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Success Factors, Barriers, and Strategies in Experimental Development in Public-Private Partnerships

MSc Thesis Management of Technology

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Success Factors, Barriers, and Strategies in Experimental Development in Public-Private Partnerships

Master Thesis

By

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Foreword

This work is part of the master's program Management of Technology (MoT) at the Delft University of Technology. In line with a 'typical' MoT thesis, the thesis abides by three criteria:

- The work reports on a scientific study in a technological context (e.g. technology and strategy, managing knowledge processes, research & product development management, innovation processes, entrepreneurship).
- The work shows an understanding of technology as a corporate resource or is done from a corporate perspective.
- Students use scientific methods and techniques to analyze a problem as put forward in the MoT curriculum.

As a study on innovation processes, this thesis aligns with the goals of the Master Management of Technology. This research focuses on managing knowledge processes, and how to improve them. This approach shows an understanding of technology as a corporate resource. Lastly, qualitative scientific methods were used to analyze a problem.

Furthermore, I would like to thank some organizations and people who were valuable and valued during the thesis process.

Firstly, I would like to thank my graduation committee for guiding me through the thesis process, with its many barriers and success factors. The feedback from Dr. Smit during the meetings throughout the thesis was essential in furthering the thesis to its full potential. Dr. Veeneman was an accommodating committee chair whose feedback was of great importance to the thesis.

The help of Sven and Martijn, with the accommodating team of the Defense Consulting Team of PwC were very valuable and our discussions proved of great help to the thesis. The team had great and motivating energy. I would also like to thank Sanne for her valuable feedback.

I would also like to thank the interviewees from the Ministry of Defence for their time and interest in helping with the thesis. Speaking to so many enthusiastic officials within several branches of the MoD has enthused me and has been a thought-provoking exercise.

The interviews with innovative and entrepreneurial people from the private sector were a great experience, for which I would like to thank them.

Lastly, I would like to thank my friends and family. I wrote two theses in one year, for which the support of those dearest to me has been an invaluable resource. I feel truly blessed to have these people around me.

Executive summary

Public-private partnerships (PPP) that focus on innovation are excellent methods to improve the innovative capabilities of both partners, however, within the complex dynamics of this cooperation, literature and management would benefit from an analysis of barriers, success factors, and strategies employed within the PPP. This research can be used as a springboard for further research by analyzing a novel research setting: Defense Ministries and Defense Industries. This novelty was compounded by taking a qualitative, explorative approach. A focus on experimental development was taken to limit the large amount of innovative activity present in the sector. Focus was kept on the effects on individual projects, as opposed to innovation systems or networks. This leads to the following research question:

What are the barriers and success factors in public-private partnerships that focus on experimental development, and how do the participants cope with the barriers, and utilize the success factors?

From the literature a theoretical framework was set up based on four categories of factors influencing the innovation process. The categories are organizational, contextual, interaction-specific, and innovation-characteristic. Literature suggested that interaction-specific barriers were the main source of barriers. The main strategies in literature revolve around interaction-specific solutions to these interaction-specific barriers. A contextual model was set up.

Dutch Ministry of Defence (MoD) and the Dutch Defense industry provided a novel research setting with hard-to-define innovation goals. Individuals from both sides of the PPP with practical experience in PPPs that focus on experimental development were interviewed. Within the Dutch MoD these were innovation coordinators within sub-organizations and within the Defense Industry these were leaders of small to medium-sized companies. The data was gathered through 13 interviews, of which 11 were used as sources of data. The data was first deductively coded through the four categories and then inductively coded based using the terminology of the interviewees.

This coding strategy led to three organizational factors: ‘process rules’, ‘culture, vision & implementation’ and ‘scale-up’, five contextual factors: ‘procurement: general’ ‘procurement: prior knowledge’, ‘procurement: perception’, ‘privacy’ and ‘technology-related’, one innovation-characteristic factor: ‘uncertainty’ and three interaction-specific factors: ‘contact with end-user’, ‘shared understanding’ and ‘expectation management’. The factors were described as ‘barrier’, ‘success factor’, ‘strategy’, and ‘not a barrier’. Organizational and contextual factors were the main factors influencing the success of the innovation process. ‘Process rules’ was named the most influencing factor for the innovation process. ‘Procurement law’ was the most prominent contextual factor. Innovation-characteristic factors were often considered to not be relevant to the cooperative innovation process. Lastly, the interaction-specific factors were occasionally cited as a barrier and often named as a success factor, specifically ‘contact with end-user’. Interaction was key to most strategies employed to overcome barriers.

In conclusion, this study has provided a unique insight into a collaborative phenomenon in a scarcely researched setting. The findings can be used in comparison with other research on PPPs with innovative goals, especially those that have taken place in the Netherlands. Compared to literature, the appearance of interaction-specific strategies is not unique, but in their broad application to overcome a plethora of barriers is. Further research focusing on communication dynamics within PPPs is recommended to enhance collaborative efforts and drive impactful innovations in the Defense sector. In a practical sense, reviewing process and contextual rules and reviewing the accessibility of the PPP to newcomers in the sector would enhance innovation programs, fostering effective collaboration between public and private entities.

Contents

List of abbreviations

Dutch definition	Abbreviation	Dutch translation	British equivalent	American equivalent
Commandant Landstrijdkrachten	CLAS	Royal Netherlands Army	Chief of the General Staff (Head of the British Army)	Chief of Staff of United States Army
Commandant Luchtstrijdkrachten	CLSK	Royal Netherlands Air Force	Chief of the Air Staff (Head of the Royal Air Force)	Chief of Staff of United States Air Force
Commandant Materieel en IT	COMMIT	Material and IT Command	Defence Equipment and Support	-
Commandant der Strijdkrachten	CDS	Central Staff	Chief of the Defence Staff	Chairman of the Joint Chiefs of Staff
Commandant Zeestrijdkrachten	CZSK	Royal Netherlands Navy	First Sea Lord and Chief of the Naval Staff (Head of the Royal Navy)	Chief of Staff of Naval Operations
Defensieonderdeel	DO	Organisational Element	Organisational grouping	Military Department
Defensie Ondersteunings-commando	DOSCO	Joint Support Command	Defence Infrastructure Organisation	-
-	FRONT	Future relevant operations with next generation technology and thinking	-	-
Kennis & Expertisecentrum	K&E centrum	Knowledge and Expertise center	-	-
Koninklijke Marechaussee	KMar	Royal Netherlands Marechaussee	Ministry of Defence Police	
Ministerie van Defensie	MoD	Ministry of Defence	Ministry of Defence	Department of Defense

1 Introduction

Innovation management is the systematic process of introducing new ideas within an organization. In line with research originating which J. Schumpeter, innovation management has had the attention of managers and academics for decades (Schumpeter, 1942). Within larger organizations, choices frequently must be made regarding which innovation gets attention, funding, and resources. It requires creating a supportive organizational culture that encourages creativity, risk-taking, and learning from failures. It requires effective leadership, strategic planning, and the ability to adapt to changing market conditions. Public institutions require innovation management for increased effectiveness, efficiency, and tackling societal problems (De Vries et al., 2016). Private institutions use innovation management as well, to eventually gain competitive advantage and grow their business. For both types of organizations, innovation management is seen as vital for the continued success of the organization.

Governments and private institutions use Public Private Partnerships (PPPs) increasingly as a tool to achieve goals that they could not achieve using in-house capacities and in doing so, PPPs with innovative goals have emerged as powerful platforms where technology can develop and grow. PPPs are a unique policy instrument based on complementary goals. The goals of the public and private sectors are central to the PPP. The state has the responsibility of “designing, fostering and implementing social covenants, regulatory frameworks, incentives, policies and innovative partnerships with the private sector and civil society actors to encourage progress in society, the economy and the productive sector within a rights-based approach” (World Economic Forum, 2014). Often PPPs are started based on the assumption that the private sector can perform a public service better, for example in the construction of a bridge, companies hold more specialized civil design talent in-house (Klijn & Koppenjan, 2016). The private sector is inherently profit-focused, but increasingly, companies have taken a more socially conscious stance (Velte & Stawinoga, 2017). Both of these mindsets weigh in in the decision-making of the private sector to cooperate in an PPP with innovative goals, with exemplary results.

In a landscape with unprecedented technological disruption, environmental crises, and interconnectivity, the successful implementation of PPPs has never been more crucial (Ministerie van Defensie, 2022b). PPPs have the unique ability to improve on both the best of private and public innovation through cooperation, which is why research into PPPs with innovative goals has increased over the years (Brogaard, 2021). With a need for further understanding of the PPP with innovative goals, this research sets out to develop both practical and academical improvements for managers and academics focusing on innovation.

