
IPO	Initial public offering
ISP	Inspektionen för strategiska produkter (Inspectorate of Strategic Products)
LOU	Lagen om offentlig upphandling
LRL	Legal readiness levels
LUFS	Lagen om upphandling på försvars- och säkerhetsområdet
MDR	Medical Device Regulation
MOA	Material and procurement manager
NATO	North Atlantic Treaty Organization
OEM	Original Equipment Manufacturer
ORL	Organizational readiness levels
PESCO	Permanent Structured Cooperation

RFI	Request for information
SME	Small and medium-sized enterprise
SOFF	Säkerhets- och försvarsföretagen (Swedish Security and Defence Industry Association)
SUA	Säkerhetsskyddad upphandling med säkerhetsskyddsavtal
SÄPO	Säkerhetspolisen (Swedish Security Service)
TED	Tenders Electronic Daily
TRL	Technology readiness levels
UAV	Unmanned aerial vehicle
UGV	Unmanned ground vehicle
URL	User readiness levels
VC	Venture capital

Contents

List of Acronyms	ix
List of Figures	xvii
List of Tables	xix
1 Introduction	1
1.1 Defence landscape	1
1.2 Purpose and Research Questions	2
1.3 Scope and Limitations	2
2 Background	3
2.1 Stakeholders	3
2.1.1 Swedish Government agencies	3
2.1.1.1 Swedish Armed Forces	3
2.1.1.2 FMV	3
2.1.1.3 FOI	4
2.1.1.4 ISP	4
2.1.1.5 Swedish Security Service	4
2.1.1.6 Vinnova	5
2.1.2 Private and public companies in the defence ecosystem	5
2.1.2.1 Original Equipment Manufacturers (OEM)	5
2.1.2.2 Tier 1 and Tier 2 suppliers	5
2.1.3 Intermediaries	5
2.1.3.1 SOFF	6
2.1.3.2 Accelerators	6
2.1.3.3 DIANA	6
2.1.3.4 EDF	6
2.2 Regulation and permits	7
2.2.1 Permits associated with ISP	7
2.2.2 Security clearance	7
2.3 Public procurement in the Swedish defence industry	8
2.4 Military systems	9
2.4.1 The acquisition process	9
2.4.2 Interoperability	10
2.5 Emerging technologies	11

3	Methods	13
3.1	Research strategy	13
3.2	Research design	14
3.2.1	Cross-case element	14
3.3	Sampling	14
3.4	Data collection	14
3.4.1	Primary data	15
3.4.2	Interviews	15
3.4.2.1	Unstructured interviews	15
3.4.2.2	Semi-structured interviews	15
3.4.2.3	Networking	16
3.4.3	Secondary data	16
3.4.3.1	Literature review	16
3.5	Data analysis	16
3.6	Research Quality	17
3.7	Ethical concerns	18
3.8	Use of generative AI	18
3.9	Method discussion	18
4	Theory	21
4.1	Needs and value creation	21
4.1.1	Value Creation in Service Logic	21
4.1.2	Effectuation versus causation	21
4.1.3	Signaling and information asymmetry	22
4.1.4	Translating Needs into Requirements	22
4.1.5	Stakeholder management	23
4.2	Funding	24
4.2.1	Non-dilutive funding	24
4.2.2	Dilutive funding	24
4.2.2.1	Venture capital (VC)	24
4.2.2.2	Corporate venture capital	24
4.2.2.3	Angel investors	25
4.2.2.4	Accelerators	25
4.2.3	Valley of death	25
4.2.4	Startup hype and expectations	26
4.3	Commercialization pathways	27
4.3.1	Dual-use	27
4.3.2	The Innovation Process	27
4.3.3	Profiting from innovation	28
4.3.4	B2B procurement	28
4.3.5	B2G procurement	28
4.3.6	Lessons from other industries	29
4.3.6.1	Aviation	29
4.3.6.2	Renewable energy	29
4.3.6.3	Medtech	30
4.4	Innovation and system integration	31

4.4.1	Systems engineering	31
4.4.1.1	Technology Readiness Levels	31
4.4.1.2	User, organization and legal readiness levels	32
4.4.1.3	Dual-use readiness	32
4.4.2	Innovation and Value Creation	33
4.4.2.1	Defence innovation	33
4.4.2.2	Civil versus defence innovation	33
5	Empirical material	35
5.1	Needs and value creation	35
5.1.1	Sources of customer need	36
5.1.2	Access to stakeholders	36
5.1.3	Defining the value proposition	38
5.2	Funding	39
5.2.1	Early-stage funding and the financing gap	39
5.2.2	Finding the right partner	40
5.2.3	Dual-use as a funding enabler	40
5.3	Commercialization pathways	40
5.3.1	Partnerships as a pathway	40
5.3.2	Acquisition as a pathway	41
5.3.3	Independent commercialization	41
5.3.4	Civil versus defence market entry	42
5.3.5	Expansion beyond Sweden	43
5.3.6	Accelerator programs	43
5.4	Innovation and system integration	44
5.4.1	Maturity	44
5.4.2	Incremental or radical innovation	45
5.5	Regulation and permits	45
6	Challenges	47
6.1	Needs and value creation	47
6.1.1	Identifying the customer need	47
6.1.2	Demonstrating and signaling value	49
6.2	Funding	50
6.2.1	Bridge between early stage funding and late stage funding	50
6.2.2	Value from investors	51
6.2.3	Dual-use as a way of managing financing risk	51
6.3	Commercialization pathways	52
6.3.1	Commercialization pathways and structural constraints	52
6.3.2	Emerging pathways	52
6.3.3	Crossing the Valley of Death	53
6.4	Innovation and system integration	53
6.4.1	System evaluation	53
6.4.2	Test	54
6.4.3	Scale	54
6.5	Regulation and permits	55

7	Addressing the challenges	57
7.1	Needs and value creation	57
7.2	Funding	59
7.3	Commercialization pathways	59
7.4	Innovation and system integration	61
7.5	Regulation and permits	63
8	Discussion and conclusion	65
8.1	Comparison with other industries	65
8.2	Recommendations for startups	66
8.3	Future Relevance of the Findings	67
8.4	Contribution to research	67
8.5	Suggestions for future research	68
	Bibliography	I
A	Appendix 1	VII
A.1	The Vinnova reports	VII
A.1.1	Demand Accelerator for civil-military synergies	VII
A.1.2	CMILES	VIII
A.1.3	Synergia	X
A.1.4	Ideon	XI
A.1.5	Kraftsamling Öst för nationell infrastruktur civil-militär synergier	XIII
A.1.6	Innovationsinfrastruktur för Civil-Militär samverkan	XV
A.1.7	Infrastruktur för Civil-Militära synergier Nord	XVI

List of Figures

2.1	<i>Overview of FMV's organizational structure</i> (FMV, 2023)	4
2.2	<i>Overview of FOI's organizational structure</i> (Totalförsvarets forskningsinstitut, n.d.)	4
2.3	<i>Defence supply chain structure</i> (Danske Bank, 2025)	5
2.4	<i>Apache helicopter during an exercise in Sweden. Photo by the authors.</i>	11
3.1	<i>The basic building blocks of systematic combining</i> (Dubois & Gadde, 2017)	13
4.1	<i>Overview of the signaling timeline</i> (Connelly et al., 2011)	22
4.2	<i>Stakeholder map</i> (Freeman, 2015, p. 55)	23
4.3	<i>Model of development steps and funding</i> (Auerswald & Branscomb, 2003)	26
4.4	<i>Dual-Use Readiness Diagram</i> (Murray & Keselman, 2024, p.3)	33
6.1	<i>Example of different stakeholders in the acquisition process. This image is AI-generated.</i>	48
7.1	<i>Defence and civil solutions cross-over</i>	62

List of Tables

3.1	<i>Number of interviews</i>	15
5.1	<i>Description of interviewees</i>	35

1

Introduction

This chapter presents the context relevant to the thesis, as well as the purpose, research question, scope, and limitations.

1.1 Defence landscape

Sweden's and Europe's security has deteriorated during the 2020s. Russia's invasion of Ukraine in February 2022 has reinforced the likelihood that conventional warfare in Europe is possible. In response, Sweden has moved from decades of post Cold War downsizing towards rapid capability growth, materiel development and larger wartime organization. On March 7, 2024, Sweden joined NATO, which ended a long period of military neutrality and placed Sweden within NATO's collective defence framework (NATO, 2024). By 2035, member states of NATO must allocate 5 percent of GDP on defence requirements rather than the previous agreed upon 2 percent GDP requirement in 2014 (NATO, 2025b).

This development is reflected in Sweden's rising defence expenditures, the defence budget for 2025 is estimated to be 148 billion SEK, with a further increase for 2026 by approximately 27 billion SEK (Government Offices of Sweden, n.d.-a). In the Swedish defence ecosystem, FMV has a central role in procuring and supplying materiel and services for the Swedish Armed Forces (Government Offices of Sweden, n.d.-b). FMV describes procurement as a structured chain of activities, from demand specification to delivery. Additionally, FMV describes the procurement process as a regulated one where suppliers must respond to defined requirements within formal rules (FMV, 2020b).

SOFF (2025) (Swedish security and defence association) describes the Swedish defence market as slow-moving but stable, shaped by long procurement cycles and established supplier relationships. For startups and smaller firms, this can result in long lead times before a contract is signed, as identified needs must be translated into funded purchases through formal procurement routines. These processes can be difficult to navigate, particularly in a sector characterized by secrecy and limited transparency. At the same time, defence minister Pål Jonsson has emphasized the need for a defence ecosystem where both small and large organizations contribute to innovation (Government Offices of Sweden, 2023). This is significant because Sweden has a relatively limited number of defence suppliers, while SMEs are often regarded as important drivers of innovation.

This situation creates the central theme addressed in this thesis. While Sweden's changing defence landscape increases the need for innovation and a broader supplier base, it is not clear how startups can successfully commercialize in the defence industry or what challenges prevent them from doing so. The defence sector is growing, but that growth does not translate into market access for startups.

1.2 Purpose and Research Questions

The thesis aims to identify the challenges startups face when commercializing in the defence industry in Sweden and explore how these challenges can be addressed.

- **RQ1:** *What challenges do startups face when attempting to commercialize in the defence industry?*
- **RQ2:** *How can startups address these challenges?*

1.3 Scope and Limitations

The study focuses on startups targeting the defence sector. Startups in this context are defined as early-stage companies developing innovative solutions. The study is primarily based on the Swedish defence ecosystem. Additionally, the study is to be considered a snapshot of the situation during the spring of 2026. The defence sector is rapidly evolving due to geopolitics, innovation and ever changing policies and legal frameworks. Therefore, the findings of the study are to be considered context and time dependent.

Furthermore, the study provides a system level analysis of legal frameworks and funding mechanisms while not covering specific laws. While these factors are important, they fall outside the primary scope of the study which focuses on commercialization pathways and providing guidance for strategic decision making. The study may also be viewed as an introductory overview of the defence market, particularly targeting startups aiming to enter this domain.

2

Background

This chapter presents the background and processes relevant to the Swedish defence ecosystem as well as relevant stakeholders. This chapter is included to introduce the reader to the defence ecosystem in Sweden and to give context to the following chapters.

2.1 Stakeholders

The defence industry and its ecosystem consists of a number of actors, ranging from government agencies to private companies. To give an overview of the landscape, stakeholders have been categorized in the following categories:

- Swedish Government agencies
- Private or public companies
- Intermediaries

2.1.1 Swedish Government agencies

The following section provides an overview of relevant national government agencies.

2.1.1.1 Swedish Armed Forces

The Swedish Armed Forces (FM) is a Swedish government agency tasked with defending the country and its allies. It consists of four branches; the army, navy, air force and the home guard (Försvarmakten, n.d.-b). Furthermore, there are also functional units that support and operate across the different branches. The major functional units include command, logistics, intelligence and security, cyber security, medical services, and special units (Försvarmakten, n.d.-b). Regarding procurement, FM procures goods and services used in their operations (Försvarmakten, 2026b). However, more complex, technical systems are procured by FMV (FMV, 2020b).

2.1.1.2 FMV

The Swedish Defence Materiel Administration is an authority part of the ministry of defence. The primary mission of FMV is to procure equipment and services for the Swedish Armed Forces, ranging from basic equipment to complex systems (FMV, n.d.-a). *Figure 2.1* shows an overview of the organizational structure of FMV.

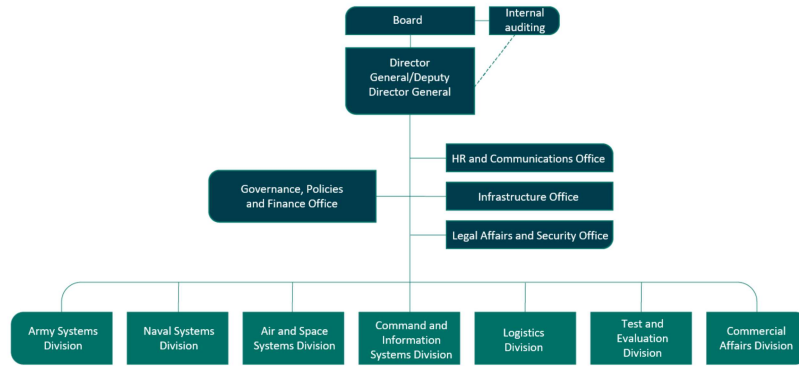


Figure 2.1: *Overview of FMV’s organizational structure* (FMV, 2023)

2.1.1.3 FOI

FOI is a government agency that conducts research in the fields of defence and security. Its mission is to generate knowledge and provide support that helps develop and innovate Sweden’s military and civil defence (Totalförsvarets forskningsinstitut, n.d.). *Figure 2.2* shows an overview of the organizational structure of FOI.

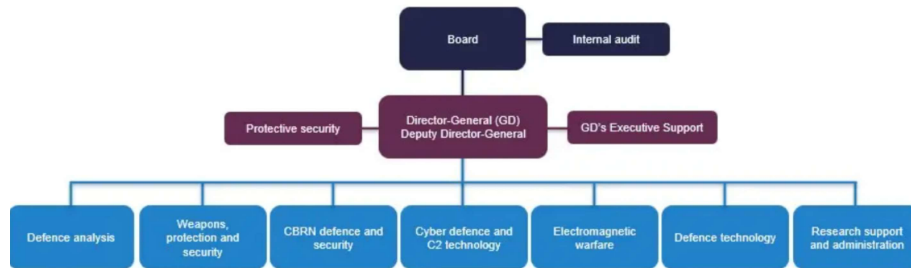


Figure 2.2: *Overview of FOI’s organizational structure* (Totalförsvarets forskningsinstitut, n.d.)

2.1.1.4 ISP

The Inspectorate of Strategic Products (ISP) is an independent Swedish government authority. ISP’s responsibilities include overseeing export of military equipment, act as Sweden’s screening authority for foreign investments, and administrating certain targeted sanctions (Inspectorate of Strategic Products, n.d.). ISP also serves as Sweden’s National Authority under the Chemical Weapons Convention. The agency is supported by three advisory councils: the Export Control Council, the Technical-Scientific Council, and the Strategic Cooperation Council.

2.1.1.5 Swedish Security Service

The Swedish Security Service (SÄPO) is a government agency responsible for the national security (SÄPO, n.d.-a). This includes preventing and detecting threats related to security and terrorism.

2.1.1.6 Vinnova

Vinnova is the Swedish governmental agency for innovation. The mission of Vinnova is to strengthen the national innovation capabilities and to contribute to growth. This is done by programmes and funding for organizations and projects that encourage innovation (Vinnova, 2025). Several of Vinnova's initiatives are related to defence and dual-use technologies such as the program for civil and military innovation (Vinnova, 2024).

2.1.2 Private and public companies in the defence ecosystem

Private and public companies refer to actors within the defence ecosystem that are interconnected through supply chains and operate across different tiers (Danske Bank, 2025). *Figure 2.3* shows a representation of actors in the defence supply chain.



Figure 2.3: *Defence supply chain structure* (Danske Bank, 2025)

2.1.2.1 Original Equipment Manufacturers (OEM)

OEM, sometimes referred to as system integrators, are responsible for delivering the solution to the purchaser (Danske Bank, 2025). For example, Saab is an OEM and global organization that delivers defence solutions (SAAB, n.d.). Small and medium sized companies tend to operate in the tiers below the OEMs (SOFF, 2025).

2.1.2.2 Tier 1 and Tier 2 suppliers

Tier 1 and Tier 2 suppliers deliver sub-systems and solutions to the tiers above (Danske Bank, 2025).

2.1.3 Intermediaries

Intermediaries are defined as organizations supporting startups with resources, guidance and networking.

2.1.3.1 SOFF

SOFF is an industry association that works to improve the conditions for member companies operating in Sweden's security and defence sector (SOFF, n.d.). Its purpose is to improve conditions for member companies to operate in Sweden, improve market access and strengthen their ability to trade. They describe their own role as connecting Swedish companies with international businesses, sharing industry knowledge and analysis among members, supporting partnerships including for NATO and EDF projects, and acting as a linking organization across defence and societal security.

2.1.3.2 Accelerators

Several intermediary organizations, such as IDEON, offer accelerator programs for startups (Ideon Science Park, 2026). Other examples include Innovatum Science Park and LEAD (Innovatum Science Park, 2026; Lead, 2026). These organizations can support startups by providing advice, education, networking opportunities and other resources relevant for companies seeking to enter the defence sector.

2.1.3.3 DIANA

NATO DIANA, short for Defence Innovation Accelerator for the North Atlantic, is NATO's organization for finding and accelerating new technologies that can strengthen allied defence and security. It works with researchers, startups and other innovators across the alliance, with a focus on emerging and disruptive technologies such as AI, autonomy, energy and propulsion (NATO, 2025a). DIANA runs competitive challenge programs built around concrete defence and security problems. Selected innovators develop deep tech dual-use solutions. Those selected can receive non-dilutive grants, access to accelerator sites, test sites as well as mentoring and connections.

2.1.3.4 EDF

The European Defence Fund (EDF) is the EU's funding programme for collaborative defence research and development. According to European Union (n.d.-b), the fund supports companies and organizations across EU member states in developing innovative and interoperable defence technologies and equipment, as well as providing support through the research and development cycle. Its main purpose is to reduce fragmentation in European defence investment and strengthen the competitiveness of Europe's defence technological and industrial base. Funding is mainly provided through grants, in some cases covering up to 100 percent of eligible costs, with added incentives for SMEs and projects linked to the EU framework PESCO. To receive funding, applicants generally need to form a consortium from at least three member states or associated countries. For disruptive technology calls, smaller consortia can qualify.