In PPP research, the actions, and experiences of public and private actors in the PPPs are central to the effectiveness of the cooperation, therefore study into their strategies and actions within the PPP is warranted, although measurement of effectiveness has been a challenge. Studies have been performed with the express goal of understanding and improving PPPs' performance (Zou et al., 2014). In the measurement of results, scholars have managed to categorize factors that are relevant to PPPs with innovative goals (Brogaard, 2021). Measurement of the factors influencing success is often analyzed using case studies and quantitative studies (Brogaard, 2021; Cinar et al., 2019). These studies discuss broad terms with categories of barriers. Even fewer studies describe strategies or tactics that parties within the PPPs use to further the collaborative innovative process (Cinar et al., 2021). Identifying and categorizing barriers, success factors and strategies of the process is a steppingstone towards understanding the complex collaborative innovation process. Understanding is no easy feat: Differences can exist even within single companies since innovation projects have different attributes. These can range from factors such as strategic importance, novelty, and basicness, leading to success or failure (Cassiman et al., 2010; Du et al., 2014).

Scientifically, there is also a lack of information on the strategizing of the actors within PPPs with innovative goals (Cinar et al., 2021). The study dissertates these strategies into categories. Also, the thesis gives recommendations on the relevance of these strategies to the factors that caused their development. This is an identified research gap, which, as exploratory research, this thesis will not fill. It will, however, provide

valuable insight into the behavior of actors within the context of PPPs with innovative goals. As exploratory research, the study can open unidentified interesting routes for scientific analysis and further study.

This study will focus on PPPs with the goal of experimental development, as opposed to other innovation process stages, such as fundamental research. This creates focus while being the most relevant period of the innovation process. Different periods of the innovation process have different dynamics between the public and private organizations because goals are different, therefore this focus increases the reliability of the results. For example, during fundamental research, research has less applicable goals than in later stages of the innovation process, creating different cooperation within the PPP, leading to different experiences from both public and private institutions. Due to this, it is sensible to research a specific section of the innovation process. During the phase of experimental development, which is the phase where a usable product or service is developed, the PPP with innovative goals experiences the most barriers, which this research sought to clarify scientifically in a new context. Within the innovation process, which can be lengthy, experimental development provides an option to research a specific timeframe of innovation, while being the period where most parties experience collaborative difficulties (Cinar et al., 2019). Its throughput time to implementation is generally shorter than basic or applied research leading to a more compact period of studies as well.

Research on PPPs with innovative goals focuses on several sectors, but no research could be found on PPPs with innovative goals in the Defense sector, which is a scientific research gap. This sector is interesting from a scientific perspective since the goals of Defense departments are different from other public organizations. Defense departments in peacetime focus on operational edge and responsiveness, which are different and simultaneously hard to measure It cannot be assumed that the military context works in similar manners as the studies identified in the review papers, due to the previously since goals of shape the measurement of innovative success.

The study has practical relevance, since PPPs with innovative goals are now more important than in the last 30 years, as defense and security threats around the world increase (Nikolic, 2018). Militaries, as the protectors of a country's territorial integrity and values, have always used technology and innovation to one-up their competitors. For example, the development of the plane changed from a reconnaissance aircraft in the Italian-Turkish War and the First World War to fighter planes and bomber planes in World War Two (Crouch et al., 2023; Maksel, 2011). Military innovations like this were partially fueled by companies such as Fokker and Lockheed. Relatively smaller developments can be equally significant. The development of the 3D printer by companies provides the opportunity for militaries active in hostile territories to print machine parts for nontrivial repair, without a shipment having to come in with replacement parts (Schwaar, 2022). As these examples show, innovation in cooperation with companies has historically been a powerful force in achieving an operational edge.

As can be seen on the edges of Europe at the time of writing, 2023, technological edge plays a significant role in the effectiveness of the Russian and Ukrainian militaries (Franke & Söderström, 2023). Large and small companies in the Defense industry shape the constantly moving battlefield. Companies and governments in other countries are curious onlookers, not only seeing which technologies work on the modern battlefield but also how cooperation between the state and the private sector can most effectively improve the military (Ministerie van Defensie, 2023a).

Getting the cooperation with companies right appears to be an essential factor in improving any military. However, Ministries and Departments of Defense around the world have struggled to implement private sector innovations into their method of operating (Abel, 2023). This is troubling since effective technological advancement is essential in an operable and effective military. Meanwhile, the private sector appears happy to help but has a hard time trying to co-innovate with the military and wants to create something that works for this specific government branch. Militaries around the world recognize this issue and the role that innovation could and should play in their policymaking and goalsetting (Foggo et al., 2022). Research into PPPs with an innovative focus is therefore essential in the functioning of militaries, but also in other sectors where PPPs are active, such as infrastructure (Othman & Khallaf, 2022).

For a practical application, this study is relevant for public institutions and private organizations looking for practical examples of the behavior of partners within PPPs. Increasingly, cooperation between public and private sectors are divers of innovative technology in many sectors. Because the chosen setting of the research is the Dutch Ministry of Defense, this study will have extra relevance to the Dutch MoD and the industries active in the Dutch Defense sector. The Dutch MoD intends to increase its budget for innovation in general by significant amounts, and the MoD states that increased cooperation with the private sector is part of the increase in innovative input. The Dutch Ministry of Defense (MoD) regards “a strong innovative capability” as one of its ten main institutional principles. The Dutch MoD intends to spend at least 2% of its expenses on innovative developments by the Defensievisie (Ministerie van Defensie, 2020a). Currently, this value is around 1.1% (Ministerie van Defensie, 2023).

1.1. Research question

Innovation is key to tackling the problems of today and tomorrow. Considering this imperative, this study attempts to shape a bridge in understanding between private and public organizations and provide a contextual study that can be used as an insight into an important phenomenon in a rarely studied setting. There is a scientific and clear need for a better understanding of PPPs with experimental development goals, and identifying the barriers that actors encounter, success factors that actors utilize, and strategies that actors employ.

The Ministry of Defence and the Defense industry would provide a unique setting in which there has been little to no research. The experimental development phase of the innovation process is identified as the most relevant for finding barriers within the innovation process. Therefore, the following question is relevant in a social context and to the scientific community:

What are the barriers and success factors in public-private partnerships that focus on experimental development, and how do the participants cope with the barriers, and utilize the success factors?

The knowledge from this study can be used in the improvement of the collaboration between the Defense Industry and the Ministry of Defense and can be used for comparative analysis within comparable public institutions and private sectors. As a contextual study, the study will provide insight into potential research areas of interest. Any public institution that intends to improve on its experimental development through public-private partnerships could use this case study as a comparative analysis. Getting a clearer scientific picture of the innovation process can help innovators and policymakers pursue technological development and evidence-based policymaking quicker and better.

1.2. Research approach

The research approach is based on an understanding of the literature, followed by the application and utilization of this knowledge in the research setting, qualitatively comparing the literature with the findings. This is done through a literature review, where a theoretical framework was set up. In the methodology, the qualitative methods of garnering and analyzing data are discussed. In the results section, the findings will be named, and in the discussion section, they will be compared to the literature from the literature review. Lastly, conclusions will be drawn with recommendations for further studies.

Firstly, within the thesis, a literature review is performed, which can be found in section 2, where the nature of PPPs that focus on innovation is explored in detail, after which the barriers and success factors within case studies and review papers of PPPs with innovative goals are investigated. The coping strategies for the barriers and the utilization strategies for the success factors are explored further. A framework is set up from the literature, which will be used as a guideline for the further sections of the exploratory research.

The study is performed through 13 semi-structured interviews of both public and private sector persons, with experience with PPPs that focus on experimental development, which is described in section 3. Specifically, interviewees are asked to describe the success factors, barriers, and strategies within projects

they have undertaken. The interview looks for examples and specifics, to prevent speculation from becoming part of the interview results. Their interview is recorded and transcribed. Coding is done deductively based on categories in literature. Within the categories, codes were selected inductively. The coding led to 14 identified codes within the four categories.

The combined results of the interviews are analyzed in the results section, in section 4. New and interesting findings are presented in this section. The analysis will provide quotes from the interviews to communicate examples of the barriers, success factors, and strategies.

In the discussion and conclusion, which can be found in section 5, the results are compared to the literature, and the effects of the methodology on the results are discussed. Recommendations are given for further study, which is extra relevant due to the exploratory nature of the thesis.

2 Theoretical framework

This section aims to get an overview of the literature about the research question and its impact on this research. The research question of this thesis is:

*What are the **barriers** and **success factors** in **public-private partnerships that focus on experimental development**, and how do its participants **cope** with the barriers, and **utilize** the success factors?*

The theoretical framework is set up in three stages to review the literature on the research question. The research question contains three subjects of review, and which literature will be reviewed. Firstly, the theoretical review investigates the setting: The PPPs focusing on experimental development and the roles of the actors. Secondly, the action is researched, and a contextual model is built. The findings of the literature review are categorized to investigate the role of specific types of barriers, success factors and the role of strategies in improving on them.

2.1. PPPs that focus on experimental development

To research PPPs that focus on experimental development, a wider knowledge of PPPs in general is required, to assess their setup and definition. It is relevant what a PPP is, and is not, to be able to include and exclude research. A PPP is an arrangement where the public and private sectors join a long-term partnership for mutual benefit (Leiringer, 2006). This is one of many state instruments that can be used to stimulate innovation. Borrás & Edquist (2013) state different public innovation instruments can be regulations, such as intellectual property protections, economic transfers, such as competitive research funding, or soft instruments, such as partnerships. In this research PPPs are defined as 'a cooperative arrangement between the public and private sectors that involves the sharing of resources, risks, responsibilities, and rewards with others for the achievement of joint objectives' (Kwak et al., 2009). Hodge & Greve (2017) deduce that in literature, PPPs are interpreted as having five meanings, which are visualized in Figure 1.

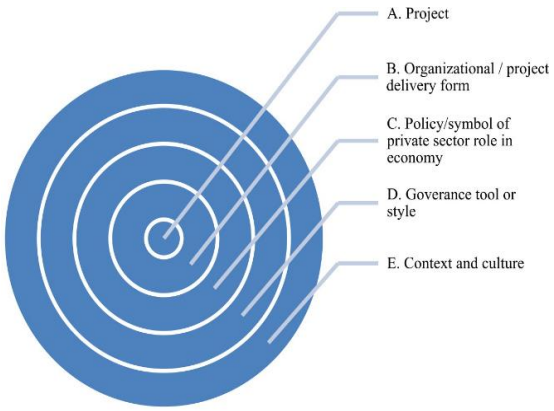


Figure 1: Dimensions of the public-private partnership phenomenon (Hodge & Greve, 2017).

This thesis will use the level B definition of Figure 1 since the thesis will analyze the innovations on a project-level basis. Other definitions will be excluded from the study, and are therefore relevant to descrive. PPPs are different from *concessions* and *privatization*. In concessions, there is a limited risk transfer as opposed to PPPs (Silvestre & De Araújo, 2012) and privatization does not require any partnership (Forrer et al., 2010). Secondly, *outsourcing* is different from PPPs. Outsourcing is 'one application of a make-buy policy', where a government has the major decision-making role and PPPs suit projects that are too complex for just the public party to make decisions (Wang et al., 2018). Lastly, PPPs are not *collaborative governance*. In collaborative governance, the 'institutionalization of a collective decision-making process' is central to its goals (Ansell & Gash, 2008). In PPPs, decision-making is not an end goal, but a step towards the goals of agreement and production. This thesis will exclude these types of collaborations in the literature review and the data acquisition.

PPPs usually, but not exclusively, take the role of contracts that define the allocation of resources, risks, responsibilities, and profits (World Economic Forum, 2014). In PPPs with innovative goals, this often falls in the Design-Build-Operate or the Design-Build-Finance-Operate category. PPPs can be set up in different manners, based on both parties' shared goals, expectations, and dedication. Infrastructure is a sector where

the PPP setup has been active for longer than other sectors, and in this sector, a continuum of types of PPPs can be set up, as is visualized in Figure 2 (Kwak et al., 2009). As can be seen in Figure 2, PPPs can be molded into the contractual shape both parties desire, from very public to very private. Operation management is a PPP where the private sector is least involved and build-own-operate is the PPP type where the public sector is least involved. This flexible definition of a PPP allows both parties to shape the cooperation without being limited by legislative methods. This is the case as well within an innovative setting, however, when a type of partnership is chosen, the actors are still subject to the legislative boundaries that that type of partnership is associated with.

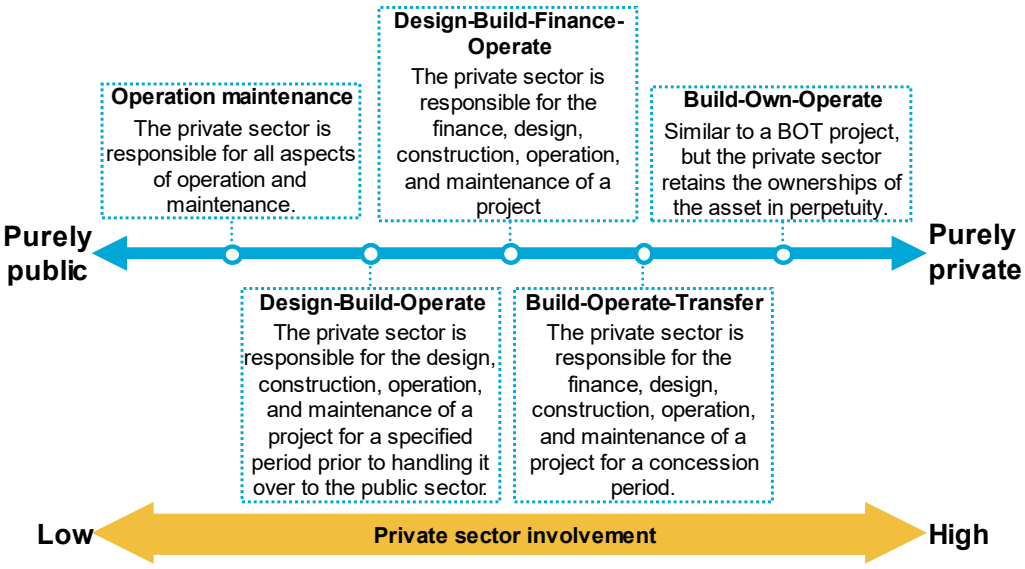
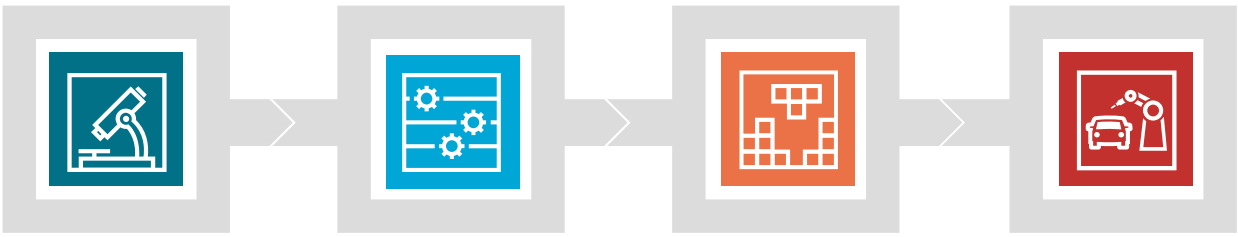


Figure 2: Several types of PPPs in infrastructure development, adapted from (Kwak, Chih, & Ibbs, 2009).

This literature review on PPPs that focuses on experimental development uses literature on PPPs with innovative goals in general. This is because research on this specific region of innovation is limited to a few case studies, which provide context, but not the generalizability that a conceptual model should be focused on. The World Economic Forum (2014) states that the underlying logic of the PPP with innovative goals is complementary to long-term needs. PPPs with innovative goals share the property of 'regular' PPPs that complementarity is key to effective collaboration. Some scholars therefore also prefer the term public-private cooperation or public-private co-innovation. Extra attention should be given to the difference between an innovative PPP and a PPP that focuses on innovation or has innovative goals. Innovative PPPs are set up in many innovative manners, yet this is a method to achieve defined goals that are technologically achievable and definable in an innovative manner. A PPP that focuses on innovation or has innovative goals is inherently different since its end goal is innovation. Innovation is inherently complex and often improved in a network setting, making PPPs a 'natural choice' for organizations seeking to achieve an innovative goal.

Often innovation cooperations between industry and government also involve knowledge institutes such as universities. Introduced in the 1990s, the triple helix model describes the mechanics of cooperation between university, industry, and government (Etzkowitz & Leydesdorff, 1995). Simões et al., (2020) describe this process in the Defense industry in Portugal and exemplify that 40% of projects involve at least two parties (university, industry, and/or government) and 37% involve all three. The role of external partners such as knowledge institutes should therefore not be ignored in research. Increasingly scholars have introduced more actors to the triple helix model, such as democracy and the environment, creating the quadruple and quintuple helix (Carayannis & Campbell, 2021).



Basic/fundamental research
Research projects that represent original investigation for the advancement of scientific knowledge and that do not have specific commercial objectives, although they may be in the field of present or potential interest to the reporting company.

Applied research
Research projects that represent investigation directed to the discovery of new scientific knowledge and that have specific commercial objectives concerning either products or processes.

(Experimental) development
Experimental development is a technical activity concerned with nonroutine problems that are encountered in translating research findings or other general scientific knowledge into products and services.