2.2 Regulation and permits

Companies operating in the defence industry in Sweden face a highly regulated environment. The two main authorities involved are ISP and SÄPO.

2.2.1 Permits associated with ISP

Any company that wishes to deal with military equipment, whether by selling, producing, purchasing, or developing such equipment or associated technology requires approval from ISP (ISP, 2022a). It is primarily the company's responsibility to assess whether their solution falls within the classification and under what category (ISP, 2022a). If needed, the company can seek guidance from ISP to classify their solution. The application processing times vary, but according to ISP companies should expect a wait of at least two months (ISP, 2026). This assumes that the application is properly completed and no additional guidance is required.

There are several types of permits and classifications. Depending on whether the product or service is intended for military purposes or dual-use, the permits and application procedures differ (ISP, 2022b). If a company wishes to export their products or services a separate permit is required (ISP, 2022c).

There are not many known instances of recalled permits from ISP, it is possible. ISP's standpoint is that mistakes are possible, and if the violation is deemed mild or done without intent the subject can be free from any fees arising from the matter (ISP, 2025).

2.2.2 Security clearance

A security protection agreement is the instrument a Swedish operator uses to legally impose security protection requirements on a supplier when that supplier may gain access to security classified information (SÄPO, n.d.-b). There are also requirements on personnel, meant to stop unreliable individuals from taking part in security sensitive activities and to ensure that those who do participate understand protective security. Before someone can work in such a role, they must undergo a security vetting. This is usually done by the employer and can include interview, references, register checks and deeper personal investigation for higher security classes. The process must also be followed up over time. There are three security classes based on the sensitivity of the information and the level of harm a person could cause to Sweden's security. The security services carries out register checks, but the final decision on employment or assignment is normally made by the employer.

2.3 Public procurement in the Swedish defence industry

In Sweden, FMV is the public authority responsible for procuring, developing and delivering materiel and services for the Swedish Armed Forces (FMV, 2023). In this arrangement, the Swedish Armed Forces define capability needs and allocate resources, while FMV translates those needs into technical specifications and procurement activities (Hellberg, 2023). The process of translating a need to a procurement involves several stakeholders and may differ depending on the need. A common stakeholder involved is a MOA (material and procurement manager), which is employed by the Swedish armed forces and acts as a bridge between FM and FMV (Försvarsmakten, 2026a). The MOA is responsible for identifying future needs within a certain area, for example drones (Johansson, 2026).

As a public contracting authority, FMV conducts procurement within the legal framework for public purchasing (FMV, 2020b). The main legal framework consists of the Public Procurement Act (LoU), while procurement in the defence and security field may instead fall under the Defence and Security Procurement Act (LUFs), depending on the content and security level of the procurement.

In the ordinary procurement process, FMV publishes procurement opportunities through Kommers Annons, which is a Swedish supplier portal/database for public procurement notices and e-tendering (FMV, 2020b). Procurements are also advertised through Tenders Electronic Daily (TED), which is the EU's official portal that publishes notices in the supplement to the official journal of the EU (European Union, n.d.-c). Procurement documents are published in English when an international supplier base can be expected. Suppliers then access the procurement documents, monitor updates and clarifications, and submit tenders within the specified deadline. Following the submission period, FMV evaluates the tenders against the requirements and award criteria set out in the procurement documents before awarding the contracts (FMV, 2020b). If there is no active tender via Kommers Annons, it is not possible to sign a deal with FMV since a public procurement process must take place. After FM and FMV agree on needs and economics, FMV is tasked to acquire and deliver via the public procurement process (Försvarsmakten, n.d.-a).

Hellberg (2023) describes the Swedish procurement model as one shaped by an arm's length interpretation of public procurement law. The relationship between authorities and suppliers is expected to remain neutral and procedurally bounded, which limits the extent of cooperation. Within this model, contracts are to be awarded to the tender that best meets the stated criteria, rather than on the basis of supplier nationality or pre-existing preference. Historically, this model has been associated with an emphasis on minimizing purchasing cost in areas not classified as essential security interests.

There are exceptions to the public procurement process, namely when regarding materiel characterized as essential security interest. Hellberg (2023) notes that Ar-

article 346 of the Treaty on the Functioning of the European Union allows exception from ordinary procurement rules in order to protect essential security interests. In the Swedish context, this applies to areas such as the underwater domain, fighter aircraft and certain functions within cryptography and sensors.

FMV also uses RFIs (Request for information) as a form of market research which they use to gather information about which products and services the market can offer (FMV, n.d.-c). An RFI may contribute to the development of more complete specifications for future procurements but it does not create any obligation for FMV to proceed with a contract award. Alongside ordinary procurement procedures and RFI, FMV also maintains interfaces intended to identify emerging technologies. Through certain military innovation program, FMV seeks ideas and technical solutions that may strengthen the capabilities within defined areas (FMV, n.d.-b).

If a procurement involves security sensitive activities or access to security classified information, additional security requirements apply. A security protection agreement is used to ensure that the supplier applies the same level of security protection as the procuring authority (Upphandlingsmyndigheten, n.d.). FMV further states that access to security sensitive activities or security classified information must not be granted before such an agreement is in place (FMV, 2020a).

2.4 Military systems

This section presents military systems in a Swedish context, as well as within the framework of NATO.

2.4.1 The acquisition process

The life cycle of a materiel system can be described as a sequence of stages. It begins with the concept stage, which is triggered when a capability need is identified, such as changed threat environment, new or altered tasks for units, replacements of existing materiel or when new technical possibilities are assessed to offer substantial advantages if translated into new or modified materiel. The next stage is the development stage, where the system is defined in scope and its interfaces to other systems are described, while the ambition and objectives of the chosen solution are further concretized. Market surveys are typically used to understand what existing products can meet and the required ambition may be adjusted through iterative requirement adaptation to a level the market can deliver at a reasonable cost (Statens offentliga utredningar, 2022). Building on that, the acquisition stage produces the requirements specifications, procurement strategy, and tender documents used to run the procurement process, including collection, evaluation, and negotiation of supplier bids.

Once a contract is signed, the system enters the production stage. Some items can be delivered directly, but military systems are often complex and need to function

with other materiel, which often requires adaptation. Design work is followed up through design reviews in which FMV and FM can provide input before production starts. During series deliveries, delivery inspection is carried out to identify production quality issues, while verification checks that contractual requirements are met, which is a time consuming process. The materiel is also validated, which means that an assessment is made in regard to whether delivered materiel meets the actual military need which is intended to inform FM on how the materiel should be used and potentially adapted further. For FMV-managed procurements, series deliveries typically go from the supplier to FMV, and after delivery inspection, verification and any needed system integration, the materiel is handed over to FM. Deliveries and handover may proceed in parallel with verification, and deficiencies can require retroactive measures, normally by the supplier (Statens offentliga utredningar, 2022).

After handover, the system enters the use stage until it is withdrawn from service (Statens offentliga utredningar, 2022). In this stage, the materiel is sustained and often further developed. Sustainment includes ensuring performance over time, safety, maintainability, preventive maintenance as well as replacing components that can no longer be procured as spares. Refurbishments to extend the technical lifetime of systems are common to meet new or changed requirements, for example due to a changed threat. When the system reaches the end of its operational or technical life, meaning it can no longer be used safely or cost effectively, or cannot be modified to meet the current threat, FM decides on disposal and the system is moved into the disposal stage where the materiel is destroyed or sold.

2.4.2 Interoperability

In the Swedish context, materiel supply is broader than the purchase of a single product. It covers the entire life cycle and aims to secure relevant and usable capability over time. Military capability is further described as mutually dependent components; doctrine, organization, training, material, leadership and education, personnel, and facilities (DOTMLPF) (Statens offentliga utredningar, 2022). This means that materiel has limited value without the surrounding capability package, and the need for materiel is therefore dependent on how the rest of the armed forces is designed and organized. For new materiel to generate operational capability, it must be introduced in step with the other components that create capability. If this coordination fails, the consequence may be delayed capability, reduced operational effect, higher cost or not realized at all (Statens offentliga utredningar, 2022). NATO practice additionally adds an I for interoperability as an additional dimension. Interoperability adds further constraints since it shifts attention from whether a system works on its own to whether it can function together with other systems, organizations and allies.

2.5 Emerging technologies

Historically, warfare has been shaped by major technological shifts, from the introduction of gunpowder to the development of helicopters as seen in *figure 2.4*, missiles and more recently, drones and autonomous systems. New technologies often generate hype, as they are presented as solutions capable of changing the character of warfare (Rossiter, 2025).



Figure 2.4: *Apache helicopter during an exercise in Sweden. Photo by the authors.*

Kunertova (2023) argues that earlier use of drones or UAV, often focused on aircraft-sized, medium altitude long endurance systems associated with remote surveillance and precision strikes, but the war in Ukraine has highlighted new areas and use-cases. Both sides use drones in large numbers across different sizes and roles. In heavily contested airspace, larger drones are vulnerable, especially when facing capable air defences and electronic warfare, which limits their use. Small drones are typically lightweight, often commercially derived, and easier to scale and replace than larger systems. Commercially available navigation and guidance components enable relative accuracy at a low cost compared to traditional munitions. The benefits to the attacker create corresponding problems for defenders (Kunertova, 2023). Plichta and Rossiter (2024) note that many one-way attack drones can be intercepted, but the challenge lies in doing so consistently, at sustainable cost. This creates an asymmetric cost burden, as defenders may be forced to use expensive air defence systems to intercept comparatively cheap incoming drones.

Similar developments can be seen in the use of unmanned ground vehicles or UGVs.

2. Background

Rossiter (2020) defines UGVs as mobile ground based systems that can sense and interact with their environment. Equipped with sensors, communications and sometimes weapons, they may be remotely operated or autonomous. In military use, their main value lies in reducing human exposure to danger by transferring risk to machines.

3

Methods

This chapter presents the methods applied in the thesis with regards to research strategy, research design, sampling, data collection, data analysis as well as research quality and ethical considerations.

3.1 Research strategy

The research questions guiding this thesis require an in-depth understanding of how stakeholders perceive, interpret, and respond to the challenges faced in a real world startup context. Because the study seeks to explore these perspectives rather than measure relationships between predefined variables, a qualitative research strategy was considered appropriate. This approach enables the thesis to develop a rich and contextual description of the case. The qualitative strategy therefore supports the case study design by allowing the research questions to be examined within their specific empirical context (Bell et al., 2019).

Furthermore, the thesis adopts an abductive logic, more specifically systematic combining as described by Dubois and Gadde (2002). Dubois and Gadde (2002) describe the systematic combining as a process where theory, empirical material and analysis evolves simultaneously. *Figure 3.1* showcases the basic building blocks of systematic combining.

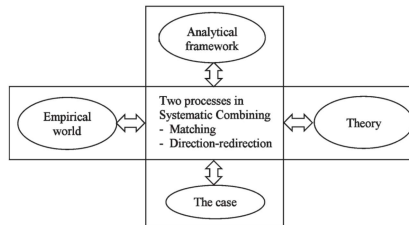


Figure 3.1: *The basic building blocks of systematic combining (Dubois & Gadde, 2017)*

This approach is suitable due to the explorative nature of the study as well as the lack of previous research (Dubois & Gadde, 2017). By adopting the process

of systematic combining the authors allow for insights to emerge as the study progresses. For example, insights gathered from interviews often guided the literature review. Likewise, the initial literature review guided the questions asked during the interviews. Additionally, the analysis provided guidance for additional literature review as well as additional interviews.

3.2 Research design

This study adopts a descriptive case study design with a cross-sectional time horizon, meaning the phenomenon is examined at one defined point in time, the spring of 2026 (Bell et al., 2019). A case study is appropriate where the goal is an in depth examination of a system or phenomenon. Case studies are typically characterized by awareness of contextual conditions and the unique features of the case, and they often combine multiple sources of data collection, which is mentioned subsequently. Descriptive case studies are sometimes criticized for limited generalizability, but they are valuable for developing contextual understanding (Remenyi, 2012). Hence, the authors aim to compare similar phenomena, in sectors which also adhere to high costs and long project cycles. The study design is deemed to be suitable due to the research focus, which is an examination of a complex system.

3.2.1 Cross-case element

Similar industries were also examined and compared to the defence industry. These industries were chosen based on similar characteristics as the defence industry, such as high regulation and high share of the market being concentrated among a few actors. While similar industries were not an integral part of the analysis, it provided guidance for the interviews and literature review within the defence industry.

3.3 Sampling

This study used non-probability sampling, mainly through convenience and snowball sampling. Convenience sampling made it possible to recruit accessible and relevant participants, while snowball sampling helped identify additional respondents through referrals (Bell et al., 2019). This approach was suitable for reaching participants with relevant experience, but it limits the generalizability of the findings. Throughout the thesis, the authors attended fairs and demonstration events which led to new opportunities for data collection.

3.4 Data collection

Data were collected through a combination of interviews as well as from Chalmers databases and open source material from relevant authorities. Using multiple sources enabled triangulation and provided a richer and more contextualized description of the case (Bell et al., 2019). The logic of systematic combining was used throughout

the data collection by allowing secondary data to guide primary data and vice versa (Dubois & Gadde, 2002, 2017).

3.4.1 Primary data

Primary data refers to data collected first-hand by the researchers for the specific purpose of the study, for example through interviews, participation or observations at networking events (Bell et al., 2019).

3.4.2 Interviews

Interviews were used to capture contextual insights that are difficult to obtain from literature alone. Two complementary formats were applied: Unstructured interviews in an exploratory phase and semi-structured interviews as the main data collection approach. The majority of interviews were conducted online, using Teams. Some interviews were conducted in person. *Table 3.1* presents the number of interviews and the category of the interviewee.

Table 3.1: *Number of interviews*

Category	Interviews
Startups	8
Established companies	4
Intermediaries	2
Swedish government agencies	6
Industry experts	3

Table 3.1 Presents the category and number of interviews conducted.

The interview subjects were chosen based on their ability to provide insight as well as perspectives from different view-points. Additionally, the authors attempted to gather data from multiple roles in the areas of interest.

3.4.2.1 Unstructured interviews

Unstructured interviews were primarily used as a pre study method to build an initial understanding of the case context and to surface issues that were not yet well defined. In this format, the conversation is kept open which allowed the interviewees to emphasize what they consider important. Unstructured interviews therefore are a tool to help build orientation and inform subsequent data collection (Bell et al., 2019). Through the unstructured interviews, several dimensions relevant to the thesis manifested.

3.4.2.2 Semi-structured interviews

Semi-structured interviews constitute the main interview method for the empirical chapter. They were guided by an interview guide around themes derived from the

research question and the developed understanding from earlier stages, but they retain flexibility in sequencing and phrasing. This balance enables some comparability across respondents while still allowing probing and enabling follow up questions. As a result, semi structured interviews support both cross respondent synthesis and the level of depth needed to capture nuance and context (Bell et al., 2019). Through the semi-structured interviews, the dimensions that was previously identified were reduced to five distinct dimensions, which then laid the foundation of future data collection.

3.4.2.3 Networking

The authors attended fairs and networking events with relevant defence actors, in Gothenburg, Stockholm and Lund throughout the project. Data was also collected during demonstration events by the armed forces. The purpose of attending these events was to meet people relevant to the project who in turn could be part of interviews or could recommend others to interview as well as raising awareness about the project. During these events, there were also several presentations by industry experts, entrepreneurs and intermediaries from which information was also collected.

3.4.3 Secondary data

Secondary data refers to data that has already been collected and published by others, such as academic literature, reports, and official documents. In this thesis, secondary data was used to provide theoretical background and contextual support for the analysis.

3.4.3.1 Literature review

The thesis includes an extensive literature review to map what is already known about the phenomenon and to build the conceptual background used to perform the analysis. Keywords were entered in Chalmers databases, such as "defence" and "dual-use" and "startup". Preferably, peer reviewed data was chosen when possible. Some literature was recommended by the interviewees, for example, the article about the dual-use framework which is consistent with systematic combining (Dubois & Gadde, 2017).

In addition to peer-reviewed research, the thesis includes literature from relevant public bodies gathered from open sources. This is complemented by public documents from public authorities which are found in the appendix of this thesis.

3.5 Data analysis

Thematic analysis was used to analyze the qualitative data collected in this thesis. Bell et al. (2019) describe thematic analysis as one of the most common approaches

to qualitative data analysis, particularly for identifying patterns in interview transcripts and field notes. A theme is understood as a category identified by the researchers through the data, connected to the research focus or research questions, and built from codes in the empirical material.

The data analysis follows the logic of systematic combining (Dubois & Gadde, 2002, 2017). The initial literature review and early interviews served as an initial direction and a list of common challenges. The identified challenges were then grouped into the following eight dimensions:

- Understanding needs and value
- Funding
- Valley of death
- Regulatory demand
- Permits
- Validation and implementation
- Scale and fit
- Commercialization

This initial grouping of the themes guided subsequent literature review and interviews. As the work progressed, this was reduced to five dimensions:

- Needs and value creation
- Funding
- Commercialization pathways
- Innovation and system integration
- Regulation and permits

These five dimensions were established at the half-way point as a result of data collection and analysis. The number of dimensions was decreased to reduce overlap.

3.6 Research Quality

Since the study is a qualitative case study, traditional criteria such as reliability, validity and replicability are difficult to apply in the same way as in quantitative research. As Bell et al. (2019) argue, social contexts cannot be frozen in time or recreated under identical conditions, which limits the possibility of exact replication. Instead, this thesis aims to strengthen reliability by clearly describing how the study was conducted. Since both authors were involved throughout the research process, interview material and interpretations were continuously discussed to reduce the risk of inconsistent interpretations. Validity was addressed by comparing interview findings with secondary data where possible. This triangulation strengthens the credibility of the findings.

Several limitations should be noted. The defence sector is characterized by limited transparency which not only affects actors in the ecosystem, but also those

studying it. This has been apparent both in retrieving and analyzing secondary data as well as in primary data. The result is that some areas and some perspectives are less prominent than others. For example the viewpoint of the authorities is somewhat limited as relevant individuals have been difficult to reach. Additionally, some perspectives, such as that of investors, are lacking. Public documents which have been requested from public authorities are in some cases censored to protect sensitive information. In this case, the redacted information is related to business and operational conditions where disclosure could cause economic harm.

3.7 Ethical concerns

Interviews were conducted with attention to standard practical and ethical considerations, including informed consent, transparent communication about the study purpose and use of data as well as appropriate handling of confidentiality (Bell et al., 2019). Where possible and consented to, interviews were recorded to support accurate transcription and analysis. In the cases where software transcription was not possible e.g., during physical interviews, it was transcribed manually. The transcription was then shared with the respondent for verification.

Bell et al. (2019) identify four ethical principles in business research: avoiding harm to participants, obtaining informed consent, protecting privacy and avoiding deception. These principles guided the design and execution of the data collection.

Before each interview, participants were informed about the purpose of the study, the general topic of the interview and how the collected material would be used. Participants were given the opportunity to decline answering questions or withdraw from participation. When interviews were recorded, this was done only after consent had been given. Since the Swedish defence sector is relatively small, there is a risk that individuals or organizations could be indirectly identified even without using names. To reduce this risk, interviewees and organizations were anonymized to a certain degree. Before collecting data from a person or an organization, the purpose of the thesis was presented as is, without withholding relevant information.

3.8 Use of generative AI

Artificial intelligence was used to improve readability through spelling checks, language review and minor rephrasing. Additionally, AI was used to generate keywords and to generate one figure, as specified in the figure caption.

3.9 Method discussion

The selected methodology was useful for gathering information from relevant and accessible sources. However, it also had certain implications for the quality and scope of the thesis. In some cases, it was difficult to contact potential respondents,

either because their contact information was no longer valid or because no response was received. This limited the range of perspectives included in the empirical material.

The use of convenience and snowball sampling made it possible to reach respondents in a sector characterized by secrecy and limited accessibility. This sampling approach affected which perspectives were represented in the empirical data. Consequently, the findings reflect the views of actors who could be reached and were willing to participate. As a result, some perspectives are less developed, particularly those of investors and startups that are no longer active. This affects the analysis, since several identified challenges concern processes where these actors could have provided additional insights.

4

Theory

This chapter presents the theoretical framework, structured around four of the five key dimensions, namely: needs and value creation, funding, commercialization pathways and innovation and system integration. The dimension of regulation and permits is primarily addressed in the background chapter, as it is specific to the Swedish defence sector.

4.1 Needs and value creation

This section presents theory on how customer needs are understood, communicated and translated into requirements, and how value is created in relation to those needs. It focuses on service logic, effectuation, signaling theory and value creation in uncertain environments.

4.1.1 Value Creation in Service Logic

In economics value is traditionally viewed to be created during the exchange of product or services (Grönroos, 2008). In contrast to this, service logic states that value is created by the customer during the use of the product or service. The proposition is that customers create value by integrating the purchased resources with existing resources as well as with skills and knowledge.

In other words, the value is not achieved by the product or service itself but in its use. The supplier's role is therefore to facilitate the customers value creation and the offering can be understood as a value proposition. According to Grönroos (2008) customer need is an abstract construct that is really about what the customer perceives as valuable in their operations. Furthermore the suggestion is made that it is difficult to capture the need from the customers themselves as they may lack knowledge on how value is created. By focusing on the activities and processes associated with the customer the supplier can better support value creation.

4.1.2 Effectuation versus causation

The logics of causation and effectuation are two different types of strategies in entrepreneurship (Sarasvathy, 2001). Causation can be considered the more traditional approach where the entrepreneur starts with a predefined goal and then identifies the optimal way to reach that goal. A common method involves using segmentation,

targeting and positioning when forming the strategy. A prerequisite for this is that the market can be analyzed and that customer needs are available. In cases where there is a higher degree of uncertainty and more dynamic, effectuation can be used as a basis for the strategy. In contrast to the causation-logic, effectuation does not have a predefined goal but rather looks at the available resources which guide an emerging goal. The resources are categorized as follows:

- **Who they are:** Traits, tastes and abilities
- **What they know:** The knowledge corridors they are in
- **Whom they know:** The social networks they are a part of

The resources can therefore give a general sense of direction but the goal of the company emerges by interacting with potential customers and partners, and by experimenting.

4.1.3 Signaling and information asymmetry

Information asymmetry occurs when actors have different levels of information (Connelly et al., 2011). This can lead to difficulties in decision making as the necessary information to make the decision is not available. Signaling theory is a way to address this issue. Actors can communicate through signals, which are actions taken by the sender to convey information to the receiver. *Figure 4.1* below illustrates an overview of the signaling timeline.

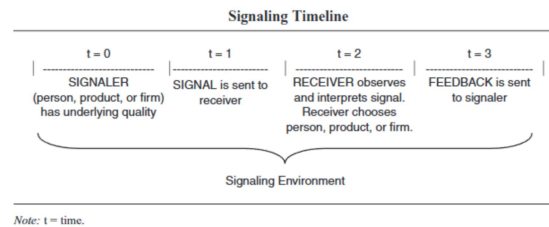


Figure 4.1: *Overview of the signaling timeline* (Connelly et al., 2011)

The signaler may be a supplier, the signal information about the suppliers underlying qualities such as competence, and the receiver a customer (Connelly et al., 2011). The signals must both be observable and credible to have the desired effect. The purpose of the signal is to influence the decision making of the receiver as well as to receive feedback.

4.1.4 Translating Needs into Requirements

Welsh and Narby (2025) investigates the process of translating needs into requirements. The paper suggests that the ideals outlined by laws, rules and regulations are hard to meet in practice. The requirements are formed under uncertain conditions and may fail to accurately translate the expressed needs. Factors such as long lead times and rapidly evolving technologies impact the translation. Furthermore,

rigid and specific requirements may affect the supplier's ability to offer innovative solutions.

4.1.5 Stakeholder management

Stakeholders are described as “Groups and individuals who can affect, or are affected by, the achievement of an organization's mission” (Freeman, 2015, p. 52). Stakeholder management is a concept which involves mapping and managing stakeholders. Additionally, Freeman (2015) argues that there are three aspects which dictates the success of an organization's stakeholder management, namely:

- Who the stakeholders are, and the perceived stakes
- The processes involved to manage the identified stakeholders
- Transactions and bargains to balance the interest of the identified stakeholders

In other words, successful stakeholder management involves identifying stakeholders, managing them and balancing the interest of the identified stakeholders. To do so, organizations must create a stakeholder map. Organizations may do it at different levels where the first level acts as a high-level starting point as seen in *figure 4.2*:

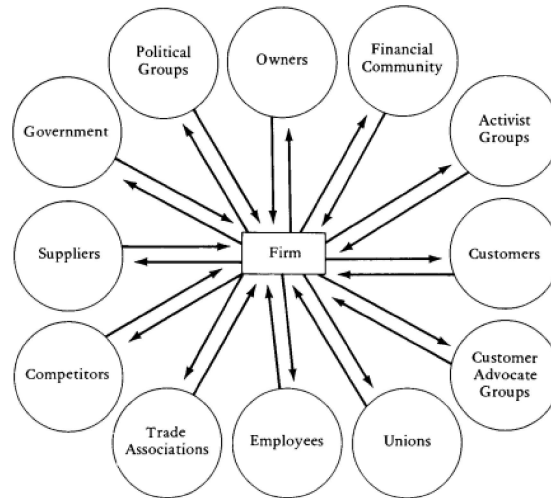


Figure 4.2: *Stakeholder map* (Freeman, 2015, p. 55)

Subsequent levels may be used to go into more detail. For example, the competitor's category can be expanded to include specific companies. Finally, that can be detailed further in providing departments or specific groups or individuals within a specific competitor. Freeman (2015) emphasizes that the stakeholder map is not static, rather subject to change and therefore need to be updated.

4.2 Funding

This section presents theory on how startups finance their development over time. It focuses on funding structures, the challenges of long lead times, and how firms navigate financial uncertainty.

4.2.1 Non-dilutive funding

Non-dilutive funding such as grants or self-funding refers to capital without giving up ownership of the company (Wood, n.d.). Non-dilutive funding often comes from governmental bodies or public organizations to support efforts within certain fields, often at the early stages of a venture. In addition to this, self-funding, or non-dilutive funding from close networks may be used. Non-dilutive funding has the advantage of allowing the entrepreneur to have full ownership of the company. However, limited additional value may be offered, such as guidance.

4.2.2 Dilutive funding

Dilutive funding, or equity investments, refers to situations where startups exchange ownership shares in the company for capital. Depending on the stage of development, different funding options may be pursued (Drover et al., 2017).

4.2.2.1 Venture capital (VC)

According to Drover et al. (2017), venture capitalists typically invest in mid to late stage ventures. Furthermore, venture capitalists typically work closely with the startup, providing guidance and value beyond capital. Different criteria may be used when evaluating potential investments, such as assessing the team, the market, and analyzing multiple data sources. The evaluation process is not purely objective but is described as subjective and contingent, where different criteria may be emphasized at different stages such as initial screening and due diligence. Venture capitalists also commonly use staged investments and syndication with other investors to manage risk and uncertainty over time.

4.2.2.2 Corporate venture capital

Corporate venture capital (CVC) refers to equity investments made by established corporations. Unlike venture capital, CVC tends to be invested during the early to mid stage phases. In addition to capital, the corporation may provide complementary assets such as industry knowledge and access to customers. CVC investors often invest for strategic purposes, for example to gain exposure to novel technologies, access complementary solutions, and enter new markets. This means that the objectives of CVC investments may differ from traditional VC, as financial returns are not always the sole priority. While CVC may appear attractive, Drover et al. (2017) warn that the corporate investor may imitate the asset. Imitation may be especially likely when the two companies operate within the same industry and when the intellectual property (IP) regime is weak.

4.2.2.3 Angel investors

Angel investors are generally individuals who invest their own capital into ventures (Cohen, 2013). Typically, these individuals are entrepreneurs themselves and often have experience within the field of the startup. Therefore, angel investors may provide guidance and other forms of value beyond capital. The angel investors' evaluation process is typically less formal than that of VC or CVC investors, as they generally invest at the earliest stages of a venture. They may also rely more on personal judgment and experience rather than formalized evaluation processes.

4.2.2.4 Accelerators

Accelerators are programs that combine small amounts of funding with mentorship (Cohen, 2013). The funding may be provided in exchange for equity, but this is not always the case. Typically, accelerators occur at the very early stages of a venture and run for a period of three to six months. The accelerator often ends with an opportunity to pitch to potential investors and other stakeholders. They are commonly structured as cohort-based programs where startups participate together during a fixed time period.

4.2.3 Valley of death

The valley of death is a term used to describe the critical period that occurs between early research, and development and subsequently commercialization (Fiott, 2019). While it is often described as a funding gap, it can also be described as a gap between technology and market recognition (Auerswald & Branscomb, 2003). The transition can be understood through TRL. Many technologies may show promise during the early levels, but fail to progress through the later ones which involve validation, prototyping and commercialization (Kapurch, 2007). This is further supported by (Auerswald & Branscomb, 2003) who provides a model of development and funding, seen in *figure 4.3*.

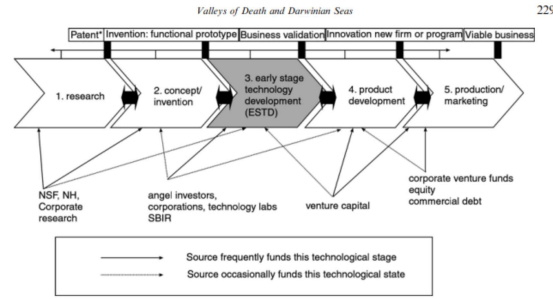


Figure 4.3: *Model of development steps and funding* (Auerswald & Branscomb, 2003)

Auerswald and Branscomb (2003) argue that step 3 is the most critical step, which they term as the transition between invention to innovation. As seen in *figure 4.3*, this step is associated with both a functional prototype and business validation. Meaning that there is a transition from technical feasibility to commercial opportunity.

4.2.4 Startup hype and expectations

Hype is defined by Logue and Grimes (2022) as “a collective vision and promise of a possible future, around which attention, excitement and expectations increase over time.” Although hype is described as collective, it often begins with the entrepreneur. In practice, hype refers to presenting a vision of a future state despite limited existing proof of technological or economic feasibility (Garud et al., 2026). For entrepreneurs, generating hype can be an important mechanism to attract investors, potential users, and public attention.

The tolerance of hype varies across sectors and depends on the type of technology involved (Rady et al., 2025). In emerging industries dealing with new and uncertain technologies startups may be expected to provide more visionary narratives than in more mature sectors. In technology-driven sectors generating hype can be a necessary step when proof of feasibility is low. However, while some hype may be required, setting expectations too high can also lead to negative consequences. Garud et al. (2026) describe this dynamic as part of the hype cycle where initial hype generates interest and rising expectations, which may lead to unrealistic expectations that cannot be met. This in turn leads to a downswing characterized by disappointment and loss of legitimacy.

The hype cycle can also be observed at the sector level, where collective enthusiasm around an entire industry shapes expectations and investment behavior (Garud et al., 2026). Rady et al. (2025) demonstrate an inverted U-shaped relationship between hype and startup valuations where moderate hype increases valuations and both low and excessive hype reduce them. In an upward-trending sector such as defence, more startups may be attracted. As sector-wide enthusiasm grows, tolerance for ambitious claims may also increase. While this may reward ambitious narratives and over-promising in the short term it simultaneously increases the risk of a collec-

tive downswing if expectations are not met. Startups that have over-promised are particularly vulnerable in such a correction.

4.3 Commercialization pathways

This section presents theory on how startups bring their solutions to market and navigate different commercialization pathways. It focuses on market entry strategies, procurement processes, and the role of partnerships and complementary assets.

4.3.1 Dual-use

Dual-use refers to technologies, products or ventures that can create value in both civilian and defence-oriented contexts. Dual-use ventures are described as operating where commercial opportunities overlap with national security or other public mission objectives, and as companies that serve both private markets and government customers. Dual-use is then a strategic choice to position the product or service towards more than one type of user. The same underlying capability may therefore be relevant in defence, public safety, healthcare or logistics depending on how it is adapted, governed and brought to market (Murray & Keselman, 2024).

4.3.2 The Innovation Process

The innovation process is usually described as iterative rather than strictly linear (Bhave, 1994). Even so, it can be divided into a set of distinct but connected stages. It often begins with opportunity recognition or problem identification, continues through concept development and evaluation, proceeds to organizing and resource mobilization and then moves into market introduction and further refinement. Innovation is then seen as a process in which an initial idea is gradually shaped into a viable offering through repeated interaction between the entrepreneur, the solution and the market (Bhave, 1994; Cuervo et al., 2007).

Within the first stage, Bhave (1994) distinguishes between externally and internally stimulated opportunity recognition. In externally stimulated opportunity recognition, the decision to start a venture comes first, after which the entrepreneur searches among recognized opportunities for one that fits their knowledge, skills and perceived market demand. In internally stimulated opportunity recognition, the process begins instead with the entrepreneur encountering or experiencing a need that cannot easily be fulfilled, developing a solution to that need and only later recognizing its commercial potential. These two paths describe different points of departure, but both lead into a second stage in which the opportunity is assessed and the concept is clarified in relation to technical feasibility, customer value and market relevance.

Once a concept has been identified and judged promising, the process moves toward developing it further and creating the conditions needed for exploitation. At this point, financing and resources needed must be secured to move forward. It can

be described as the phase in which the entrepreneur moves from idea to action by deciding how the opportunity should be pursued and by building the structure needed to support that effort (Cuervo et al., 2007). As the offering develops, it is usually gradually introduced to users or customers and refined through interaction with the market. Feedback from use, responses from customers and practical constraints often lead to adjustments in the solution itself, as well as in how it is delivered or organized. The innovation process therefore continues after market introduction.

4.3.3 Profiting from innovation

A key aspect for innovating organizations is how to profit from innovation. According to Teece (1986), there is not necessarily a reward for being innovative and first. Rather the financial success of innovation is dependent on complementary assets such as manufacturing, distribution, system integration and access to customers. The importance of the complementary assets is dependent on how easily the innovation can be protected from imitation, for example through patents and trade secrets. In cases where the innovation is not protected, Teece (2018) argues that the actor with the necessary complementary assets will receive the profits. The innovator must therefore develop the complementary assets or form a partnership with those that possess them.

4.3.4 B2B procurement

In B2B markets, procurement is typically not a single person decision but a process involving a decision making unit, or buying centre, made up of several organizational actors. Jobber and Ellis-Chadwick (2020) describe six general roles in this unit.

- Initiators - Who trigger the purchase process
- Users - Who will work with the product or service
- Deciders - Who have authority over the final selection
- Influencers - Who contribute information and evaluation criteria
- Buyers - Who handle the contractual and transactional aspects
- Gatekeepers - Who control access to information and decision makers

These roles are not necessarily fixed, and the composition of the decision making unit may change as the procurement process develops (Jobber & Ellis-Chadwick, 2020). In practice, the process varies with the type of purchase, with routine purchases often being simpler and high risk purchases being more complicated.

4.3.5 B2G procurement

B2G procurement shares similarities with B2B procurement, especially in that the process involves several stakeholders. However, an important distinction is that B2G procurement is governed by extensive laws and regulations (Obwegeser & Müller, 2018). As B2G procurement involves spending of public funds, particular emphasis is often made on the efficiency of the purchased solution. Furthermore, the laws and

regulation can create an inflexible process which can result in a lack of purchased innovation. B2G procurement is often used as a tool to drive innovation within certain areas such as sustainability. According to Obwegeser and Müller (2018) this is particularly important in the early stages of the product life cycle, where solution exists but demand is lacking. As an example, pre-commercial-procurement involves the procurement of research and development as opposed to a finished solution. However, this creates a tension with the focus on efficiency, cost-efficiency and risk minimization.

4.3.6 Lessons from other industries

In order to compare challenges in the defence industry, three separate industries were chosen as a basis for comparison.

4.3.6.1 Aviation

A study by Sun et al. (2022) investigates airlines during the COVID-19 pandemic. The authors show that while the crisis presented opportunities for startups, the structures that existed prior to the pandemic remained. New entrants face issues in securing partnerships for distribution, for example with booking companies and travel agencies. These distributors tend to favor established companies over startups, leading to difficulties in achieving visibility and reaching customers. Furthermore, larger and more established companies were reluctant to experiment with new innovation unless major external pressure is present.

The authors also found that the inherent strength of startups, agility, is counteracted by the high degree of regulation and lengthy processes within the industry (Sun et al., 2022). In addition to limiting startups flexibility while waiting for regulatory approvals, these processes also place financial strain on the startups. Finally, startups face challenges related to legitimacy. The aviation industry and its customers may question the reliability of startups, as they often operate with limited cash reserves, frequently make substantial changes to their product offerings, or may even exit the market.