(Production and) diffusion
Activity to produce and spread the innovation to users, removing it from the innovation development process and entering the diffusion phase, where a product matures and eventually becomes standardized.

Figure 3: The linear model of innovation, adapted from **(Godin, 2006)**. Definitions of basic/fundamental research, applied research, and (experimental) development according to the National Center for Science and Engineering Statistics (2022). The definition of diffusion is according to Godin (2006).

Experimental development is the phase of the linear model where public innovation encounters the most barriers; 55% of public innovation projects experience barriers in this stage of the linear model (Cinar et al., 2019). The linear model simplifies the innovation process into four stages and, when categorized as part of the linear model, experimental development is the third step in the innovation process. Scholars call this stage-based view of innovation the 'linear model of innovation', which was developed through several studies (Godin, 2006). The linear model of innovation is visualized and described in Figure 3. The linear model of innovation has many critics in scholarly circles for its simplicity and rigidness (Tidd, 2021; Torugsa & Arundel, 2016), however, the model is often used by institutions as a tool for innovation managers (OECD & Eurostat, 2018). A strength of this linear model is the separation of actors and their roles. The linear model is a simplification and is useful in some domains of policy analysis and policy areas (Balconi et al., 2010).

To apply the desired focus on a section of the linear model, a quantification of the research progress is required to determine what is, and is not, experimental development. A common method is the quantification by the National Aeronautics and Space Administration (NASA) for assessment of the maturity of new technologies. In 1995 NASA published a 9-point scale which has become the base for the currently used Technology Readiness Levels (TRLs) (Mankins, 1995). Figure 4 provides an overview of the different TRLs. In military settings, which is relevant for the empirical setting, scholars occasionally use the terms "long-cycle innovation", "immediate adaptation" and "short-cycle innovation", as coined by Grissom et al. (2016) to define the linear process of innovation. Grissom et al. (2016) defined 'long-cycle innovation' as the development of new technologies over many years. 'Immediate adaptation' was defined as tactical and technique adjustments to innovation. Lastly, 'short-cycle innovation' was defined as the innovation space in between, where operators, developers, and aggressors are combined in the innovation space. Originating in the U.S. Air Force, this definition has spread to other militaries, such as the Dutch Ministry of Defense (MoD), where the term is adapted to describe the demo to the implementation phase of innovation, with a TRL of 6 to 9 (Ministerie van Defensie, 2020b). This definition generally overlaps with experimental development and shows that the Dutch MoD's short-cycle innovation could be a subject of research on experimental development.

Innovation monitoring can focus on different scopes of innovation methods. When analyzing innovation policy, research should not be limited to organization-wide analysis or outputs: studying innovation on a project level is crucial because it allows for a deeper understanding of the intricacies of the innovation system. Projects form the backbone of overall innovation efforts and studying the factors that drive or hinder innovation will give policymakers a picture of the effects of their policy (Mu & Wang, 2022).

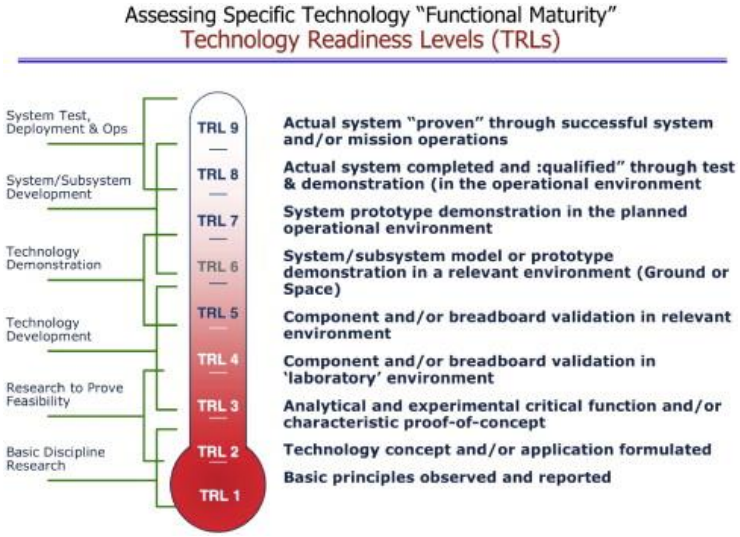


Figure 4: Overview of the technology readiness level scale (Mankins J., 2009).

2.2. Conceptual framework

A theoretical framework is set up based on the literature, mainly from Cinar et al. (2019) and Brogaard (2021), which is visualized in Figure 5. From the literature can be concluded that four types of barriers influence the perceived success of the innovation process. The contextual factors are visualized around the organizational, interaction-specific, and innovation-characteristic factors. This is because the setup and context of the PPP define the ability to act and the problems that are encountered. It sets the stage for the PPP with a focus on innovation to work. For example, the subjects of Klievink et al. (2016) experienced legislative issues around platform governance, and the public sector was able to adjust those legislative guidelines to make the project successful. However, these legislative guidelines also influenced the organizational factors and interaction-specific factors of the case.

This framework encompassed the research question by bundling the barriers, success factors and strategies together into their respective categories. Success factors and barriers can be interpreted as being 'two sides of the same coin'. For example, the lack of shared innovative vision could be a barrier, and a shared innovative vision could be a success factor. Also, strategies should be associated with a specific barrier, therefore they could be combined into the theoretical framework as well.

The strategies employed by the participants of the PPPs are the effect that the participants have on the arrows within this framework. Success factors and barriers exist, and it is the actors' job to utilize and mitigate their effects. The intention of this research is not to prove or disprove this framework. This framework is used within the research as a guideline to explore the nature of the relationship between these factors. These relationships are not direct correlations but instead have a different effect on a case-by-case basis. To understand these relationships and what types of barriers, success factors and strategies could be bundled in the categories of the theoretical framework, a literature review of these factors is warranted.

For reference, Brogaard (2021) provides her own analytical framework to example PPPs with innovative goals, which was set up by examining thirty-three studies, for factors that influence PPPs with innovative

goals. This framework is based on literature, making empirical evidence limited. A recommendation Brogaard herself poses is the demonstration of the usefulness of the framework. This study intends to contribute to this research gap, adapting the theoretical framework put forward, with its main contributors being Cinar et al. (2019), Brogaard (2021), and Smith et al. (2019).

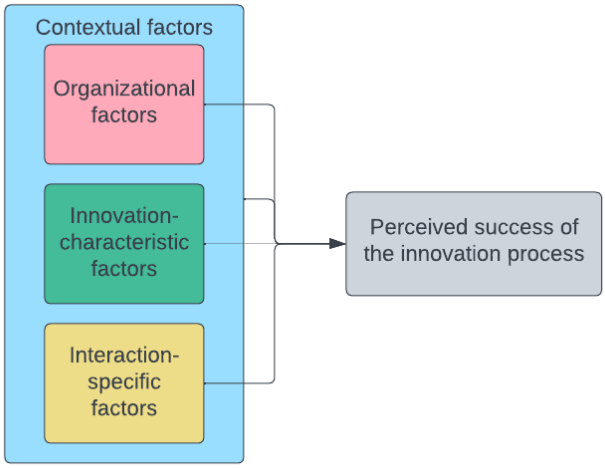


Figure 5: Theoretical framework of barriers and success factors influencing PPPs with a focus on experimental development.

2.3. Topology of barriers and success factors

In describing barriers and success factors to processes, academics have used different terminology. D'Este et al. (2012) identified *revealed barriers* for the first time, these are experiences that were perceived as difficulties within the innovation process. This study aims to respond to calls for further research into these barriers (Brogaard, 2021; Cinar et al., 2019). Within the literature, difficulties that hinder the innovation process have been labeled as barriers (Cinar et al., 2019) and obstacles (Akhmadi & Tsakalerou, 2020).

This topology will focus on the factors as shown in the theoretical framework in Figure 5, and literature that is selected are often case studies or quanititative studies into the PPP with innovative goals. It can be observed that much of the research is by similar researchers, that often continue to research a specific field.

The most frequently cited barrier in literature are interaction-specific barriers, while innovation specific barriers are infrequently named as barriers. This aligns with the literature reviews by Cinar et al. (2019), where interaction-specific barriers were named as causing the most barriers within PPPs.

The participants of the PPPs, in a proactive setting, will attempt to overcome barriers and promote success factors. Literature on the coping and utilizing strategies for managing these success factors and barriers in PPP that focus on innovation projects is limited. A literature review is firstly set up a limited number of studies that focus on coping strategies on PPPs in innovation, and secondly around the review papers that study this phenomenon in general PPPs, or only on innovation. This is included in the topology of barriers from section 2.3.1 to 2.3.4.