Although aviation startups face many challenges and constraints, there are also opportunities when the industry is confronted with a crisis such as COVID-19 (Sun et al., 2022). The need for innovation increases and startups may find themselves in a position to provide value. However, the authors emphasize that the structural barriers present in the industry continue to pose challenges for startups even during a time of crisis.

4.3.6.2 Renewable energy

Renewable energy has been an increased focus as countries aim to become less dependent on fossil fuels. This coupled with the need for innovation in the sector presents an opportunity for startups (Myroshnychenko et al., 2024). However, despite the opportunity, startups face significant barriers related to technology and innovation,

financial constraints and regulation. Navigating the landscape requires managing key stakeholders such as investors, regulators and customers (Bendig et al., 2025).

Firstly, regulators and the associated regulatory framework presents a big hurdle for startups (Myroshnychenko et al., 2024). The regulations span various areas such as permitting processes, grid connection policies and tariff structures. Furthermore, the regulation differs between markets, making adaptation necessary for a broad market presence. Regulation is also linked to technology and innovation as regulation may hinder new innovation (Bendig et al., 2025).

Bendig et al. (2025) states that a key success factor for innovation in renewable energy is iterative development as well as adaptation to local conditions. This can be interpreted as a form of incremental improvement where best practices from other markets are adopted to local contexts to increase legitimacy and competitiveness. However, making incremental improvements can be difficult as the knowledge sharing within the industry is limited.

Technological development and research within the sector often requires substantial funding (Bendig et al., 2025). Securing funding is often challenging due to long return horizons and regulatory uncertainty. As a result startups often depend on policy support mechanisms, public funding programs or blended financing to bridge early stage funding gaps.

To summarize, the sector seems to be in a state of strong technological development, growing investments and increasing political support (Bendig et al., 2025). Despite this, structural barriers remain significant. Regulatory complexity, limited information sharing, long return horizons and capital intensity are all significant barriers (Bendig et al., 2025). Therefore startups success is not only dependent on innovation but also on their ability to manage these challenges.

4.3.6.3 Medtech

Commercialization in the medtech sector is shaped by the interaction between technical development, clinical evidence generation, regulatory compliance, and health-care purchasing and reimbursement. In Europe, the medical device industry includes a large number of SMEs, and many early stage innovations originate from smaller firms and collaborations with clinical or academic environments. At the same time, moving from development to market entry typically requires completing activities that extend beyond product design, including regulatory documentation, clinical and quality assessment work (Maresova et al., 2020).

In the European context, CE marking is a prerequisite for marketing a device in many cases (European Union, n.d.-a). The existence of different device categories and regulatory instruments can contribute to administrative and compliance demands, which may be relatively more burdensome for SMEs because they often have fewer regulatory resources and smaller product portfolios over which to distribute fixed compliance costs.

Regulatory change can add an additional planning and resource challenge. Implementation of updated EU medical device regulations, can result in higher scrutiny for high risk devices, increased transparency through EU databases and more extensive post market surveillance obligations for manufacturers (Maresova et al., 2020). For SMEs, these changes can be associated with higher certification and administrative costs as well as higher workload. One such instance was the introduction of the MDR (Medical device regulation) which large companies as well as SMEs found challenging to adhere to (Carl & Hochmann, 2024).

Collaboration with larger or established organizations is described as a way for medtech startups/SMEs to access capabilities and assets that are often difficult to build internally before market entry such as clinical trial infrastructure, regulatory and manufacturing experience, financing and sales/distribution channels (Barrett et al., 2021). Additionally, other means are possible as well. Open-innovation enables startups and SMEs to bring in outside knowledge to address immediate needs (Barrett et al., 2021).

4.4 Innovation and system integration

This section presents theory on how innovation develops into solutions that can be implemented and used in practice. It focuses on technology maturity, system integration, and the challenges of aligning new solutions with existing structures and requirements.

4.4.1 Systems engineering

Systems engineering is a disciplined way of making complex systems work as a coherent whole. Kapurch (2007) defines systems engineering as a methodical, multi-disciplinary approach used across the system’s life cycle including design, development, operations and retirement. In this view, system is a term broader than hardware and software, it also includes people, processes, procedures and other enabling elements needed to deliver capability. INCOSE (2023) similarly describes systems engineering and emphasizes that systems engineering exists to keep decisions aligned with the overall system perspective.

4.4.1.1 Technology Readiness Levels

According to Kapurch (2007), TRL is a description of performance on a given system. It is divided along nine levels where the lower levels refer to basic concepts and the validation of technical principles in laboratory settings. At intermediate levels, individual components, subsystems and integrated system elements are tested and demonstrated in increasingly relevant environments. At the higher levels, the focus shifts towards product development and system level demonstration.

4.4.1.2 User, organization and legal readiness levels

SOFF (2019) presents a multidimensional concept for validating products aimed at the defence market. Four complementary levels are described, namely: TRL as described previously, URL (User readiness levels), ORL (Organizational readiness levels) and LRL (Legal readiness levels)

URL concerns the preparedness of personnel to use a capability and is graded to a scale from 1-6, compared to the others which have 9 levels (SOFF, 2019). At the lower levels, the user has only a general awareness of the technology and a theoretical understanding of the concept and its intended application. At the higher levels, the user has advanced proficiency and can employ the capability in more complex or stressful environments as well as an ability to adapt the capability to new needs and contribute to its further development.

ORL refers to the ability of an organization to integrate new technology into its operations (SOFF, 2019). It includes the adaptation of structures, roles, processes, tactics, doctrine and education so that the organization can fully benefit from the technology. At lower ORL levels, the organization is only aware of the technology and begins to explore its implications. At subsequent levels, concepts for integration are developed, limited tests and pilot activities are carried out and the implications for organization, training and operations are assessed. At higher levels, the technology and associated changes begin to be implemented, integrated into exercises and routines, as well as further optimized through updated structures and education.

LRL concerns whether an organization is prepared to handle the legal and ethical implications of new technology (SOFF, 2019). This is described as particularly important in defence contexts, where the use of new systems must comply with national law, international humanitarian law and other applicable rules and regulations. At the lower levels, legal readiness consists of awareness that a capability may have legal implications and the carrying out of preliminary legal assessments. At intermediary levels, legal questions and risks are analyzed in greater depth, and more detailed legal interpretations and guidelines are developed. At higher levels, formal decisions are taken regarding the use of the capability, legal frameworks are implemented in the organization and routines are reviewed and adjusted over time.

4.4.1.3 Dual-use readiness

Murray and Keselman (2024) describe dual-use as a strategic approach rather than a fixed category. Firms must actively shape how a technology is positioned across different domains rather than assuming that the same solution will automatically fit both commercial and defence settings. This involves adapting product design, revenue models and intellectual property strategies to different users, requirements and institutional environments. As a result, dual-use ventures are characterized by the need to balance commercial growth and the high demands of defence oriented adoption. The dual-use readiness framework addresses this by presenting dual-use as progress along several parallel dimensions. Besides technology readiness, the

framework consists of commercial and mission funding as well as commercial and defence customer readiness as described in *figure 4.4*.

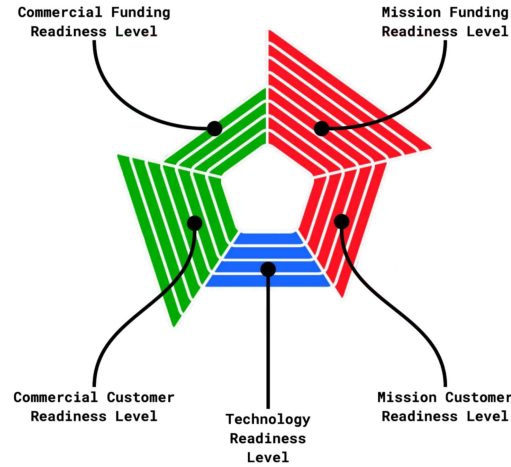


Figure 4.4: *Dual-Use Readiness Diagram* (Murray & Keselman, 2024, p.3)

4.4.2 Innovation and Value Creation

In this section the basics of innovation are covered, with regards to civil as well as defence innovation. Innovation is the process of turning a new idea into something useful that creates value. That value can be technical, economic, social or organizational.

4.4.2.1 Defence innovation

Defence innovation is the process of turning ideas and knowledge into new or improved products, services, or ways of working that have military or dual-use applications (Hultqvist et al., 2026). It broadens the concept beyond new materiel to include new tactics, doctrines, organizational methods or integration approaches that allow existing resources to be used more effectively. Therefore, defence innovation means building the capacity to innovate, which includes developing people and networks. In Sweden, a recently highlighted model is cross sector "triple helix" collaboration, where government agencies, universities and industry jointly contribute with different strengths. Agencies provide governance and funding, academia generates knowledge at the lower technology readiness levels and industry translates results into higher technology readiness levels which subsequently turns into systems, products or services (Hultqvist et al., 2026).

4.4.2.2 Civil versus defence innovation

Historically, defence innovation has largely been associated with a closed innovation model (Reuven & Shamir, 2025). Meaning that innovation has largely been the result of utilizing internal resources within the authorities. The defence sector was historically dominant in producing innovation that was then adopted to a civilian context. However, in recent decades the innovation has been driven in a civilian

context. Civilian innovation can be associated with the open innovation model which utilizes internal as well as external resources, especially in fields such as artificial intelligence and autonomous systems. As a result, the defence sector has adopted a more open innovation model to utilize innovation from external actors.

5

Empirical material

This chapter presents the empirical results of the thesis. It includes interviews with startups (S), established companies (E) and other intermediaries (I), as well as information from presentations during a network event where startups presented their companies. Furthermore, several conversations were held during networking events. Though they are not explicitly referenced, they nonetheless provided insight as well as guidance for the interviews. The empirical material is structured according to the five outlined dimensions. In addition to the anonymized interviewees, interviews were also held with members of FM, FMV, FOI as well as from Vinnova, and are not included in *table 5.1*.

Table 5.1: *Description of interviewees*

Object	Description	Role
Startup 1	Simulation technology	CTO
Startup 2	Mobility technology	CEO
Startup 3	Developer of medical equipment	CEO
Startup 4	Space technology	CTO
Startup 5	Material technology	CTO
Established 1	Global defence company	Product developer
Established 2	Nordic defence company	Deputy CEO
Established 3	Nordic defence company	Senior advisor
Established 4	Nordic defence company	Advisor
Intermediary 1	Industry expert at a trade association	Industry expert
Intermediary 2	Industry expert at Halmstad University	Senior lecturer
Intermediary 3	Industry expert at Swedish Defence University	Senior lecturer

5.1 Needs and value creation

One major theme in the empirical material has been the understanding of the customer need and how value is created and communicated with relevant stakeholders. In this section we present the findings related to how needs are identified, how startups gain access to relevant stakeholders, and how value propositions are formulated and developed.

5.1.1 Sources of customer need

The material shows that customer need can be identified in different ways. In some cases the identified need was matched to the internal capabilities of the startups, such as experience within a field. Regarding need, one common method of collecting customer needs is through the founders' experience as an end-user. For example S1 identified the need for improved ways of training as existing training was considered unrealistic and not engaging. S3's product was a result of first-hand experience in Ukraine. In other cases the needs were identified more indirectly through authorities announcing needs within certain areas. A representative of FOI gave an example of this in the case of the Civil-Military Innovation Program (CMIP) (Vinnova, 2024), which is a collaboration between FM and Vinnova that states a general need and provides funding for organizations pursuing the need.

Needs can also be identified through established organizations in the industry. For example the presentations by industry actors had a group of established organizations within the defence-field expressing need for innovations within a wide range of areas. In some cases the need is to improve existing solutions, and in others it involves new solutions. A representative from Vinnova talked about how companies new to the defence sector often derive needs from established actors. The representative further stated that it is not necessarily because they have access to more information, but rather that they are able to interpret the information in a better way. Furthermore the Vinnova representative described how established actors have access to markets outside of Sweden which means that they have information about needs outside of Sweden.

Regardless of how the need is initially identified a common theme was the importance of interaction with end-users and understanding the operational context. E3 emphasized that all development depends on understanding of how the solution is used in practice. Further stating that without interactions with users and actors in the industry, the startup risks developing a solution based on assumptions. S4 described their progress as strongly connected to the fact that their CEO had traveled extensively, met actors in the industry, and through this identified needs, partnerships, and potential business opportunities. Similar views were brought up by Vinnova who stated that needs often emerge as you build credibility, gain security clearances and gain closer access to industry actors. A representative from Vinnova continued by stating that validation is often necessary to get closer to the need and that the validation is often made in a civil context. This was also observed during the presentations where many emphasized the civil validation and that they now seek defence collaborations.

5.1.2 Access to stakeholders

Several interviewees highlighted that identifying a need does not necessarily imply access to the relevant stakeholders. Some startups such as S1 and S3 had natural access to the end user as they themselves were one. However they experienced difficulties in accessing stakeholders other than end-users. In S1's case, they described

that they had support and validation from end-users and stakeholders close to the end-users. However they experienced difficulties with other stakeholders, where additional validation and proof were required to proceed further.

I2 emphasized the importance of distinguishing between user, decision-maker and buyer as well as interacting with all of the stakeholders. They described it as a common mistake that startups often build something themselves because they think it is interesting, not engaging with the stakeholders enough to get feedback. I2 goes on in saying that the organizations not only need to understand the end-user but also who owns the problem, who makes the decision and who purchases the solution. In I2's experience, companies that succeed in the defence field work close to the stakeholders from the start and have an understanding of their reality. This is also supported by I3, who states that a supplier must understand not only the expressed needs but also how the product or service is actually used. I3 goes on stating that the supplier does not create value alone, but through the customer. Several of the interviewees highlighted this and had different explanations as to why it occurs. I3 stated that the authorities are required to have an arms length distance to the suppliers per the procurement laws. E3 also mentions this, stating that it is difficult for suppliers to understand the need without access to the customers context. In addition to the challenge associated with the arms-length principle, a common challenge was understanding the structure of the authorities. E4 states that startups often lack knowledge of who to talk to and how the system actually works. Many agree with this sentiment, feeling that it is difficult to understand the decision making structure and the process of taking a need to a purchase. That it is often difficult from an outside perspective to understand which people or departments are involved in the different steps in the process. In talks with representatives from FM and FMV, they think it is difficult to understand the structures and the system. I2 argues that if you establish contact with the right person you get easier access to key information but also states that reaching the right person is difficult and depends heavily on which field your company operates within and your value proposition. It should also be noted that several interviews highlighted the fact that the needs differ between the stakeholders. The end-users may prioritize one aspect while the decision maker prioritizes another. The procurement may differ vastly from the expressed needs from the end-user as the translation from need to specifications often alters the initial need.

As access to stakeholders within the authorities is often difficult, many startups attempt to form a partnership with established companies within the defence industry. A representative from Vinnova explains that startups and smaller organizations rarely are able to commercialize independently. Instead they use established organizations which often has a better understanding of the processes and the structures involved. As mentioned previously Vinnova talk about how established organizations often has insights into other markets and can help to identify opportunities outside of Sweden. E1 states that they have a very good relationship with the authorities and that it is common for them to recruit from the authorities and vice versa. E2 contributes with the perspective of established company by stating that they can

support startups with their competence and network. However, E2 expressed that many startups lack a clear business model and contact with the end-customer stating that they are approached by many inventors that have, in their mind, an interesting idea. For them it is important that the startup has considered the intended market, established that there is a willingness to pay for their solutions and how their solution fits into the existing product or service.

5.1.3 Defining the value proposition

Another recurring theme concerned the value proposition. Several of the interviewed startups described that they had a broad scope in that their solution could have a wide range of use-cases. However, many interviewees from startups and established companies, also emphasized the fact that a more focused offering is necessary to succeed in establishing partnerships and securing funding. S1 described that their solution could be used broadly, but that they narrowed down their offering to showcase a specific and tangible use-case that could be more easily understood and evaluated. I2 also highlighted the importance of narrowing the value proposition stating that *"if everyone is the customer then no one is"*. Going on saying that startups eventually need to identify a primary customer and to clarify who is actually willing to pay. By keeping this in mind, startups can avoid building "nice to haves" and instead focusing on paying customers. However, conversations across most interviewees also involved the fact that the value proposition is something that evolves over time. Similar to identifying customer need, startups describe how their value proposition evolves over time.

E2 provides a similar perspective. As mentioned previously, E2 stated that many startups lack a clear business model. E3 shares similar views, stating that it is not only about how the value is created. Rather that it is also important how the value is delivered, for example through contracts and collaboration. E2 also mentions the importance of integration into the existing solution, which I1 also states as a key part of the value proposition that startups sometimes fail to consider. I1 goes on stating that the authorities have expressed the need for more incremental solutions. I3 adds that the value proposition is not only addressed in performance or price but also criteria such as resilience, flexibility, production capabilities, lead times and repair services which has become more important. I3 goes on in mentioning that the value creation may differ substantially in times of peace versus in a conflict scenario. I3 also mentions the fact that suppliers often lack understanding about the value creation in general as a result of what he calls the arms-length distance. This is related to procurement-laws which prohibits the authorities to have a close collaboration with the suppliers in a way which gives an advantage to one supplier over others. That is to say that all should have access to the same information.

Validation was also a key point in the discussion of the value proposition with the interviewees. Across several conversations it was emphasized that validation and practical use-cases were often a prerequisite for collaborating with both the authorities and established organizations. S1 described how they were rejected because

they could not provide sufficient proof of soldier utility, while emphasizing that such proof is difficult to obtain in the defence context. S3 had combat testing and proof of performance stating it as a key part of their value proposition. A representative from FOI described self-assessed TRL as a way to both judge and to show validation in whether a technology is mature enough. As mentioned previously many respondents stated that validation is often easier to achieve in civilian contexts where feedback is more accessible, testing is more readily available and an iterative development process is more feasible than in a defence context. For example S5 described how their product was used in a civilian context and how they now wanted to validate it in a defence setting. S4 highlighted that startups may need to develop a product or prototype not only as a final solution, but as a way to demonstrate the underlying technology and capability.

5.2 Funding

The empirical material highlights funding as a central challenge for startups, particularly in the transition between early-stage support and later-stage investment. In this section, findings are presented regarding access to capital, investor fit, dual-use, and the structural gaps in the financing system.

5.2.1 Early-stage funding and the financing gap

Several actors describe early financing as relatively easy, while later phases are more difficult. In S1 and S2's case, the companies are described as being financed mainly through soft funding without dilution, such as grants from Vinnova or private funding. S4 described themselves as solely relying on soft funding and stated that they are currently looking for VC investments. The company is described as being in a pre-seed stage and as not yet having taken in real outside investment. However, S2 perceives that the increased soft-funding options has increased the competition and has attracted unserious actors. S2 goes on stating that some funding programs reward ambitious and innovative claims.

A significant problem described is that some companies are too small for many venture capital investors, who prefer to enter at a later stage and with larger amounts. At the same time, these companies do not have the capital to rely on self-funding. In S1's case, this means that they rather look for angel investors than larger venture capital actors. However S1 also experiences challenges with identifying angel investors. I2 also adds that early financing through Vinnova or Almi Invest is relatively easy, but describes the situation after that stage as considerably more difficult. It is further described that once a project becomes large enough, capital becomes available again but that there is a lack of funding between early and later stages.

E3 offers a similar view, although from a broader system perspective. They argue that grants may help firms move some distance forward, but that there are few mechanisms that support the next step once a company needs to scale, hire, or make larger development investments. According to E3, the issue is not only lack of

funding, but lack of structures for sharing risk in the phase between early validation and actual procurement. E3 adds that the financing system of today is not designed around startups and SMEs.

5.2.2 Finding the right partner

Several of the interviewed startups were open to collaborating with established companies. S1 described how established organizations were interested in their solution, but were not interested in investing at this time. E2 described how they invest in SMEs, but that the companies approaching them often lack a clear business model and sufficient contact with the end customer. E3 offers a similar view in that startups often lack knowledge about the defence landscape and have failed to consider key aspects of their offering. However, E3 also mentions that in some cases a partnership or acquisition may happen relatively quickly if there is a clear match.

I1 provided an example of a company that had been dependent on soft funding and was ready to bring in larger amounts of capital, but struggled to find a suitable choice. A challenge is to find the right investor, who not only contributes with capital, but also with knowledge and network effects. S4 also emphasizes this, stating that there are not many investors who provide value beyond capital.

5.2.3 Dual-use as a funding enabler

I1 suggests that companies working within defence need to have a civil market as well in order to stay competitive. Dual-use and the ability to build a parallel civilian market are described as important for survival because they spread risk and secure revenue while defence cycles remain long. This is also described as attractive to investors. It is also stated that defence companies might have other exit strategies compared to purely civil companies, in the sense that a common goal of a civil company may be to undergo an IPO, whereas for a defence company, a common goal may instead be partnership with or acquisition by an established company. A representative from FOI notes that dual-use is desirable because it reduces dependence on a single customer and increases commercial possibilities, which an interviewee from Vinnova also supports.

5.3 Commercialization pathways

The empirical material suggests that commercialization in defence and dual-use has multiple, viable routes. In this section different pathways are presented.

5.3.1 Partnerships as a pathway

A common theme in the material is the fact that partnerships with established actors function as one of the most accessible and realistic commercialization pathways. I1 states that in the defence sector, the business strategy is often partnership-based.

I1 goes on in stating that partnerships addresses the key issue of access to the customers and understanding the customers. A Vinnova representative reinforces this by stating that companies new to the defence sector often derive needs from established companies. This is also supported by I2 who argues that many startups should not consider FMV as the customer, but rather established actors. I2 described that established actors understands the system and have existing relationships. I3 made a similar point in that established actors have an understanding of the complexity involved in procurement, customer contracts and the overall ecosystem.

This is further supported by the established companies. E2 describes themselves as helping startups with networks, contact with customer and offers support. E4 presents itself as a bridge between SMEs and system integrators. E1 presents a structured evaluation process which can result in partnerships, supply chain roles or acquisition. E3 also talks about how they are interested in both acquisitions and partnerships, if they find a match. They further describe that even should it not be a match, informal partnerships could still be established to provide guidance and insights. E3 also mentions that many small companies approach them for partnerships at an early stage. They go on stating that a clear business model is sometimes lacking. Similar views were shared by E2 who states that startups often lack a business model. However, both E3 and E2 say that especially interesting solutions may not require a clear business model.

5.3.2 Acquisition as a pathway

The material shows that acquisition is another pathway which some startups pursue. I2 mentions how many firms see an exit through established actors as the end goal. As explained in the previous section acquisition is one possible outcome when being evaluated by E1. A representative from Vinnova argues that a possible exit through acquisition depends on the firms ambition. If the goal is to develop to a certain point then that pathway can be suitable. But if the ambition is to build a large company, acquisition and tight partnerships may be the wrong path as the startup risks losing control. I2 also mentions this and how firms need to consider the implications of an acquisition.

The acquisitions may not only be done by Swedish defence companies. I2 mentions how there is a trend where Swedish defence startups are being acquired by Ukrainian defence firms. According to I2 this is driven by Ukraine's strong demand and Sweden's relatively lower labour costs compared to Ukraine's.

5.3.3 Independent commercialization

Although independent commercialization is a pathway, the material suggests that it is the most difficult one. Interviewees from both FM and FMV described confusion around procurement and the decision making processes, even among people inside the organization. I3 explains how suppliers must adhere to the procurement rules and work within the legal frameworks. I3 does mention that there are some areas

in which the procurement rules are not enforced in the typical way. Primarily in the case of systems and solutions which are especially important for the nation's security. However this is an exception and not the rule.

Furthermore, the material shows that defence customers expect evidence of the product's value. FMV describes how it is a major advantage when a solution has been validated, ideally in combat. S3 explained how their validation in Ukraine is a big part of their offering. I2 mentions how important testing and validation is, but also warns that firms should be close to a sharp product before testing with the authorities as failed demonstration may negatively affect future opportunities.

E3 argues that Sweden lacks structures which translates political ambitions into market access for smaller firms. According to E3 once a need has been identified, there are no mechanisms for helping smaller firms to finance the next steps. Meaning that even when demand exists, smaller firms struggles with transitioning from prototype to procurement as there is no support offered. FM and FMV provides additional insight, stating that previously, the constraint has been the budget. Now, the constraint is time. According to them the system has not yet adapted to the increased budgetary willingness to integrate new technologies.

However, the material does not suggest that direct commercialization is impossible. A representative from Vinnova highlights that pre-commercial procurement as a pathway where authorities do not procure a finished solution, but rather fund the development of one. Based on the material this is rare, but I2 offers an example of a startup which received funding from the authorities to develop their solution. E3 also mentions how a key point of discussion in the industry is how Sweden can reward abilities. E3 goes in describing how in Ukraine, firms receive funding to develop and to do research within certain areas, such as drones and autonomous vehicles whereas in Sweden, finished solutions are purchased.

Finally FM mentioned that all major branches in the armed forces, have innovation units which focus on identifying and developing innovation relevant to their operations. Though little additional information about these units were provided, it was suggested that private companies may be able to collaborate with these units if their solution is deemed to be relevant.

5.3.4 Civil versus defence market entry

A clear theme throughout the material is that many startups should look towards both the civil market and the defence market. A representative from Vinnova states that they have broadened their focus beyond startups to companies that have an established civil business. Further, they state that many firms need to be mature and a civil business to enter the defence market at all. FOI supports this in stating that dual-use is desirable as it reduces dependencies on one customer. I1 goes further in stating that the only true competitive firms are the ones that have a dual-use strategy as it spreads risk and secures revenue over the long procurement cycles. E3

states that having a civil market has historically been important. Previously, suppliers have been required to build a civil business in parallel to reduce risk exposure and to avoid dependence on military contracts.

The material also shows that having a civil market is not only about revenue but also about validation and regulatory flexibility. I2 advises firms to separate civil and military versions of their solutions, because once a product is classified as military material, it is very difficult to reverse that classification. Vinnova also notes that some firms set up separate structures to appeal more to civil-market investors and because they want to keep developing on the civil side, where the environment remains more open.

5.3.5 Expansion beyond Sweden

While the thesis primarily focuses on the Swedish market, the material shows that markets beyond Sweden have relevance. Vinnova emphasizes that Sweden is export dependent and that companies aiming to scale will have difficulties in doing it in Sweden alone. They argue that firms need international collaborations and customers, and depending on their solution, foreign markets may be easier to penetrate. At the same time they emphasize that targeting global markets could be strategic. For example by assessing NATO capability targets and the different markets' intended roles in order to identify where their offering is most relevant. I2 argues that it is often easier to supply the Finnish or Polish defence sector compared to the Swedish. I2 further argues that having orders from other nations makes it easier to gain entry to Sweden.

While markets outside of Sweden present opportunities, it also presents challenges. The material show that some startups mention the fact that understanding and reaching global markets presents different challenges than those in Sweden. Many startups mention collaborations in order to penetrate global markets as it is difficult for them to understand the different markets and the structures involved, even if they in some cases are less bound by rules than Sweden.

5.3.6 Accelerator programs

Accelerator programs were discussed by several respondents. I2 generally thought well of accelerator programs, but noted that there are many different ones, and that the quality of them varies. Furthermore, I2 recommended to consider your solution, and see if established companies relevant to your startup are participating. In general, interviewees thought accelerators were valuable but several noted that it depends on where you as a startup are and your experience.

During talks with startups and SMEs at a networking event, several companies talked about that the main value of accelerator programs is related to networking. However, several also mentioned that it may be very valuable information if you are new to the defence sector. S2 described accelerator programs as a way to network

and to increase exposure. S2 goes on stating that the value is not in education or advice but rather in meeting with stakeholders and increasing the chance for opportunities.

5.4 Innovation and system integration

A high degree of novelty is not the same as being easy to introduce, but rather the opposite according to several sources. Across interviews and other material, implementation readiness is described in relation to factors such as maturity and incremental or radical innovation.

5.4.1 Maturity

From the interviews, this distinction between innovation and implementation is expressed particularly in S2's case. There, the interviewee explicitly stated that TRL and ease of integration are not the same thing. The company's subsystems are described as relatively mature, while the overall system remains complex and difficult to integrate. The company described their collaboration with a larger manufacturer as a way to facilitate implementation and system integration, because technical maturity is not enough to reach the market.

A similar pattern appears in S1. There, the product is described as not being based on "extreme deep tech", but rather on taking existing technology in a new context. S1 further states that the company moved from a more advanced product, to something that should be usable on a mobile phone, because it was cheaper, more accessible and considerably easier to disseminate to a large number of users. The interviewee described it as reducing technical sophistication in order to make it easier to implement. In S3's case, implementation was deemed easier because of relatively low level of innovation. In this case, the product itself was not revolutionary, but is easier to use and with a more sophisticated interface.

The representative from FOI brought to attention that implementation readiness is not only assessed through novelty, but also through maturity, continuity and realism. FOI described that part of their work is to review self assessed TRL levels in order to determine whether a technology is mature and relevant. Innovation is also described in broader terms, including methods and ways of working instead of only hardware. At the same time, continuity is described as a challenge in the sense that if a company goes bankrupt or changes ownership, the ability to supply FM/FMV is compromised.

A representative from Vinnova further described maturity in relation to dual-use as something broader than a purely technical issue. It is not enough for a technology to be technically mature in the sense that it functions well in isolation. The offering must also work in both a commercial and defence related context. More specifically, they emphasized that companies often need to progress along two paths at the same time. One path concerns commercial viability, such as customer inter-

est and the ability to generate revenue. The other concerns mission side adoption, where the company must show that the product is relevant for defence or other public mission contexts and adapt the offering to those needs. Maturity is therefore described as more than TRL, but also through non-dilutive government funding readiness, dilutive funding readiness, as well as commercial and mission customer readiness.

5.4.2 Incremental or radical innovation

I1 describes several situations where innovation is contrasted to implementability. One recurring point is that success requires more than novelty and further states that "it is not lack of innovation" that is the main issue, but rather culture and the fact that civilian and military business strategies differ. There is also a strong warning that some startups can "burn their own bridges" by promising significant leaps in innovation, but which is not technically or otherwise feasible. They further argue that promises of high novelty or innovation can be perceived negatively if they are not matched by realistic implementation paths.

This is further emphasized by I2, who criticizes startups whose solutions may appear highly innovative but are difficult to integrate into existing systems or lack a realization plan. I2 further states that defence actors often ask for more incremental improvements and for solutions that function with existing systems, rather than radical innovations that require major system changes. Another point I2 makes is that companies need to understand the difference between nice to have, and need to have features that the customer is willing to pay for.

I2 additionally states that "firms should move from PowerPoint to actual prototypes" as quickly as possible. Testing is described as crucial, but should be done with caution. Private testing is part of product development, but a test with FMV/FM or private company representatives should only be considered once functionality is at an acceptable level as it is difficult to obtain a subsequent opportunity, should the first attempt fail. Several interviewees further emphasize that testing is crucial for development, but that the opportunities for testing are limited.

5.5 Regulation and permits

Issues with ISP and export control are described by S2 as important, but often difficult to assess early. Their assessment is that their product does not clearly fall under war materiel, and that ISP becomes most relevant when one actually handles such materiel. S3 reasons in a similar way.

I2 further describes dual-use as a regulatory issue linked to export control, and that a civil product adapted for military use may be classified as military equipment, and that once such a classification has been made, it can be difficult to reverse. Several interviewees also state that companies often want to delay potential security classifications since they might hinder the civilian part of business as well as limit

the ability to develop the product publicly. However, Vinnova states that security clearances allow companies to access classified information. I2 states that the company's own view of what the product is for is not decisive, what matters is the interpretation of the regulatory framework by the relevant authorities. It is further described that Sweden's interpretation of the rules are relatively strict compared to other countries in the European Union. Additionally, should something be considered a military invention, the state might confiscate it according to I2 and the representative from Vinnova.

Although regulation and permits were not generally described by interviewees as the most significant barrier for startups in the early stages, several respondents still emphasized that regulatory processes can be time and resource consuming. Some interviewees described public authorities as operating according to a compliance oriented logic rather than a business logic, where avoiding mistakes appeared to be prioritized over enabling business progress.

Security protection is also described in relation to data handling and information sensitivity as well as affecting personnel and recruitment. In several cases, across interviews and networking, several stakeholders mention that an employee's background can affect the ability to work within defence. Several respondents noted that Swedish or allied country citizenship may simplify security related processes.

6

Challenges

This chapter answers **RQ1**: *What challenges do startups face when attempting to commercialize in the defence industry?* It is categorized in the five established dimensions.

6.1 Needs and value creation

This section presents findings with regards to customer needs and value creation, as well as value signaling.

6.1.1 Identifying the customer need

The empirical material surrounding need and value creation suggests that startups do not only struggle to identify what the customer says it needs but also how the customer creates value in use. The lack of insight into value creation makes it difficult to understand what constitutes value for the customer. According to the service logic value is created by the customer in use by integrating existing resources (Grönroos, 2008). Furthermore, Grönroos (2008) states that customer need is an abstract concept that reflects what the customer perceives as valuable. The arms-length distance as discussed in chapter 5.1.2 and in the Vinnova reports, creates the issue that the suppliers, including startups, lack understanding in how the customer creates value. Instead they often rely on the authorities' ability to express their needs, which is consistent with findings from the Vinnova reports indicating weak dialogue and low transparency around actual military needs. In the empirical material 5.1.3, I1 mentions that the authorities have expressed the need for more incremental solutions. While this may certainly be the case, it could also suggest that the result of relying on the authorities' ability to express their need is that the needs are heavily focused on existing solutions. However, due to the arms-length principle it is difficult for startups to develop solutions which are based on existing solutions. Additionally, Welsh and Narby (2025) describe that the process of translating needs into requirement specifications may fail to accurately translate the needs.

Key challenge 1: Startups lack insight into how value is created in the customer's context which makes it difficult both to improve existing solutions and to develop new, innovative solutions.

However, needs may not only be identified through the authorities. Section 5.1.1

shows that needs are also identified through experience as an end-user, through established companies and general involvement in the defence ecosystem. Section 5.1.1 also suggests that the initial needs are often used as an initial direction for startups that evolve over time through interaction and exposure to the industry. For example Vinnova states that companies often get closer to the actual need after validation, building credibility and through interacting with people in the industry. This can be interpreted as consistent with an effectuation-based logic as described by Sarasvathy (2001). Rarely are they able to operate through a predefined goal associated with the causation-logic due to the lack of information. Rather startups rely on emerging insights which guides them through the next steps. Startups often begin with a general direction which is based on the founders experience, competence, interest and a general understanding of the need/problem.

Key challenge 2: Startups face difficulties in adapting their offering to the specific needs of the defence actor due to limited access to information.

Furthermore, I2 in section 5.1.2 suggested the need to distinguish between end-user, decision-maker and buyer. This aligns with Jobber and Ellis-Chadwick (2020) regarding general roles involved in business to business procurement. Although a detailed overview of the different roles involved are not possible due to lack of information. *Figure 6.1* showcases a simplified overview of the roles involved:



Figure 6.1: *Example of different stakeholders in the acquisition process. This image is AI-generated.*

In some cases the startups have relatively good access to the end-users, however in nearly all cases the startups lack access to the decision-maker and the buyer. This

creates the challenge of developing a solution which may be considered useful by those close to the operational problem but fail to progress to other stakeholders. The decision-maker may, as in the case of S1 in chapter 5.1.2, require proof of value, or may prioritize other aspects than the end-user. The buyer, typically FMV in Sweden attempts to translate the need into specifications which may poorly reflect the end-users need. This aligns with prior research showing that needs are not static, but are shaped and transformed as they move between actors (Grönroos, 2008; Welsh & Narby, 2025). It is further supported by the findings in the Vinnova reports which identifies fragmented processes and layers between needs and procurement.

Key challenge 3: Startups need to understand not just one need, but the needs of several actors who together constitute the customer.

Another theme in the empirical material was partnerships with established actors. Section 2.1.2 showcases the defence supply chain and the different actors involved. As FMV typically procures larger systems, startups would typically enter as tier 1 or tier 2 suppliers, meaning that the direct customer is often either the OEM or a tier 1 supplier. As mentioned previously, Grönroos (2008) suggests that value is created by the user. Therefore, though the startup's direct customer may be an OEM or tier 1 supplier, value is realized at the level of the end-user. Additionally, the empirical material states that established companies typically want their collaborators to have contact with the end-customer. At the same time, Vinnova emphasizes that established actors often play a key role in interpreting needs. In addition, established actors often operate across multiple markets, giving them insight into how needs differ between countries and regions.

6.1.2 Demonstrating and signaling value

The empirical material shows that startups often begin with a broad value proposition which is narrowed as the startup matures. A recurring theme in the empirical material is how organizations new to the defence industry often must start with a broad understanding of the need and by interacting with people in the industry and showcasing competence and validity, gradually get closer to the need. The value proposition is dependent on the understanding of need, as this understanding increases, the offering becomes more focused. This process is closely tied to signaling theory (Connelly et al., 2011). Signaling in this context may occur through interactions with people in the industry, by prototypes, combat testing, or by civil use-cases. In other words, startups signal qualities and by doing so can gain access to information that was previously unavailable to them.