2.3.1. Organizational factors

Organizational barriers are defined by the issues that arise when a process 'proliferates into diverse pathways' within the organizations (Cinar et al., 2019). These issues can be attributed to a single party within the PPP. That does not mean that the barrier only has an effect on a single party within the PPP. In well-functioning cooperative agreements two parties can help with each other's organizational barriers. The organizational barriers that are named are diverse. Governance is a reoccuring factor, with 'complexity of actor composition',

'clear governance', 'integration of the divisions' all being named as barriers (Brogaard, 2021; Klijn & Teisman, 2003; Zou et al., 2014). Zou et al. (2014) name objecttives and commitment issues, which could tie in with the research by Othman & Khallaf (2022), since unskilled and financial issued could also be attributed to lack of commitment.

Table 1: Identified organizational barriers to PPPs in literature.

Organizational barriers	**Source**
Cultural	(Smith et al., 2019)
Governance	(Klijn & Teisman, 2003; Othman & Khallaf, 2022; Zou et al., 2014)
Financial	(Othman & Khallaf, 2022)
Training related	(Brogaard, 2021; Othman & Khallaf, 2022)

2.3.2. Interaction-specific factors

Cinar et al. (2019) describe interaction-specific barriers as the most common barrier in public-private partnerships with a focus on innovation. This is a natural conclusion, since PPPs have additional communication requirements, and the two types of organizations are fundamentally different. Interaction-specific barriers are defined as: "barriers between innovation partners within the process". Interaction-specific barriers include a lack of shared understanding between two organizations, a lack of effective network governance, or inadequate communication and knowledge sharing. Smith et al. (2019) define this as inter-organizational barriers, with partner relations and division of work being prominent barriers to the PPP. Zou et al. (2014) focussed on the relation-management in general PPPs and found specific improvements, such as the commitment of senior management, and the defining of objectives.

Table 2: Identified interaction-specific barriers to PPPs in literature and strategies to overcome those barriers.

Interaction-specific barriers	**Strategies**	**Source**
Conflict and contract management		(Brogaard, 2021; Othman & Khallaf, 2022; Smith et al., 2019; Warsen et al., 2019)
Communication	• Seek informal settings with colleagues.	(Brogaard, 2021; Cinar et al., 2019; Jalonen & Juntunen, 2011)
Thought diversity	• Implement freedom of choice for customers. • Implement boundary-spanning, roles for actors to check for new information.	(Jalonen & Juntunen, 2011)
Strategy related		(Cinar et al., 2019; Klijn & Teisman, 2003)
Trust related	• The setup of management strategies to improve trust. • Establish new ways of intensified collaboration. • Institutionalization of governance.	(Brogaard, 2021; Cinar et al., 2019; Edelenbos et al., 2011; Klievink & Janssen, 2014; Warsen et al., 2019)

There are some factors that are reoccurring within the literature review. Trust, or lack thereof is a reoccurring theme by multiple academics and the most prominent theme (Brogaard, 2021; Edelenbos et al., 2011; Warsen et al., 2019). Some barriers could be categorized as a trust issue, while it is not specifically named, for example, 'hesitancy to give up control over data' and inadequate communication sharing (Cinar et al., 2019; Klievink & Janssen, 2014). Some contract issues are described as barriers (Brogaard, 2021; Othman & Khallaf, 2022), and lack of shared commitment is also cited as a barrier (Brogaard, 2021; Cinar et al., 2019). Most interaction-specific strategies rely on the increase in interaction. Some parties look for a more informal setting (Jalonen & Juntunen, 2011), while others institutionalize the communication to create long-term communication commitments (Edelenbos et al., 2011; Klievink & Janssen, 2014). In Table 2 the interaction-specific barriers and strategies are shown.

2.3.3. Innovation-characteristic factors

Innovation-characteristic factors are factors that can be attributed to the technology itself. The technology can be deemed too complex or end up incompatible with the goals set by the partnership. Innovation-characteristic factors are a 'natural' development of innovation: innovation can fail or be delayed. Within literature on PPPs with innovative goals this was cited infrequently. The categories are based on public sector innovation as opposed to PPPs with innovative goals, so this could be a reason for the decreased frequency of this category. Othman & Khallaf (2022) experienced this barrier, when public support for the PPP reduced in significant amounts when there was too little to show for the innovation process. In Table 3 the identified barriers in the innovation-characteristic category are shown.

Table 3: Identified innovation-characteristic barriers to PPPs in literature.

Innovation-characteristic barriers	**Source**
Too little technological development	(Othman & Khallaf, 2022)

2.3.4. Contextual factors

Within confidential sectors of the public sector, such as policing and military manners, states may increase regulation. This regulation can be assumed to be a hindrance to PPPs. Especially in innovation, the free sharing of information is seen as a success factor, and this regulation often hinders the free sharing of information. Governments have set up contextual factors to influence the other factors to improve their effectiveness.

The literature is generally vague when describing contextual issues. Most of the cited parties describe just regulatory institutional issues. Strategies that are named are in a double-case-study by Klievink et al. (2016), which has strategies that are related to its technological niche. In Table 4 the identified literature on the contextual barriers is shown.

Table 4: Identified contextual barriers and strategies to PPPs in literature.

Contextual barriers	**Strategies**	**Source**
Regulatory	Setup of new governance models with public-private interaction in mind.	(Klievink et al., 2016; Klijn & Teisman, 2003; Othman & Khallaf, 2022; Smith et al., 2019)
Political		(Othman & Khallaf, 2022)
Technology related	The development of new platforms	(Klievink et al., 2016)

3 Methodology

To answer the research question as stated in the introduction, a methodology is set up around three sections. Firstly, a research setting is chosen. Secondly, data collection is discussed, where information is gained through interviews, and an interview protocol is discussed. Lastly, data analysis methodology is discussed, which describes how the data is processed.

A qualitative research approach was used, which was a unique method to analyze PPPs with innovative goals since most studies use a case study or quantitative approach. The qualitative approach suited the research, since the setting, which will be discussed in section 3.1, was unique to the existing literature. A qualitative approach would be able to create the opportunity to analyze in more depth the complex social phenomena that PPPs are, explore contextual factors in-depth, and allow for theory development during the research. This type of qualitative research makes it easier for this study to become a springboard for further research in this context. The goal of the research therefore became to come to a close understanding of PPPs that focus on experimental development, with their associated complexity. This would allow further research into the most interesting and scientifically relevant sections of PPPs with innovative goals in this setting.

3.1. Research setting

A military setting was chosen due to its unique position regarding innovation and PPPs. Historically militaries have had a unique role regarding innovation, since ‘military innovation’ is a term that is often separate from ‘conventional’ innovation (Grissom, 2006). Militaries do not innovate for financial gain but for operational advantage. This makes innovation, itself a hard-to-measure process, have hard-to-measure goals (Kattel et al., 2014).

For the public partner of the PPP, the Dutch Ministry of Defense was chosen. The decision to choose a single innovative partner allowed for a more careful analysis of culture. The Dutch Ministry of Defense is an organization with more than 60,000 full-time equivalents (Ministerie van Defensie, 2023c). This allows multiple PPPs to be active within the organization from multiple organizational elements to be analyzed. From the private sector, companies are interviewed that have cooperated with or are currently cooperating with the Dutch Ministry of Defense. Interviewees are selected to be individuals with knowledge of the manner of cooperation within the Dutch Ministry of Defense. These were mostly CEOs or higher-ups within smaller organizations.

3.1.1. Dutch Ministry of Defense

The Dutch Ministry of Defense (MoD) was chosen as the sole public organization within the research setting. In this decision factors such as access to expertise, organizational setup, capacity, and history with the subject weighed in. Firstly, access to expertise was made easier within the network granted by PricewaterhouseCoopers. Using this network, Defense personnel with innovation portfolios could be contacted. The Dutch MoD is also eager to analyze the effects of its innovation policy, which adds to the availability, and ease of access to participants for interviews.

This eagerness is because of its stated goals. The goals of the organization are, as a public organization, not based on profit, but instead on impact. The Dutch MoD is responsible for the protection of Dutch and allied soil and has the goal of promoting legal order and stability in disasters and crises (Ministerie van Defensie, 2020a). The MoD regards “a strong innovative capability” as one of its ten main institutional principles, in addition to its mission statement. In organizational setup within the MoD, experimental development is separated from basic and applied research by their organization. Experimental development in the Dutch MoD is performed by innovation institutions within the Organizational Elements (*Dutch abbreviation: DO’n*), where basic and applied research is done in knowledge institutes. This separation

limits the scope and allows for a clear separation of experimental development and applied research. Also, the organization is suited to the research, since it consists of multiple DO'n, which all have key differences in culture, organization, and innovation policy, allowing the analysis to retrieve diverse results based on the effects of those differences. Thirdly, the Dutch MoD has the current capacity to be active in multiple PPPs with innovative goals, in a sense that other public institutions, such as a municipality could not. Lastly, the Dutch MoD has been active in PPPs with innovative goals for several years, leading to the possibility to examine not just currently active PPP projects, but concluded projects as well.