Key challenge 4: Startups need to effectively signal their qualities and demonstrate their current value based on the information available to them at the time.

Additionally, section 5.1.3 shows that criteria such as resilience, flexibility, production capability, lead times, repair services, peace versus war-time application, and fit within existing systems are also relevant measures. The offering is therefore not

only assessed as a stand-alone solution but how well it integrates into the existing system. Again this aligns with the theory mentioned by Grönroos (2008), which states that value must be understood through the customer's use rather than the solution in isolation.

Key challenge 5: Startups need to not only demonstrate value, but may need to demonstrate it across more than one measure.

This also ties in to the fact that civil validation is a recurring theme in the empirical material. The civil market offers a more open environment for development. Civil applications may therefore function both as a way to develop the offering and to signal qualities to defence actors. Civil validation is therefore not only a separate market but a way to signal value and subsequently gain access to information which allows for a better aligned value proposition towards defence. This finding is also supported by the Vinnova reports, which describe co-creation between demand-side actors and solution providers as central for translating needs into useful applications.

Key challenge 6: Startups with a dual-use strategy need to identify how their solution can be adapted to a civil use-case that demonstrates its value to defence actors.

6.2 Funding

This section presents challenges related to financial constraints as well as the value from investors.

6.2.1 Bridge between early stage funding and late stage funding

The empirical material suggests that funding in the early stages is relatively accessible. Nearly all interviewed startups described receiving grants from Vinnova or Almi Invest. As noted in the empirical material, several startups relied on soft-funding through grants. The theory in chapter 4.2.1 which states that non-dilutive funding is often the result of the will to support research and development within certain areas Wood (n.d.), which is aligned with Sweden's ambition to increase defence spending and capability.

The challenge comes during the mid to late stages of funding where several startups described issues in securing funding. S1 described that they were considered too small for venture capital, but also struggled in identifying angel investors. Several startups are open for partnerships with established organizations. And while that may seem like an option, the empirical material suggest that an established business model is often a prerequisite, indicating that they may seek startups which are more mature than many of the interviewed ones. This aligns with the concept of Valley of Death described in section 4.2.3, where startups struggle to transition from de-

velopment to commercialization (Auerswald & Branscomb, 2003).

The empirical material further suggests that the issue is not only lack of funding, but lack of mechanisms that support the next step once a firm needs to scale, hire, or make larger development investments. In this sense, the gap appears to concern both access to capital and the lack of structures for sharing risk between early validation and later implementation.

Key challenge 7: Startups need to identify suitable funding that allows them to cross the Valley of Death.

6.2.2 Value from investors

Several respondents highlight the importance of finding investors who contribute with knowledge, networks, and strategic support. This is aligned with theory in section 4.2.2, where different forms of dilutive funding are described as providing varying levels of value beyond capital (Drover et al., 2017). In this context, value consists not only of financial resources, but also of market understanding, customer access, and support in navigating a complex defence ecosystem.

At the same time, the empirical material suggests that investor expectations may create additional challenges. S2 describes how investors may reward companies that present ambitious or innovative narratives. This aligns with theory on hype and expectations, where strong narratives can attract attention and investment (Garud et al., 2026; Logue & Grimes, 2022; Rady et al., 2025). However, the empirical material also suggests that the authorities have expressed the need for more incremental solutions. This creates a tension between attracting investment in the short term and maintaining legitimacy in the long term. This tension appears to be particularly relevant for startups that focus on incremental solutions. Such firms may offer practical value but have greater difficulty competing with more ambitious narratives.

Key challenge 8: Startups need to balance ambitious narratives with credible implementable solutions.

6.2.3 Dual-use as a way of managing financing risk

Several respondents describe a civil market as important for survival, since it reduces dependence on a single customer and secures revenue while defence cycles remain long. In this sense, dual-use may function as a way of compensating for the absence of suitable defence related financing mechanisms in later stages, which aligns with dual-use as described in section 4.3.1 (Murray & Keselman, 2024). Furthermore, as mentioned in 5.2.3, a dual-use strategy may not only provide a source of revenue, but also increases the attractiveness to investors.

6.3 Commercialization pathways

This section presents findings related to commercialization.

6.3.1 Commercialization pathways and structural constraints

The empirical material suggests that there are multiple pathways towards commercialization. However, the material also suggests that the most realistic pathway is through partnership or acquisition. For example I1 describes partnerships as a dominant strategy in the defence sector. I2 argues that startups should consider the established actors as the customer and not the authorities. Furthermore, the empirical material suggests that independent commercialization is the most difficult pathway. The complexity of the procurement process, proof of validation, and structural barriers are important aspects. Additionally, section 5.1.2 highlights the difficulties of accessing key stakeholders. While this appears to be challenging for all suppliers, the established ones seem to have a better understanding of the processes involved and a better access to key stakeholders. This aligns with Teece (1986), which argues that complementary assets are key in securing financial returns from innovation. In this context the assets could be considered the understanding of the complex system associated with procurement, ability to integrate into existing systems, stakeholder relationships, access to testing environments and distribution channels. This helps in explaining why partnerships or acquisitions seem more realistic, and in some cases necessary.

Key challenge 9: Startups need to identify and access the complementary assets needed for commercialization.

6.3.2 Emerging pathways

The empirical material suggests that the commercialization pathway is rarely defined by startups. Instead, several respondents describe how they are open to a multitude of pathways. The Vinnova representative explains how startups gradually define their solutions over time through interaction. As the solution becomes more defined the commercialization pathways also become apparent. This is aligned with the effectuation logic in section 4.1.2 as described by Sarasvathy (2001), or the externally stimulated opportunity recognition as described by Bhawe (1994) in section 4.3.2, where emerging insights guide the direction.

However, the empirical material also suggests that first establishing oneself in a civilian context is advantageous. In a civilian context the access to customers, feedback and information is more readily available. This allows for a more structured strategy which is aligned with causation logic as described by Sarasvathy (2001). It may therefore be necessary to adapt the commercialization strategy depending on the market.

Key challenge 10: Startups need to adapt their commercialization strategy to

the market in which they operate.

6.3.3 Crossing the Valley of Death

E3 highlights the risk of long procurement cycles by stating that even when a need has been identified, there are few structures available to support startups in transitioning from development to procurement. This transition is commonly referred to as the Valley of Death as described previously. One key aspect of crossing this gap is access to funding (Auerswald & Branscomb, 2003). However, the purpose of the funding is ultimately to commercialize. Startups must therefore communicate a realistic commercialization pathway. The Vinnova reports similarly point to a gap between innovation activities and full scale procurement, where pilots may fail to lead to implementation despite technical promise.

This creates a challenge as the empirical material suggests that this gap is not only a question of funding, but also of system capacity. While earlier constraints have been related to limited budgets, representatives from FM/FMV describe how the current constraint is instead time. Despite increased funding and ambition to integrate innovation, it would appear that the system has not yet adapted its processes to absorb and implement new solutions at a faster pace. As a result, even when resources and demand exist, startups struggle to progress from prototype to procurement. Similar to section 6.2.1 it is a question of crossing the valley. However, a prerequisite to do this is to establish and articulate a credible commercialization strategy.

Key challenge 11: Startups need to articulate a credible early-stage commercialization strategy while navigating structural constraints.

6.4 Innovation and system integration

This section presents findings with regards to validation, solution maturity and implementation readiness.

6.4.1 System evaluation

Chapter 4 introduces two concepts that together clarify why maturity must be treated as more than a technological attribute. First, in chapter 4.4.1, Kapurch (2007) describes capability not as an isolated artifact, but as a system outcome involving hardware, software, people, processes and procedures across the life cycle. Second, TRL in chapter 4.4.1.1, provides an ordinal language for technological maturity, from early phenomena observation through proof in an operational environment. Read in isolation, TRL might suggest that progress is primarily an engineering maturation problem (Kapurch, 2007). However, as mentioned in chapter 2.4 it is emphasized that adoption decisions occur within a structured system.

From the interviews, an empirical observation is that technological novelty is inversely related to implementability and that implementation readiness is discussed in relation to compatibility with existing systems. In S1's case where the original product was deemed highly innovative, validation became more difficult to explain and integrate whereas in S3's case the product was already validated which was a success factor for them. With regards to the evaluation models as described in chapter 4.4.1.2, S3 was therefore high on TRL, ORL, LRL, with only minor adaptations needed to increase the end user proficiency in the system, whereas S1 had major issues with ORL and LRL, which has slowed their development pace.

Additionally, Murray and Keselman (2024) outline that dual-use potential may be assessed through a set of defined parameters. Given the significance of dual-use considerations, it was notable that the startups addressed the issue only to a limited extent, suggesting that their offerings could benefit from evaluation through a dedicated dual-use assessment framework.

Key challenge 12: Startups must demonstrate not only technological functionality, but also organizational fit and training feasibility, as high novelty can itself become a barrier to implementation.

6.4.2 Test

A struggle that mainly startups face is the limited access to testbeds or demonstration environments as stated in several of the Vinnova reports. The consequence of this is that it becomes hard for startups to generate the kind of evidence needed to show that a solution works under realistic operational conditions. At the same time, the validation is resource intensive as well as hard to determine what counts as sufficient evidence. The empirical material and the Vinnova reports, suggests that firms should move quickly from presentations to prototypes, yet testing opportunities, especially within defence is limited and the tests are associated with risks themselves. Should the startup deliver unsatisfactory test results, this would then signal that the company does not possess the capacity to deliver future value as per the signaling theory (Connelly et al., 2011).

Key challenge 13: Startups face not only challenges to accessing test environments, but also the risk of signaling that their solution is unfit to meet military needs.

6.4.3 Scale

Scale constitutes a barrier for startups because defence procurement is generally not limited to the purchase of a single product, but concerns long term supply, support and continuity over the system life cycle. The issue is then whether the startup can deliver reliably over time. Several findings indicate that continuity and organizational robustness matter in procurement decisions, which disadvantages startups with limited resources, revenue and production capacity. Startups may therefore

be seen as attractive sources of innovation, while simultaneously being perceived as risky suppliers.

Key challenge 14: Startups must demonstrate innovation potential, as well as provide credible long-term continuity and delivery capacity.

6.5 Regulation and permits

As described in section 2.2.1, companies that wish to produce, purchase or develop military equipment or associated technology require approval from ISP. The empirical material suggests that it is primarily the company's own responsibility to assess whether a product or service falls within the relevant classification. It is also mentioned in the Vinnova reports that civilian actors might be unaccustomed to the defence landscape, which can complicate collaboration. This places a particular stress on startups, since early stage companies often develop products whose final use case, customer segment and technical configuration are still evolving.

Regulation then is different from the other challenges identified in this chapter. The others can often be approached gradually while regulation is a binary barrier. If a company lacks the necessary permits, classifications or security conditions, certain activities cannot proceed. The difficulties related to regulation are therefore on one hand the permits themselves, and on the other hand the uncertainty regarding when the startup must treat regulation as a commercialization issue. This is especially relevant for companies which are pursuing a civil business as well. A startup may initially position its technology as civil in order to access a broader market, validate the solution and secure funding and revenue. If the product later becomes adapted to military use, the company may need to reassess if the solution falls under defence related regulation. Hence, the same dual-use strategy that created flexibility initially, may also cause regulatory ambiguity. Although firms may seek guidance from ISP, this interpretation is placed on the company. However, the empirical material suggests that this is not a substantial barrier at the early stages.

With regards to security clearance from SÄPO the interviewees mainly do not see this as a barrier because the awareness seems to be high. When handling sensitive information, a person must pass a security vetting by the employer, or SÄPO depending on security classification. In any of these instances, a register check also takes place as mentioned in section 2.2.2. Several interviewees do mention that they have taken precaution with regards to the nationality of their employees, as there are certain nationalities which could be disqualified from accessing sensitive information. Should a person not pass the security clearance, he or she may not work with the associated tasks, resulting in people being excluded from qualified work. Should a company or an organization not have the correct permits from ISP, consequently they are not allowed to continue their operations.

Security clearance thus adds additional layers of complexity. For startups, these requirements are difficult to separate from broader organizational development, and

can lead to situations where certain individuals are not allowed to work at the startup. Since startups tend to build their organizations quickly and with limited resources, decisions made before formal defence engagement may later influence their regulatory and security compliance.

Key challenge 15: Startups need to navigate regulatory uncertainty and timing of compliance, while preserving strategic flexibility.

7

Addressing the challenges

This chapter discusses how the challenges identified in Chapter 6 can be addressed. While Chapter 6 answered **RQ1** by identifying the main barriers startups face when trying to commercialize in the Swedish defence industry, Chapter 7 addresses **RQ2**: *How can startups address these challenges?* The discussion in the chapter is structured around the previous dimensions, but the challenges should not be understood as separate obstacles since they reinforce each other.

7.1 Needs and value creation

As discussed in chapter 6.1 startups often lack insight into the value creation, which makes it difficult to develop solutions that are either innovative or incremental (Grönroos, 2008). The arms-length principle, the translation of needs to procurement specifications and the multiple actors involved reinforce this (Hellberg, 2023; Welsh & Narby, 2025). Customer needs are therefore hard to identify and often expressed poorly. Interacting with the end-user provides useful input from one perspective. However, if the startup only validates the solution with the end-user, they may fail to commercialize due to failing to consider other stakeholders. To address this, startups are suggested to do iterative stakeholder mapping (Freeman, 2015). Firstly, startups are suggested to do a top-level map, for example:

- Authorities
- Financiers
- Competitors
- Suppliers
- Trade associations
- Incubators and accelerators

Next, deeper levels of the mapping can be done. For example, authorities may be categorized as follows:

- FM
- FMV
- FOI
- Vinnova
- ISP
- SÄPO

One or several additional levels may be suitable. For example, for FM, military branches, divisions and specialized units. The mapping should be guided by the definition of a stakeholder, that is groups or individuals that affect or are affected by the organization. The initial mapping should be done as early as possible to support early decisions such as attending accelerator programs, events as well as in interacting with stakeholders. As the startup interacts with stakeholders, the stakeholder mapping is to be updated. By doing so, the interaction and stakeholder mapping reinforce each other. Throughout the mapping, the other principles of stakeholder management should be considered (Freeman, 2015). Firstly, managing identified stakeholders, for example through interactions and networking, Secondly, by balancing the interest of different stakeholders.

Key challenge 4-6 concerns the startup's ability to signal and demonstrate value (Connelly et al., 2011). The findings indicate that startups need to narrow their value proposition to progress. One reason for this is that narrowing the value proposition allows for more effective signaling. A tangible solution and use-case makes it easier to evaluate. Prototypes can aid in making the solution more tangible as well as to signal capabilities and for validation. Furthermore, it can act as a basis for discussion and provide valuable feedback. Additionally, the findings suggest the need for considering value across several dimensions, not just the technical one. Rather, startups can address this by separating the value proposition into three levels. The first level is the technical one, what the technology does. The second level is the organizational/operational one, how the solution relates to the customer's organization and mission. Finally, the third level is the system one, how the solution integrates into the existing system.

Finally, civil validation can play a key role. The findings show that civil markets often have easier access to information and feedback. To successfully utilize a dual-use strategy, startups should not consider the civil market as a completely separate one. Rather, it can function as a method to signal qualities to the defence sector and its stakeholders. Furthermore it can provide credibility and evidence by having solutions used by customer in the civil market. An important consideration is how well the civil solution can demonstrate qualities that are relevant to the defence sector.

To summarize, the challenges associated with need and value creation can be addressed through stakeholder mapping, signaling value across multiple dimensions and by adopting a dual-use strategy. The stakeholder mapping guides direction and provides an overview of relevant stakeholders. This then becomes relevant when

considering what value dimension may be relevant for the different stakeholders. Additionally, the value proposition should be narrowed to effectively signal value across all relevant dimensions as well as to act as a basis for discussion and feedback. Finally, a dual-use strategy also ties into the value signaling in that an effective dual-use strategy allows for signaling across multiple dimensions.

7.2 Funding

Key challenge 7 concerns the Valley of Death and the need to identify suitable funding to cross it (Auerswald & Branscomb, 2003). While the Valley of Death is a common and known barrier for startups in any industry, it appears to be especially prevalent in the defence sector. Two reasons for this are the long procurement times and uncertain outcomes, creating a big risk for the startup and any potential investors. When possible, adopting a dual-use strategy is one way of addressing this. A dual-use strategy can provide revenue to support the startup during the long procurement cycles. Furthermore, the findings suggest that many actors in the defence industry value organizations who successfully enter the civilian market before the defence one. Therefore it can increase investor attractiveness. Both for the added revenue source and for the increased defence attractiveness.

Key challenge 8 concerns the need to balance ambitious narratives with credible and implementable solutions, which is related to hype as mentioned in the theory (Logue & Grimes, 2022; Rady et al., 2025). The findings suggest that there is increased competition in securing funding and that startups may be pushed to present ambitious narratives. However, the findings also suggest that defence stakeholders often value incremental improvements and implementability. This can create a tension in that narratives that attract investors may fail to convince defence stakeholders. To address this, startups are suggested to adapt their communication. Similar to the value signaling presented earlier, startups should adapt their communication depending on what the stakeholder values, instead of having a one size fits all approach to communication. Furthermore, startups should distinguish between vision and evidence. Vision can attract attention, but without evidence it may fall flat.

In summary, the challenges related to funding can be addressed through adapting the communication based on the stakeholder, having a balance between ambition and realism as well as adopting a dual-use strategy when relevant. The core issue is related to the uncertainty present in the defence sector. Startups need to address the uncertainty and communicate it to investors. Therefore, addressing challenges across the other dimensions can help overcome the challenges related to funding.

7.3 Commercialization pathways

The empirical material suggests that there are multiple pathways such as direct sales to the authorities, partnerships with established companies, acquisition, civil-first

commercialization and commercialization through international markets. Despite the multiple routes, some appear more realistic than others. Partnerships and acquisition appear to be the most realistic while independent commercialization seems to be the most difficult, based on the empirical material.

Key Challenge 9 concerns access to complementary assets (Teece, 1986). In this context, complementary assets could be procurement knowledge, customer access, system integration knowledge and capability, funding, production capacity, support, credibility and brand reputation, security permits and access to international markets. Based on the identified challenges alone, startups appear to have limited access to the necessary complementary assets. For example the challenges associated with value and need are associated with a lack of customer access and the ones associated with funding is related to a lack of financial resources. Established organizations often have access to these resources to a greater extent than startups which explains why partnership and acquisition is seen as the most realistic pathway. The question then becomes, how can startups identify and establish partnerships or be acquired? Similar to investors, startups need to address the uncertainty and therefore the other identified challenges. In a sense, established organizations acts as investors in that they need to be aware of the risk versus reward. To be perceived as credible, startups therefore need to identify the risks and the mitigation strategies as well as the reward and its associated path.

Key challenge 10 concerns the commercialization strategy and the need to adapt the strategy. As mentioned previously, the civilian market offers a more open environment. This may call for a different strategy than the one used in the defence market. While the focus of this thesis is not the civilian market, we would recommend startups to adopt a more causation-based logic (Sarasvathy, 2001). That is, identify the market and its competitors and identify a suitable segment. The reason for this is cause it allows startups to identify attractive segments which allows for effective signaling towards the defence sector across relevant dimensions. For example, if a startup develops a technology which is to be used during rescue mission, the startup may be able to identify a segment which shares characteristics with the defence sector and its intended use-case.

Key challenge 11 concerns the need to articulate a credible early stage commercialization strategy while navigating structural constraints. This is closely tied to funding and essentially comes down to addressing uncertainties. Therefore, similar strategies can be applied as when communicating with investors and established companies. Furthermore, the strategy should be emergent and guided by two aspects, complementary assets and validation (Teece, 1986). Complementary assets, as outlined earlier can be developed interdependently or gathered from partners. Validation and its importance were a recurring theme in the finding. In some cases, independent validation may be possible through internal tests and demonstration. However, in others it may require partnerships and/or civilian validation.

Finally, international markets are of relevance. The findings suggests that inter-

national commercialization can both be easier in some markets and increase the chances of entering other markets through validation. Though international markets have not been extensively studied in this thesis, it is reasonable to assume that similar challenges are seen in other markets. Furthermore, the findings indicate that partnerships can aid in reaching international markets which makes the recommendations on partnerships relevant in this context too. Furthermore, the roles of different countries in NATO should be considered as well.

In summary, the commercialization challenges can be addressed by identifying one or several pathways suitable for the startup. It should be guided by access to complementary assets and validation opportunities. When relevant, a dual-use strategy may be adopted. When doing so, startups should adopt a more causation-based logic to identify attractive segments which effectively signals value.

7.4 Innovation and system integration

As mentioned in chapter 6.4.1, a central barrier for startups is that high technological novelty can make a solution harder to explain, validate and integrate. A startup may have a technically functioning product, but still struggle if the solution does not fit within the existing organization. Hence, key challenge 12 states that "Startups must demonstrate not only technological functionality, but also organizational fit and training feasibility, as high novelty can itself become a barrier to implementation". This makes TRL insufficient on its own. Readiness should instead be communicated through a broader assessment that also includes URL, ORL and LRL as proposed by SOFF (2019). This broader readiness perspective changes how startups could present their solutions. Instead of stating only that a prototype works, they should explain what is required for adoption. Who needs to be trained? What existing systems must it connect to? What routines must change? What data or security requirements apply? What maintenance or support is needed? What legal or ethical issues must be clarified? These questions are not easy to answer, but the creator of the solution should consider these aspects when marketing their solution.

As with all dimensions, adopting a dual-use strategy may be advantageous. By this point it may be helpful to clarify and summarize why a dual-use strategy is suitable and relevant. While we would argue that a dual-use strategy in many cases is necessary when attempting to penetrate the defence sector, some aspects appear to be especially relevant. First, the civil market allows for a more open environment with easier access to feedback. Second, the civil market provides a source of revenue and may increase investor-attractiveness. Third, the civil market provides an opportunity for validation and may therefore increase the startups overall credibility. However, it is important to consider how well the proposed solution can be adapted to a civil market. *Figure 7.1* acts as a visual representation of the defence and civil solution.

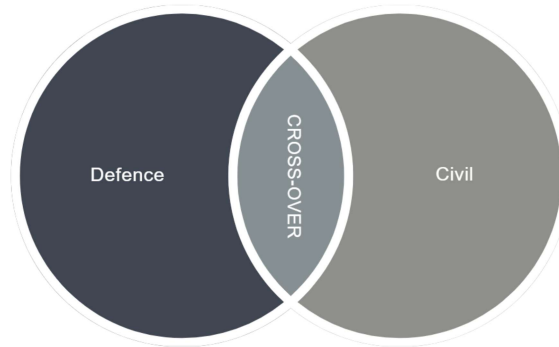


Figure 7.1: *Defence and civil solutions cross-over*

When adopting a dual-use strategy, the figure is ideally one, single circle. However, this is not possible in most cases. Rather, a large cross-over can indicate that a dual-use strategy may be suitable and can therefore effectively act as validation. The benefits of a dual-use strategy is evident from the empirical material, where several respondents suggest that dual-use is a prerequisite for success. The term dual-use is relatively new, meaning there have not been done many studies on the subject which could further support this claim.

Key challenge 13 concerns testing. Startups need access to realistic test environments, but testing also carries signaling risk. A successful demonstration can increase credibility, but a failed demonstration may reduce credibility and make it harder to gain future access. This means that startups should distinguish between internal testing, civil validation, partner testing and defence-facing demonstrations. Early tests should be used for learning and iterative product development. Defence-facing demonstrations should be treated as credibility events and should only occur when the startup can reasonably control the risk of failure. However, the type of test should match the maturity of the solution. A low-maturity prototype can be tested privately or with close partners to generate learning. A more mature prototype can be tested with civil users or in controlled environments to generate evidence. Only when the startup can demonstrate reliable proof of concept, should it seek tests with defence authorities or high-stakes stakeholders.

Key challenge 14 concerns scale and continuity. Defence procurement is rarely only about buying a product. It often involves long-term supply, maintenance, upgrades, documentation, security, support and integration over the system life cycle (Hellberg, 2023). This creates a disadvantage for startups, which may be innovative but lack the organizational robustness expected of defence suppliers. Startups must therefore show not only that they can innovate, but that they can deliver reliably over time. There are several ways to address this. One is to partner with established companies that can provide production, support or sustainment capabilities. Another is to design the offering so that it can be adopted in limited modules rather than requiring full-scale system transformation from the start. A third is to build credibility through civil customers, certifications, quality routines and documentation. The key is to reduce the perceived risk that the startup will be unable to

support the solution after adoption. This also connects to the debate between radical and incremental innovation. The empirical material suggests that defence actors may often prefer incremental improvements that fit existing systems, while startups and investors may be drawn towards more radical innovation narratives. The implication is not that radical innovation is irrelevant, but that high novelty increases the burden of proof. The more a solution differs from existing systems, the more the startup must explain integration, training, legal, organizational and sustainment implications. Incremental solutions may be less exciting from an investor narrative perspective, but they may be easier to validate and adopt.

In summary, innovation and integration challenges can be addressed by treating defence adoption as a readiness problem rather than only a technology problem. Startups should demonstrate technical function, user readiness, organizational fit, legal awareness, testing evidence and continuity capacity.

7.5 Regulation and permits

The fifth dimension concerns regulation and permits. It has been previously noted that regulatory barriers are somewhat different from the other challenges because they are often binary. If the company lacks the necessary permits, classifications or security conditions, certain activities cannot proceed. At the same time, the empirical material indicates that regulation is not always perceived as the most immediate early-stage barrier. Hellberg (2023) also describes the Swedish procurement law as shaped by an arm's length distance between procurer and producer.

Key Challenge 15 states that startups need to navigate regulatory uncertainty and timing of compliance while preserving strategic flexibility. This is particularly relevant for dual-use companies. Early classification as military equipment may create restrictions that affect export, investment, public communication, product development and civil market opportunities. At the same time, delaying regulatory assessment too long may create risks if the company later discovers that permits, classifications or security requirements block planned activities. Although there seem to be few known cases of permits being revoked by ISP, the possibility still exists. The consequences of a violation also differ, minor violations may come without economic cost if they were done without ill intent. This reduces some uncertainty, but does not remove the need for early regulatory awareness.

Startups should therefore treat regulatory readiness as a staged process. In the earliest phase, the company should identify whether the product, technology, data, customer relationship or intended use may trigger defence-related regulation. In the next phase, when the product direction, customer type or market becomes clearer, the startup should seek more formal guidance or expertise. Before entering defence contracts, handling sensitive information or adapting a civil product for military use, the company must ensure that the relevant regulatory requirements are understood and authorized.

This staged approach helps preserve flexibility. It allows the startup to continue developing civil applications where possible, while avoiding regulatory surprises that could undermine defence commercialization. It also strengthens credibility towards investors and partners, since regulatory uncertainty is one of the risks they must evaluate. A startup that can explain its regulatory assumptions, risks and planned actions is more credible than one that treats regulation as a later administrative issue.

Security clearance and personnel considerations should also be integrated early into strategic planning. Even if the startup does not yet work with classified information, future defence collaboration may be affected by employee background, ownership structure, data handling, subcontractors and information security routines. These issues can influence both partnerships and procurement eligibility.

In brief, regulation and permits can be managed through early awareness and planned decision points. A startup should understand when specific regulatory questions must be addressed. This allows the company to preserve flexibility in early development while avoiding a situation where future commercialization efforts become unfeasible due to overlooked permit, classification or security requirements.

8

Discussion and conclusion

This chapter discusses the findings of the thesis in relation to the research questions. First, there is a reflection on the defence market in comparison to other industries, followed by recommendations for startups that are trying to commercialize in the Swedish defence sector. Finally, the chapter summarizes the thesis' contribution to research and presents suggestions for future studies. Since the Swedish defence ecosystem is undergoing rapid change, the conclusion should be understood as a snapshot in time of the conditions identified during the study.

8.1 Comparison with other industries

The challenges identified in the defence sector can be better understood by comparing them with other highly regulated industries, such as those mentioned in section 4.3.6. These industries are not identical to defence, but they share several characteristics that are relevant for startups. In all cases, new firms must often navigate strict regulation, long lead times, complex stakeholder structures and high requirements for credibility before their solutions can be adopted. This suggests that the challenges faced by defence startups are not only linked to defence specific conditions, but also to broader difficulties associated with entering regulated and risk sensitive markets.

Aviation provides a useful comparison because it combines high safety requirements, established industry structures and a strong dependence on trust. Startups within the aviation industry may have innovative solutions, but their ability to commercialize is constrained by similar challenges as those uncovered in this thesis.

In Medtech, a similar pattern manifests since it is not only about developing a functioning product but also about producing evidence, meeting regulatory requirements and gaining acceptance from authorities. This is comparable to the defence sector, where products preferably are technically validated. There are differences however, as the defence sector can be harder to interpret because it may be subject to laws that require secrecy, classified needs or security protection.

Renewable energy also offers relevant parallels. Like defence, it is a sector shaped by political priorities, public funding, long lead times and infrastructure dependencies. Startups in renewable energy may benefit from strong societal demand and policy support, but still face similar challenges related to regulation, permits, financing

and integration into existing systems. This is similar to defence innovation, where increased political attention and funding do not remove structural barriers.

8.2 Recommendations for startups

As established, a dual-use strategy can address challenges related to all dimensions except the dimension of regulation and permits. It is therefore something to be aware of and consider at an early stage. Given that a dual-use strategy appears to be effective in addressing challenges, it may even be wise to consider during ideation and early-stage development. However, adopting a dual-use strategy may introduce regulatory complexity. Still, we would argue that startups should consider dual-use during ideation and early-stage development. In addition to adopting a dual-use strategy, several other recommendations were presented. The most important recommendations are summarized in the list below:

- Stakeholder mapping that is reinforced by interactions.
- Defining and gradually narrowing the value proposition to effectively signal value.
- Validate the solution, for example through internal test, civil use cases, partner tests, and defence facing tests.
- Choosing one or several commercialization paths which allow for validation opportunity as well as access to necessary complementary assets.

This is not to be seen as a sequence of activities. Rather, as outlined in chapter 7, a majority of the recommendations assume an iterative approach and that the recommendations are to be carried out in parallel. Though, the list in descending order can be viewed as a guidance for when recommendations are especially important in the startup's journey. That is, in the very early stages the stakeholder mapping and interactions is a priority. Once the startup progresses towards commercialization, value proposition, validation and commercialization path become more important.

An important aspect which has been mentioned previously is the use of prototypes, especially early ones. This essentially ties in to all the recommendations presented above in that it can act as a basis for interaction, a method to effectively signal value and capability, often necessary for performing tests as well as in validating the solution. Therefore, we propose that startups develop a prototype as early as possible. How early depends on the specific solution and startup. In many cases, narrowing the value proposition is necessary.

Finally, funding and regulation are of course important dimensions to consider. Though not the focus of this thesis, some recommendations are included nonetheless. These are to be considered in parallel with the recommendations above but may depend heavily on the specific startup. For funding, startups are recommended to adapt their communication while considering the balance of ambitious narratives and realism. Additionally, we believe that startups will better address the challenges related to funding by following the recommendation related to the other dimensions.

By doing so, startups can communicate identified risks and mitigation strategies, thus building credibility in the eyes of investors. As for regulation and permits, startups are recommended to build early awareness to gain an understanding of which regulatory questions need to be answered.

8.3 Future Relevance of the Findings

Although the thesis is time and context dependent, some findings may be relevant in the future as well. The dimension of needs and value creation concerns the lack of information and the fact that the end-customer is made up of several stakeholders with different priorities. We would argue that this will remain to be true to a large extent. We propose that the same is true for innovation and system integration. The military system puts heavy emphasis on new solutions being integrated with existing ones and being connected to the doctrine. This will likely remain true in the future. However, for both needs and value creation, and innovation and system integration, closer collaboration with the authorities could reduce the impact of the identified challenges. The authorities appear to value realism and incremental solutions, which may suggest that the authorities have resistance towards new, innovative solutions. This is likely a consequence of the relatively low defence spending in recent years and the lack of geopolitical turmoil. However, Russia's invasion of Ukraine has showed innovation's role in defence and will likely have implications on the Swedish defence sector as well.

One system change which showed up several times throughout the thesis was pre-commercial procurement. This is used in other countries, such as Ukraine, and has the potential to address challenges in multiple dimensions. It addresses funding barriers by providing a source of funding during development. It may lead to a closer collaboration with the authorities, thereby addressing challenges related to needs and value creation, as well as innovation and system integration. And although it is pre-commercial, it none-the-less provides a path towards commercialization should the development be successful.

Finally, the extensive regulation creates a high barrier to entry for new entrants. The regulatory aspects have implications for all dimensions, not only that of regulations and permits. There seems to be a will to reduce the regulatory complexity which would reduce the lead-times as well as lower the barrier to entry for new entrants.

8.4 Contribution to research

This thesis contributes to research by providing a context specific understanding of how startups attempt to commercialize in the Swedish defence industry. The study addresses a gap in the current understanding of the Swedish defence ecosystem in identifying challenges that startups face when attempting to commercialize as well as providing methods to address the identified challenges. The contribution is

primarily empirical. By studying startups in the Swedish defence sector, the thesis identifies and structures challenges as well as potential commercialization pathways.

8.5 Suggestions for future research

The broad scope of the study makes it relevant for future research to have more depth. For example, one of the key dimensions could be explored further, or even one of the identified challenges. Funding and regulation are particularly relevant as they were not a substantial part of this thesis. Additionally, future research could follow one or several startups over time to examine whether the challenges identified in this thesis appear in practice and whether the suggested navigation strategies are useful. Another possible direction is looking into the area at an international level. Either by studying another country, or multiple countries. Finally, future research could examine how the challenges can be addressed at a system level. For example by examining laws and regulations as well as procurement processes.

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A

Appendix 1

A.1 The Vinnova reports

This section presents the results of the Vinnova reports in its entirety. The reports were written in Swedish and have been machine translated into English. The question that is being answered is:

What do you see as the biggest obstacles today to a more effective exchange between the civilian and military innovation ecosystems?

A.1.1 Demand Accelerator for civil-military synergies

We believe that the foundation of every innovation process is interaction between those who demand new solutions and those who develop them. This goes beyond simply matching needs and solutions; it is about co-creation, where interaction generates new insights into both needs and possible solutions and applications. We also see that the public sector, in its innovation work, is often inspired by methods originally developed in the business sector, such as testbeds, without taking into account how procurement regulations (LOU, LUF, LUF5 and LUK) affect the conditions for such interaction.

This often means that innovation and procurement are seen as completely separate processes. Design and innovation processes are often carried out without the participation of the companies that could develop the solutions. Or companies that have been involved in innovation processes with the public sector are disqualified from subsequent procurements because they are judged to have gained improper competitive advantages. Or the innovation project leads to yet another directly procured pilot being placed in the “pilot graveyard” because it turns out there is not sufficient demand to procure a solution for full-scale implementation.

In practice, this means that many innovation projects do not result in solutions that are implemented, used and thereby create value, while the actual procurements that are carried out do not result in sufficiently innovative solutions. For civil-military collaborations, an additional dimension is added: the requirements and conditions that must be taken into account in the military context. During this project, we gained insight into, for example, the challenges of exploring whether, how, and under

what conditions civilian technologies can meet military needs without jeopardizing sensitive information. At the same time, we are aware that we have only scratched the surface of what the military dimension entails during this short pre-study, and that there are likely more barriers and challenging aspects that we have not yet seen.

A.1.2 CMILES

Historically, since the end of the Cold War, we have seen a growing distance between the defence sector and the civilian sector. This has reduced the ability for collaboration and innovation, which has also been reinforced by insufficient public-private cooperation. There is a lack of effective processes to identify and make use of relevant civilian technology, and there are few incentives for civilian companies to engage in the defence sector.

Based on available sources, a number of specific barriers can be identified as the main challenges to civil-military synergies.

Barrier 1: Lack of knowledge about needs and conditions. It is very difficult for civilian actors to gain access to the Armed Forces' capability development needs, and the conditions for civilian actors need to be improved. The reverse is also true: it is difficult for the Armed Forces to establish and maintain understanding and knowledge of what the civilian innovation landscape looks like and how it functions. Continuous participation in a collaboration structure such as the one proposed in this draft would facilitate this.

Barrier 2: Complex regulations (in transition). Regulations concerning defence materiel can be very complex. At the same time, we are in a dynamic global situation with major changes, which also affect what regulations are added and how existing regulations change, for example as a result of Sweden's NATO membership. Kinetic systems and technically advanced systems are very difficult to gain entry with in the Armed Forces. Simpler products, such as pressure bandages, are easier to build collaborations around, as they do not have equally large or detailed requirements.