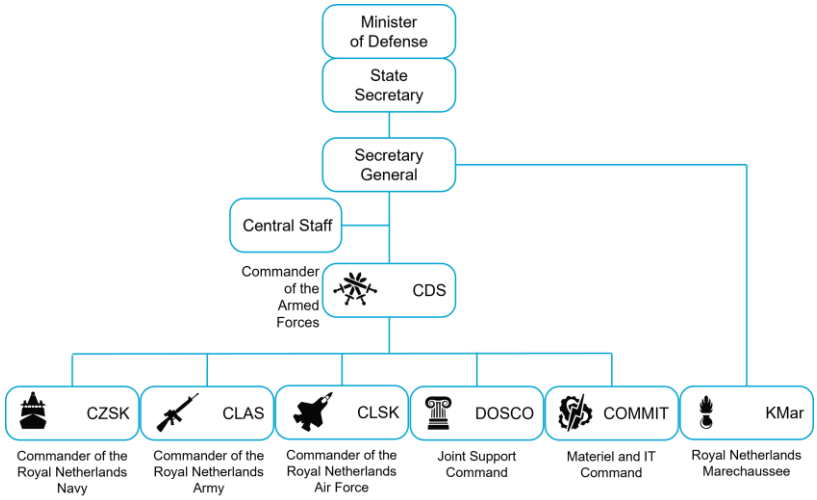


Figure 6: Organizational chart of the Dutch Ministry of Defence. Dutch abbreviations are used, with English translations of their full names. The organizational elements with logos are the seven DO'n (English: Organizational Elements).

The Dutch Ministry of Defense (MoD) provides diverse research settings for PPPs with innovative goals within a single organization. All seven Organizational Elements (Dutch abbreviation: DO'n) of the Dutch MoD have innovative activities. The organizational chart of the Dutch MoD is visualized in Figure 6. Part of the data verification will be to assess whether the innovative activities can be compared. It is known that experimental development is managed mostly by the DO'n. Two organizations within the Central Staff (CDS) have extra separate budgets for experimental development within all DO'n: FRONT and POIND. FRONT and POIND are the organizations with the MoD that have the role of coordinating experimental development. The Dutch MoD defines experimental development is done in the Dutch MoD as "short-cyclical innovation".

Six of the seven organizational elements were interviewed. The Commander of the Royal Netherlands Navy (Dutch: *CZSK*) is the organization that is responsible for maritime military activities. The CZSK has several centers for experimental development, in 2019 the CZSK had five (Koetsier-van der Werff et al., 2019). These CZSK-based K&E centers have many innovation projects. The Commander of the Royal Netherlands Army (Dutch: *CLAS)* is responsible for the land-operation branch of the Dutch MoD. The CLAS groups its innovation into subgroups where innovators work together on an operational objective. Some of these are the Kennis & Expertisecentra (K&E-centers) of which there are around 30 in 2019 (Koetsier-van der Werff et al., 2019). The commander of the Royal Netherlands Air Force (Dutch: CLSK) is the organization responsible for Air Force operations in the Dutch MoD. The Air Force has an organization specifically responsible for general innovation, AIR (Ambition, Innovation and Results). The Royal Marechaussee (Dutch: *KMar*) is a police force for the Dutch armed forces. The KMar has multiple networks and labs, in which it innovates. The Kmar works together with other ministries frequently, due to its similar role to, for example, police and customs. Command Material and IT (Dutch: COMMIT) has an innovative role in the procurement of large material and is therefore frequently active within the innovation space, on a relatively large budget. Lastly, the CDS has a central and coordinating role, having them set up their experimental development differently. All these parties coordinate with the private industry on their own, mostly on their own, unless the innovation concerns large equipment or vehicles.

3.1.2. The Dutch Defense Industry

The Dutch Defense Industry was chosen due to their close connection with the Dutch MoD, and their innovative activity. The Dutch Defense Industry is the main supplier of the Dutch MoD, supplies around 61.5% of the Dutch armed forces. This connection leads innovation in the sector to quickly reach the MoD. The Dutch Defense Industry also spends a large part of its budget on Research and Development. The Dutch Defense Industry makes up about 1000 companies, with approximately 150,000 full-time equivalents employed in 2022 (Schotel et al., 2022). Therefore, the industry is large enough that the recommendations of the thesis can have large real-world applicability.

The selected interviewed companies are representative of the overall industry, since they are Original Equipment Manufacturers and Small to Medium Enterprises (SMEs). The industry contains many smaller companies; 80% of companies active in the sector can be classified as (SMEs), as visualized in figure Figure 7. Original Equipment Manufacturers are the category of company in the Defense Industry that spends the most (13% of expenses) on R&D (Schotel et al., 2022).

Within the selected Original Equipment Manufacturers there are differences in age of company, size, and category of technology, which could lead to differing barriers and could guide the study. Literature suggests that this leads to differing barriers, and we can assume, therefore, different strategies. Older SME's often face barriers in organization, skills and bureaucracy when innovating, while younger SME's often face financial barriers when innovating (Thomä & Zimmermann, 2016). Larger companies, which are not included in the study, often face less financing barriers, but more on the general high cost of innovation making 'innovation' often unprofitable. Larger companies are more likely to report organizational rigidities as barriers than smaller firms (Tourigny & Le, 2004). Pellegrino (2015) finds that older companies experience more marked-based barriers, but less financial barriers and are less sensitive to the effects of less qualified personnel. Lastly, the technology has an effect on the barriers experienced, as was empirically shown in (Gillingham & Sweeney, 2012).

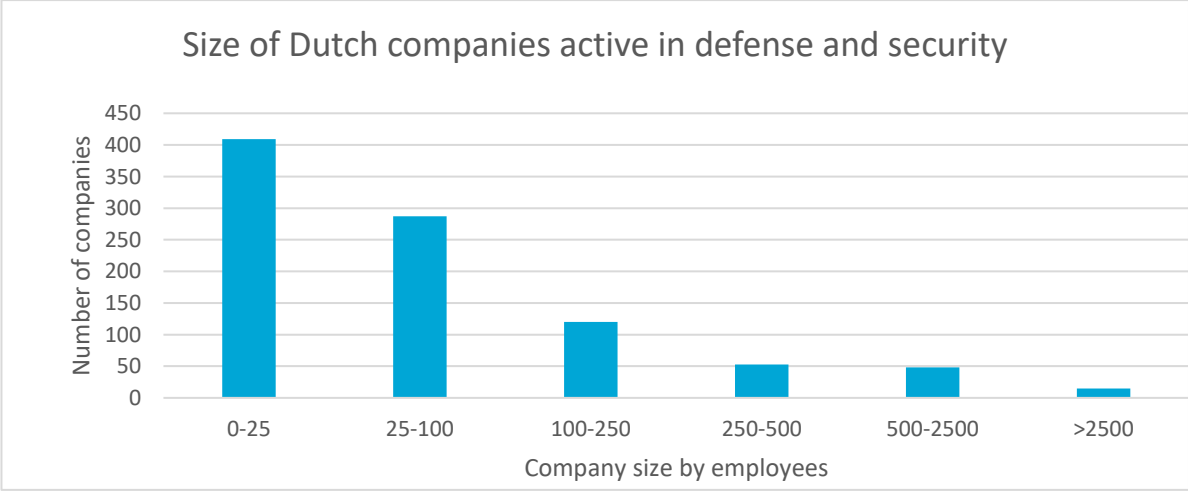


Figure 7: The size of Dutch companies active in defense and security in 2022, as identified by Schotel et al. (2022)

3.1.3. Participants

The persons that are interviewed in the research are shown in Table 5. The table includes dates, since, due to the exploratory and qualitative nature of the research, is important to define the chronology of the interviews. The earlier interviews affected the later interviews, as will be discussed in section 3.2. Because most public institutions are interviewed first, they have a larger influence on the direction of the research. The functions describe their role within their respective organization. The technology categories show that a range of technologies were analyzed within the study.

Interviewees within the selected organizations were chosen based on their availability and their attachment to the subject: All subjects were asked if they would be able to describe a specific project in detail. This was to make sure they knew the issues at play, instead of a policy view. Contacts were approached through internal conversations with an innovation operations advisor of the Ministry of Defense, and members of the Defence Consulting Team of PwC. Other contacts were made through The Netherlands Industries for Defense & Security (Dutch abbreviation: NIDV). The NIDV is the industry association for Defense and Security companies.

Table 5: Participants in the interviews, and their functions and associated DO.