Barrier 3: Long lead times - "sense of urgency." Lead times in the defence area are often very long. It is not only the pace of development that is perceived as slow; there are also difficulties in quickly translating civilian technology into military applications, as well as challenges related to implementation and structurally complex and time-consuming processes. The traditional structure in the defence area is perceived as too slow and too complex for rapid defence innovation. It looks approximately like this: Branch of service -> FMV specifies and procures -> procurement process -> winning company performs the work -> delivery to FMV, which tests -> delivery to the branch of service.

It is not uncommon for even simpler procurements to take 2-3 years before a decision is made, which clashes with the needs of innovative small companies and the need to quickly translate civilian technology into military applications. An additional

complicating factor is the personnel structure in the Swedish Armed Forces, with both employed officers and soldiers, but also a large proportion of conscripts. Rapid development and introduction of new materiel at too high a pace will be difficult to manage given the current way refresher training for conscripts is carried out. A new way of thinking is therefore needed in which materiel, personnel and training are synchronized.

Barrier 4: Procurement processes and collaboration. The Armed Forces order technical solutions, applied research and basic research through FMV, FOI and FHS. There is a lack of a culture of joint dialogue and contact between end users and suppliers of different solutions. Conversations and dialogue, for example in the early stages of development processes, are perceived as a risk of being disqualified from future procurement. The Armed Forces and defence authorities handle the financing of new solutions by placing orders. This requires a certain degree of detail and specification of the expected deliverable result.

Orders may exclude civilian research organizations that are not allowed to conduct economic activity, such as non-profit organizations financed with state aid (for example science parks), which are thereby excluded from procurement because they cannot sell services or similar offerings. The defence sector is perceived both internally and externally as having rigid and cumbersome procurement and cooperation processes that make it difficult to collaborate with smaller, dynamic civilian companies. Secrecy and security requirements create additional thresholds for civilian innovative organizations to collaborate with defence.

Barrier 5: Politics. Collaboration in defence technology has always carried political significance. For some defence materiel systems, export deals are more about politics than technology. International linkages also create problems in cases where equipment is to be re-exported or donated. Ukraine can be mentioned as an example, where several countries together may need to approve that systems are donated. Some subsystems are American, others may be German or British, but together they make up a whole in a Swedish system. Nevertheless, each country's export legislation must be complied with, and a single country can completely block a support effort/export deal - which, again, is then about politics, ideological and/or economic.

Barrier 6: Ownership. Collaboration with civilian companies and the use of civilian technology can entail security risks for the defence sector. Ownership issues concerning intangible assets can create barriers to civil-military synergies. The state often requires full ownership of the results of collaborations, which can deter civilian actors. Insufficient understanding among civilian actors of military needs and problem formulations is also linked to this challenge. Limited market opportunities and complex requirements can discourage civilian actors from collaborating in the defence area.

Barrier 7: Differences in materiel lifespan. defence materiel often has a very long lifespan, with requirements that suppliers maintain systems and provide spare parts.

At the same time, the lifespan of civilian technical solutions can sometimes be very short. Examples from Ukraine show a lifespan for a drone system of six months before a new generation of hardware/software is used in the field. Drones are also a good example in another sense, as their role has evolved through innovation from being an advanced reconnaissance and fire-control system to very cheap drones that are almost comparable to ammunition, at a cost lower than an artillery shell. Costs and production methods allow for rapid distributed production and a high production rate with a very large number of units per year.

Their use implies a short lifespan per individual drone; they are often not even delivered with a rechargeable battery. The system is estimated to be used for only 30-40 minutes, and charging never becomes relevant. The first autonomous drones, controlled by AI, have been introduced at the front in Ukraine at still the same low cost - a development no one believed possible only a year ago. This would not have been possible without civil-military collaboration.

Barrier 8: Culture and conditions for structural change. There are cultural differences between the civilian and military sectors. This includes, among other things, how one views development and innovation, needs, utility, working methods and roles. A marked cultural and operational shift is required to increase collaboration between civilian and military actors. Resource shortages and previous cutbacks in defence have created a difficult starting point for the change that is now necessary but difficult to achieve within existing structures and systems. Sweden needs a new ecosystem that complements the existing one and in which speed is built in from the outset.

A.1.3 Synergia

Access to the end customer: Lack of dialogue with a stakeholder in order to present innovations and to better understand so-called military problems through dialogue with representatives.

Time perspective: Long and sluggish processes that today exclude innovative startup companies, since the long road to market is difficult to finance. Today, it often requires already being an established actor with an existing business that is then adapted to the Armed Forces.

Differences in regulations and procurement processes: The military system is stricter and more regulated than the civilian one, especially regarding security and secrecy. This can lead to complex and lengthy procurement processes that hinder collaboration and rapid innovation. The civilian sector, on the other hand, is more flexible but may have difficulty adapting to the specific requirements of military procurement.

Different innovation cultures: The military sector has traditionally had a more cautious and carefully controlled innovation culture, while civilian companies often have

a faster and more risk-tolerant innovation process. This can lead to new technologies from civilian companies not finding their way into military applications as quickly or easily.

Security and secrecy issues: defence-related projects often involve stricter security requirements and security classification, which can limit information exchange and collaboration with civilian actors. Civilian companies may be unaccustomed to or hesitant about working under such restrictions, which can complicate collaboration.

Differences in financing models: Civilian companies are used to market-driven financing models, while military innovation often requires state funding or procurement. This can create uncertainty about which business models are sustainable for long-term military projects, especially for smaller civilian companies that want to engage in the defence sector.

Competence transfer and a shared technology base: There is a challenge in transferring technologies from the civilian sphere to the military sphere without compromising security requirements. Many advanced technologies, such as AI and cyber technology, have civilian applications but can also be used for defence purposes. Creating an effective and secure flow of competence and technology between these areas is difficult, but necessary.

Lack of demonstrator projects and test/demo environments: More demonstration projects are needed to bridge research and practical application. Such projects can show how civilian technology can be applied to military needs and vice versa. A lack of these types of projects complicates the integration of civilian innovation into military systems.

A.1.4 Ideon

The biggest obstacles to effective exchange between the civilian and military innovation systems encompass several areas. One of the most prominent challenges is the lack of access to military needs and problems, where civilian actors, especially startups and small and medium-sized enterprises (SMEs), often struggle to understand or identify what challenges and needs exist within the Armed Forces. This difficulty is largely due to insufficient transparency and inadequate communication from military actors. At the same time, complex regulations and the high costs of security classification create additional barriers. The process is both fragmented and project-based, meaning that each new project requires a new approval process, which is administratively and financially burdensome for smaller actors.

Another significant challenge is the long lead times in the defence industry's procurement processes. These slow processes make it difficult for startups to survive financially and adapt to changing requirements in time. This is aggravated by a lack of collaboration between large and small actors, where larger companies often prioritize their own interests and lack incentives to collaborate with smaller actors. This

hinders innovation capacity and the opportunities to benefit from shared resources and experience.

In addition, there are cultural barriers within the defence sector that make innovation and risk-taking more difficult. Since the 1990s, the sector has been characterized by a cost-cutting culture, which has made it difficult to foster an environment where new thinking and experimentation are encouraged. Finally, limited access to military testbeds and demonstration opportunities constitutes another barrier. Many civilian companies do not have the opportunity to develop and showcase new technologies in relevant environments, which makes the integration of their innovations into the defence sector more difficult. Taken together, these factors constitute a complex and challenging environment for collaboration between the civilian and military innovation systems.

One of the biggest problems is the absence of a functioning innovation ecosystem on the defence and security side. Despite technological advances and an increased emphasis on innovation, there is often no coherent environment in which ideas can be developed and integrated effectively. This is due in part to the fragmented structure between civilian and military actors, but also to the lack of incentives and support for promoting collaboration and joint development. Without a robust and functioning infrastructure for innovation, many promising projects risk falling through the cracks, slowing overall development in the area.

Summary of barriers:

Lack of access to military needs and problems: Civilian actors lack insight into the Armed Forces' needs and strategic priorities, which limits their ability to develop relevant solutions.

Complex regulations and security classification: Fragmented and costly security-classification processes are major obstacles for smaller actors, as they are costly and time-consuming and therefore constitute a barrier.

Long lead times: Procurement processes within the defence industry are too slow, which hinders startups and innovation. LOU makes it difficult to adapt to changing needs and creates barriers to rapid innovation.

Lack of collaboration between large and small actors: Larger companies often have weak incentives to collaborate with smaller actors, which limits synergies and shared resources.

Cultural barriers: A cost-cutting culture characterized by low risk tolerance and slow change hinders innovation.

Limited access to testbeds: Civilian actors have difficulty gaining access to military test facilities for developing and demonstrating new technology.

The absence of a functioning innovation ecosystem on the defence and security side in Sweden.

A.1.5 Kraftsamling Öst för nationell infrastruktur civil-militär synergier

Based on our knowledge of the domain, as well as lessons from material collection, interviews and practical experience from the establishment of the national civil-military accelerator program and the mobilization we have already carried out in Östergötland in this area, we have identified the following barriers that need to be bridged in order to create an effective innovation system.

Organizational inertia: There is organizational inertia in how the materiel acquisition process is structured, which has a number of negative consequences. It is difficult to understand which actor plays which role in the process. Different actors have different priorities and possibilities to move an issue forward. We also see that the process from need to procurement takes a long time, largely because many organizational units are passed along the way. Taken together, this organizational inertia is devastating for innovative companies that have solutions but need quick answers about whether/how the technology matches the needs and whether there is an opportunity to contribute to total defence.

Limited access for innovative companies to Armed Forces test environments: This problem makes it more difficult for companies to develop and demonstrate their technical solutions under realistic conditions. The Armed Forces' infrastructures for testing and evaluation are often crucial for validating new technologies and products, but accessibility is limited by security requirements, secrecy and organizational priorities.

Contextual understanding: There is a lack of contextual understanding between the military and civilian innovation systems. On the military side, there is limited knowledge of how a civilian innovation system works and what opportunities it offers for contributing to capability development. There are neither established open contact routes nor relationships, which are prerequisites for collaboration. This leads to the parties not seeing each other as an option. The military side needs pathways into the civilian innovation system to find and verify technologies that can have rapid effect, and the civilian side needs pathways to better understand the needs.

Regulations and bureaucracy: Collaboration between civilian and military actors is hampered by complex laws and rules concerning security and secrecy. The civilian innovation system is not adapted to handle the security requirements and defence-specific needs that exist within the military and lacks the competence and internal structures to handle these requirements. To bridge these barriers, investments are needed in both knowledge (export control, security legislation, EU, NATO) and practical infrastructure (SUA-classified environments). The bureaucracy in defence

materiel procurement also hinders rapid procurement processes. This is certainly necessary in some cases, but the current situation also requires parallel, faster procurement paths, and safe arenas for exploring technologies are an important prerequisite for speeding up and making procurement and implementation processes more efficient.

Capacity shortage: The Armed Forces' mission to scale up, integrate into NATO and manage increasing operational demands creates capacity shortages among key individuals. This hampers innovation and coordination within total defence. Without resources, solutions risk becoming ad hoc or not reaching the end user, since civilian actors lack insight into military needs and military requirements are technically unique. Effective resource allocation can strengthen the translation between civilian and military innovations, thereby accelerating technology development.

Organizational culture and objectives: Military and civilian innovation have traditionally had different end goals and ways of working. While the civilian sector may prioritize commercial success and rapid time-to-market, the Armed Forces have security and strategic stability as their primary goals. This leads to challenges when trying to harmonize innovation speed, risk appetite and objectives with the efforts of the innovation system.

Financing and incentives: Civilian startups and small businesses have difficulty obtaining financing for defence projects due to long development cycles and uncertain returns. Investors' lack of understanding of how defence projects are valued contributes to the problem. Sweden lacks both private and public venture capital focused on total defence. A civil-military fund, for example managed by Almi Invest or Saminvest, as well as clearer strategic guidelines and support for dual-use technologies, would be needed.

Differences in perspective: The Armed Forces have a capability perspective in which technology, organization and logistics interact to create robust capacity that functions around the clock, in all climates and conditions. Civilian companies, especially startups, often focus on technical solutions without always taking the broader perspective or the strict requirements of the Armed Forces into account. This complicates the integration of innovations into military systems and hinders effective knowledge transfer, especially in the absence of forums for increased understanding and dialogue.

Working methods and communication: The Armed Forces' order structure and language differ from those of the civilian sector, and both parties need to learn from one another. The Armed Forces would need to formulate their needs and challenges more clearly in order to create understanding in industry - daring to communicate and test ideas requires deeper mutual understanding and trust to be built.

A.1.6 Innovationsinfrastruktur för Civil-Militär samverkan

Our pre-study, carried out in collaboration between KTH Innovation, Sting and Kista Science City, is based on interviews with deep-tech startups that may be relevant for Swedish defence capability, business leaders with experience of civil-military collaboration, and a workshop with more than 25 companies based in Stockholm.

The results clearly indicate that both civilian and military actors often lack insight into each other's ways of working, needs and opportunities. This limiting mutual knowledge, together with cultural differences, extensive security requirements and a lack of structured support, leads to valuable ideas and technologies not being fully utilized. To strengthen Sweden's military capability while also contributing to company growth, clearer understanding, more effective collaboration and shared ambitions are required. The biggest barriers identified are summarized below.

Limited mutual knowledge: Military actors are often unfamiliar with the resources, methods and company structures of the civilian innovation system, while civilian actors lack insight into the defence sector's needs, security requirements and procurement processes.

Cultural and communicative differences: Different working methods, objectives, terminology and time horizons in civilian and military contexts make collaboration more difficult. Civilian actors often prioritize rapid market adaptation, while the defence sector places emphasis on robustness, secrecy and long-term operational value.

Strict security and secrecy requirements: Strict regulatory frameworks and high security requirements limit information exchange and visibility for civilian actors, creating uncertainty and raising the threshold for collaboration.

Unclear demand and communication of military needs: The absence of clearly communicated priorities makes it difficult for civilian companies to assess whether, how and when their technologies can be adapted for defence-related applications.

Lack of continuous meeting arenas and networks: Unlike some other countries, Sweden lacks recurring forums, fairs and events to regularly connect civilian entrepreneurs and companies and researchers, investors and military needs owners. This reduces the possibility of quickly identifying collaborative projects and building trust.

Limitations in translating civilian research results into defence applications: The absence of clear mechanisms and a tradition of translating civilian research results into military solutions constitutes a significant barrier. This means that potential defence innovations often do not reach implementation. In the 2024 research bill, the government emphasizes the importance of blurring the boundary between civilian and military research. This development increases the need for structures, infrastructure and processes that can connect civilian research results to concrete military applications and thereby ensure that innovations from civilian actors and research

environments are utilized to strengthen Sweden's defence capability.

A.1.7 Infrastruktur för Civil-Militära synergier Nord

The challenges for a more effective exchange between the civilian and military innovation ecosystems for small and medium-sized enterprises (SMEs), as well as newly founded startups, are currently as follows:

1. No proximity or opportunity to discuss and understand military problems and challenges from/for the Armed Forces. a) The Armed Forces cannot, without SUA, talk about challenges and problems with individuals/companies. b) There is a risk of being excluded from FMV procurements if there is direct contact with the Armed Forces (risk that you are interpreted as having received your own/different information compared with others responding to the procurement). c) Innovation-system actors have no insight into this and therefore cannot direct companies to the Armed Forces either. d) The Swedish Defence University and the Armed Forces currently have no established contact with the Swedish innovation system, such as incubators and science parks. e) The Swedish Defence University lacks an innovation office despite the research and development taking place there.
2. Difficulty gaining access to present and demonstrate new products, services and capabilities to the Armed Forces. a) Today's networks are closed and difficult for new actors to enter (a catch-22: if you are SUA-cleared, you may be allowed to listen to and talk about future problems, but to become SUA-cleared you must have a project, yet you can never get a project because you do not know what they are looking for. Today's model strongly favors established and larger companies). b) FOI, RFN Vidsel and other Armed Forces and FOI testbeds are not open and accessible in the same way as, for example, RISE. This applies both in phases when companies are to develop and test their products/services.
3. Low competence regarding how to "set up companies" so they can become security classified/SUA even before it becomes relevant - and then how you actually become SUA-cleared. Without this, you cannot deliver to FMV/FM. a) Today, innovation offices, incubators, science parks and other "friends of companies" do not have competence regarding what is required for this. There is a major risk that mistakes are made early in setting up ownership, which staff are hired, IT, etc. b) In Sweden today, SUA classification follows you as a person and per project, making it time-consuming and costly to renew for each project over and over again. c) SOFF has good competence in this area today, but startups/SMEs without customers have difficulty understanding why they should join SOFF. d) There is an awareness among different innovation actors today of the risk of industrial espionage. Going forward, as civil-military innovation increases, this threat will increase far more than it has today.
4. There is no innovation-oriented or iterative procurement from FMV/FM, nor any format from Vinnova or others to broadly challenge/demonstrate/iteratively

develop solutions today. a) The time it takes for an innovation to move through TRL levels must be shortened. b) Compared with the Ukrainian Armed Forces, which openly publish calls on the web for innovative companies to submit ideas, followed by 90-100 day cycles of challenge-procurement-select winner. c) A similar procurement culture underlies the entire new space sector in the USA, where the SDA (Space Development Agency) publishes procurements, procures and selects winners within 90 days. d) FMV currently works entirely under LOU, which in itself is extremely poorly adapted to developing new products/services. This is a general challenge within LOU - a great deal of time is spent on the perfect requirement specification, which is then procured and then delivered. This works well for known problems and challenges, but tomorrow's conflicts and challenges tend to come with their own new challenges that cannot be fully specified in advance. A more iterative and broad approach is needed in early phases in order to address them. e) The special forces currently have their own possibility to procure services and products directly, but contact with and understanding of their needs are difficult to obtain. The special forces are themselves also a smaller resource that cannot absorb a broad influx of SMEs/startups directly.

5. It is not natural for SMEs/startups and FMV/FM to work with one another. There is a culture that needs to be bridged and changed. a) Testing, developing and taking risks have not been rewarded or emphasized in Armed Forces culture, since the 1990s when the focus was on downsizing. b) SMEs and startups have not seen the defence sector, or been encouraged to see it, as an early or possible customer (rather the opposite; this has previously been explicitly excluded in various support schemes and services). c) Students and researchers need to be able to get closer to the Armed Forces. This has not been seen as an area where there are interesting and relevant problems and challenges, simply because they are not exposed to one another.

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