Interview nr.	Date	Public/ Private organization	Organizational Element (DO) of employment	Function	Technology category
1	Aug 7th	Public	CLSK (Air Force)	Senior innovation manager	-
2	Aug 8th	Public	CZSK (Navy)	Innovation manager	-
3	Aug 8th	Public	CZSK (Navy)	Innovation manager	Robotics
4	Aug 11th	Public	CLAS (Army)	Program manager	Robotics
5	Aug 28th	Public	CLAS (Army)	Head innovation coordinator	-
6	Aug 30th	Public	KMar (Marechaussee)	Staff Advisor	Information Technology
7	Aug 30th	Public	CDS (General staff)	Policy Advisor	Law
8	Aug 31st	Private (Previously: Public)	(Previously: CLAS)	Business Development Manager	-
9	Sep 5th	Private	-	CEO	Robotics
10	Sep 5th	Private	-	Account manager	Communication Technology
11	Sep 8th	Public	COMMIT (Material and IT)	Innovation expert	-
12	Sep 15th	Private	-	Managing Director	Virtual Reality
13	Sep 18th	Private	-	CEO	Sensor Technology

The method of data acquisition can be subject to confirmation bias. For example, if a subject supports the notion that communication with the MoD is essential for innovation, they will describe this factor more positively. Questions were set up to measure the factors from the theoretical framework as objectively as possible.

It was considered whether to interview the end users of successful technologies. This would be to test whether the perception of success aligned with the actual use of the innovation. After deliberation with the public side of the PPPs, this was determined not to be necessary since they often had a hand in the interpretation and eventual use of the innovation.

3.2. Data collection

Data was collected through semi-structured interviews. Data collected through semi-structured interviews allows the researcher to manipulate variables to develop a connection with the participant (Adhabi &

Anozie, 2017). This engagement is necessary, especially when different parts of the organization within the Dutch Ministry of Defense have different terminology and methods when it comes to innovation, experimental development, and PPPs. Data was gathered from multiple sources, across public and private partners in PPPs in multiple Organizational Elements in the Dutch MoD.

The interview protocol, which can be found in Appendix A.3, was set up based on the theoretical framework as presented in Figure 5. The interview was set up in four stages. In the first stage, a general introduction is performed. In the second stage, information on the nature of the PPP is gained, ranging from contractual and financial to interaction and origin. In the first interviews, Figure 2 is shown when the setting of the PPP is unclear. This is to determine the nature of the PPPs and compare whether the PPPs of the interviewees were similar in setup and nature. These questions were set up based on the literature on general PPPs. In the third section of the interview, success factors and barriers are discussed, followed by questions on strategies. The last stage would be the closure of the interview.

The third stage was therefore the most important for data collection within the interview. To make sure that real-world barriers were named, and not speculative barriers, interviewees were asked to keep a specific project in mind. This lead to threefold questions such as:

- What barriers did you face during the implementation of this project? And
- What barriers influenced the success of the project?
- How has your organization been able to overcome these barriers?

Due to the semi-structured nature of the interview, the interviewee would be allowed to deviate from these questions. When questions were already answered, they were skipped.

The interview protocol was reviewed after the first four interviews, leading to three significant changes. These changes were warranted, because some assumptions from the literature review did not align with the experiences of the interviewees.

Firstly, the second stage of the interview was changed and expanded. The second stage was set up based on literature and on the assumption that PPPs worked in a similar fashion to the PPPs in infrastructure. However, the PPPs in the MoD appeared to be less rigid in setup and could not be shaped into a ‘type’ of PPP such as in Figure 2. Interviewees mentioned that there was a large difference between projects. This was changed in the protocol to let the interviewee answer the questions in a more open fashion, where the areas of interest were identified. These were: design of the collaboration, organization, financing, contracts, communication, and completion. The open-endedness led to questions such as: *How would you describe the collaboration between the public and private sides?*

As a second change, a question was added that made sure all categories of factors were discussed. In later interviews, it was decided that, if the interviewee had not mentioned one of the four categories of factors (Organizational, Interaction-specific, Innovation-characteristic, and Contextual), the interviewee would be asked if that unmentioned category affected their innovation process. Initially there was hesitancy to ask these types of questions, as they were perceived as leading questions. However, this hesitancy was unnecessary, since the interviewees were very clear about what they did experience and did not experience as barriers.

Lastly, to mitigate the effects of asking leading questions, an open-ended question would be asked in later interviews, whether the interview overlooked certain barriers or success factors. Using this question, the interviewee would be able to openly talk about the barriers, success factors and strategies, without being guided by the categories. The question asked would often be:

> *“I want to ask a very open question, is there anything that hasn't come up yet? Something in my list of questions that makes you think: “This works very well for us. Or are we running into problems here?” Problems which we haven't talked about yet.” -Interviewer*

3.3. Data Analysis

The gathered data was transcribed and analyzed through several steps, in which decisions were made that had implications for the results and conclusions. The data analysis is performed several times to ensure interpretation of coding applied irrespective of the order the data was interpreted. All the interviews were conducted by the same interviewer to ensure reliability.

The content of the interview was compared to the requirements as set in section 3.1.3, which excluded interview 8 and interview 11 from data analysis. These interviews had to remain unanalyzed, since they had direct experience with innovation in PPPs in the MoD. This made their interview data speculatory. Interviewee 7 had no direct experience in PPPs that focus on experimental development but was occasionally active in the laws and regulations regarding innovation procurement. This interviewee could not name specifics of innovation projects but had unique information on the dealings of procurement law. This was extra relevant since few of the interviewees could name specifics of innovation laws, only their perception of it. The data from this interview was therefore used as context for the conclusions on contextual factors, but not used in overall data analysis.

Interviewee 11 had experience in PPPs with innovative goals, but no hands-on experience in the Ministry of Defence. Therefore, this information would be speculative and under the assumption that the Ministry of Defence would work similarly as the previous experience with PPPs. The goal of this research is as much about the barriers and success factors as the context in which the PPPs are active; therefore, an entirely different context is unsuitable for data analysis, and this interview is not used in data analysis. The other 11 interviews had relevance to both research questions, both that they had hands-on experience with innovative cooperation between the public and private sector and that the innovation was experimental development.

The results were coded manually using a deductive and inductive method. In deductive coding, researchers use pre-existing theories or concepts to guide the coding process. Inductive coding is the process of determining and interpreting raw contextual data without a pre-defined set of codes. Inductive coding allows for themes to emerge during coding. This makes inductive coding a natural fit for exploratory studies like this study since the context of the setting is central to the findings of the study. The mix of both allowed for a guided fit through the data, with some degree of freedom.

The interviews were transcribed using Microsoft Teams transcription functionality (Microsoft, n.d.), after which these transcriptions were corrected in Microsoft Word by comparing it to the audio recording of the interview. Coding would be done manually, based on a code book developed based on the interviews, which can be found in Appendix A.4, and the coding would be stored and categorized using Microsoft Excel. This code book would be developed iteratively during the data analysis process. The code book contains the definitions of the codes, which were used to categorize the raw data.

First, the relevant statements were categorized deductively according to the categories in Figure 5. Determining the category of coding was based on the origin of the factor. For example, the perception of procurement regulation could be a cultural issue, or a process issue, where an expert does not meet the person in charge. However, the origin of the barrier is the procurement law, therefore it is categorized with the procurement factors. This has the limitation that barriers, success factors and strategies much be associated with a single category. Secondly, barriers and success factors are inductively grouped, within the category. To be considered relevant to the study the barrier or success factor had to be named in at least two different interviews. Lastly, strategies to overcome the barriers and success factors were identified. Strategies did not have a lower barrier for relevance. Strategies needed to be connected to at least one barrier or success factor. ‘General’ strategies, which were not connected to a barrier or success factors were not identified.

The separation of barriers, success factors and strategies was in the deliberation of the action. Success factors were present since the start of the organization and required little active maintenance. Strategies were part of plans that the organization would use to improve the quality of its services. Lastly, ‘not a

barrier' was used when an interview would oppose the barriers stated in literature or other interviews. Table 6 could give the impression that all barriers are equal, which is not the case. Interviewees discussed different factors with differing strengths. The data was visualized based on the deductive categories, containing the inductive codes. This will be done by 'filling in' the categories of the theoretical model of Figure 5.

When other relevant patterns occurred, such as the origin of the cooperation (supply to the MoD or demand by the MoD), they were coded separately from the stated barriers and mentioned in the results as a separate chapter.

4 Results

11 semi-structured interviews lasting around 40 to 60 minutes were analyzed with public or private parties participating in a public-private partnership with the Dutch Ministry of Defence. Findings on the settings of the PPPs differed, but barriers, success factors, and strategies of the parties aligned. Questions focussed on the process of innovation, not the technical details of the innovation.

The results of the thesis are summarized in Table 6. Most parties discussed organizational factors and contextual factors, with innovation-characteristic and interaction-specific factors being discussed less in the interview. Most frequently cited were barriers as opposed to success factors. Within the analysis the decision was made to connect all stated strategies to specific barriers or success factors. This was due to the methodology of the interview protocol. The interview protocol first asks for barriers and success factors, and then how to deal with them. This automatically guides the interviewee to connect a strategy to a stated barrier. Labeling success factors and strategies showed significant overlap. Barriers were often experienced as a 'fact of life' and success factors and strategies were often efforts that were deliberately taken.

Some strategies did not match the categories of their origin factors. One of the findings of this research is visualized by the yellow-lined cells in Table 6. This is to highlight that interaction-specific strategies were frequently employed to improve on factors from other categories. This means parties, when facing difficulties within the innovation process, reached out to each other.

Table 6: Overview of categories of barriers, success factors, and strategies to PPPs with innovative goals. The number indicated the number of interviews the concept has been named. When cells are striped with the colour yellow, it indicates that the strategy employed depends on interaction-specific solutions. Interview 8 is both from a public and private perspective, so is counted as half for the public perspective, and half for private perspective.

		Public perspective				Private perspective			
Category	**Inductive codes**	Barriers	Succes factors	Strate-gies	Not a barrier	Barriers	Succes factors	Strate-gies	Not a barrier
Organi-zational	Public: Process rules	5,5		2,5		3,5		1,5	
	Public: Culture, vision and implementation	2	1	1		1			
	Public: Scale-up	3,5		2		1,5			
Contextual	Procurement: General	2,5		2,5		2,5		1,5	
	Procurement: Prior knowledge	2,5		1	0,5				0,5
	Procurement: Perception	2		1		2		1	
	Privacy	2				2			
	Technology-related	1		1		1		1	
Innovation-characteristic	Uncertainty	2		2	2			2	3
Interaction-specific	Contact with end user	1	2,5		1		4,5		
	Shared understanding	1,5	2	3,5		1,5	1	1,5	
	Expectation Management	1,5		0,5		0,5		0,5	

The findings are categorized into six sections, as visualized in Figure 8. The sections are based on the deductive coding as laid out by the categories of the theoretical framework in Figure 5. In sections 4.1 to 4.4 the results of the four different categories of factors are described. 4.1 describes organizational factors, factors present in separate organizations, such as process rules. Section 4.2 describes contextual factors, such as laws. This order was chosen since organizational and contextual factors showed frequent interaction. In section 4.3 innovation characteristic factors are described, such as technological complexity. As the final category, interaction-specific factors are discussed in section 4.4, with factors revolving around communication and cooperation. In addition to the categories, the setup of the PPP is discussed in section 4.5, and in this section will be discussed how closely the PPPs with innovative goals in which the interviewees experience aligned with the literature on PPPs with innovative goals. This section also discussed the difference in applicability between the interviews for the answering of the research question. Lastly, in section 4.6, the theoretical model of Figure 5 was revised to accommodate the findings of this research.

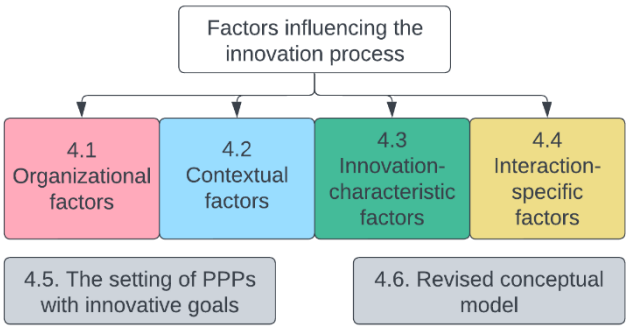


Figure 8: Visual illustrating the organization of the result section based on categories by Cinar et al. (2019).

4.1. Organizational factors

The most frequently cited barriers to the PPP-process were of an organizational kind. Organizational factors are properties of the process or organization that can be attributed to a single side of the PPP. The results from the organizational factors can be categorized into public and private organizational factors since organizational factors specifically focus on a single side of the PPP. Organizational factors are also very visible to the other side of the PPP since they experience delay without being able to affect it in a large amount. Curiously, both sides acknowledged organizational factors on their side of the PPP to affect the PPP. Three codes were inductively identified within this category: ‘Process rules’, ‘culture, vision & implementation’, and ‘scale-up’.

4.1.1. Public: process rules

Process rules in the MoD are the most frequently cited barrier to PPPs focusing on experimental development, being named in all but two interviews, see Table 6. Process rules include all regulations that are not ingrained in the law, making them different from contextual factors. Process rules have no judicial ramifications when broken, however, they could affect your relationship with or within the public body.

The interviewees cited three types of public process rules barriers they found to have a negative effect on the process: Approval procedures, the differences within the public organization, and the 3-year rotation on jobs.

Approval procedures are the checks and balances in place by the public organization to make sure the process runs fairly. Interviewees were generally vague when describing issues regarding approval procedures, yet when officials cited examples, they were telling. Interviewee 8 described a telling example of garnering signatures for documents that private organizations often required to request funds from banks:

> *“A very good example is that we still had to put in 22 signatures to make a requirement statement and needed 22 to release the money to start up an innovation. It was in the process because someone with training had to look at the statement, someone with staff management had to look at the statement, someone had to study the statement, et cetera et cetera. We eventually managed to reduce that to two signatures. That is tremendous acceleration. These are not legal rules, these are internal rules to control the entire process.” -Interviewee 8*

There is a universal realization within the public interviews that this process needs to be improved, yet the parties did not mention that they would change process rules, implying they had no power to change them. For example, one interviewee mentioned that they would try to keep the process rules as far from the technical staff as much as possible, to keep them working optimally:

> *"Because you are really working on very serious social projects here. A tangible contribution, but the working environment must also be right. And when I try to achieve that, I run into a lot of bureaucracy. We're just going to do it, but it's a matter of stoically smashing through barriers." -Interviewee 6*

Interviewee 13 mentioned that they would anticipate the next process steps and try to immediately answer any questions the public officials would have, to speed up the process:

> *"We ensure that the process runs smoothly. So, if a buyer asks us questions. [We are] proactive. Basically, what we do is make sure we are always the easiest customer." -Interviewee 13*

In another interview, interviewee 8 mentioned that due to these processes, many private organizations had trouble getting paid in a timely fashion. They recommended private organizations just to keep calling the MoD to put pressure on the process. Interviewees with the power to change it mentioned public officials were actively questioning and improving these systems of cooperation to accommodate innovative ideas from the private sector, while also having the checks and balances required from the public sector.

Different process rules are also present within different parts of the MoD, exemplifying the difficulties with process rules. These different process rules are present across the DO'n. Again, interviewees were vague in the specifics of the barrier. However, parties did mention that the re-learning of these processes was a significant barrier to the further development of the innovation. Specifically, the private sector interviews found this a major barrier. This extends to legal factors as well, as is discussed in section 4.2. Interviewee 10 puts it as follows:

> *"Everyone there has a different view on a different way of organizing: with expertise centers, knowledge centers or other departments. No matter how they deal with innovation. So yes, that sometimes makes it confusing. It takes a while before you understand how everything runs and who is responsible for what and what position someone has." -Interviewee 10*

These barriers of differing process rules give more perspective regards to process rules within the public organization, lastly, almost every official mentioned that this type of cooperation was 'new'. Public and private interviewees talked about the decennia of budget cuts, that left the MoD hesitant to approve expenses without clear results. With recent significant budget increases, investment in innovation has increased as well. However, many of the processes are therefore in a phase where many interviewees feel like organizational change is happening. As interviewee 8 describes the changes in the organization:

> *"You must imagine that in 2015, the right to talk to the industry was only reserved for Defense buyers and acquirers. So not for people like me but let alone for an end user. Yes, you are increasingly seeing that Defense is also starting the conversation with the private sector [with the sentence]: "Look, I have a problem."" -Interviewee 8*

Lastly, the 3-year rotation on jobs that the Dutch MoD uses is experienced as a process barrier by some groups. The Dutch ministry uses a 3-year rotation on jobs, which is universally used throughout the organization. This is such an established process throughout the whole MoD, that could be described as the culture within the MoD. It is grouped under process rules since there are examples of individuals disregarding this rule and serving for longer in a position. Most private organizations found this to be a difficulty since they mentioned they would need to build up a business relationship with the new contact every time. Public interviewees acknowledged that this created process barriers. No party named strategies

to overcome this. One interviewee found this not to be a barrier and mentioned that the contact generally knew how to find the company when they needed their technological solution. As an example of the barrier an interviewee experienced:

> *"A disadvantage is always that people often change positions. Within 3 years we also encounter that during an innovation process: the enthusiastic person who wanted something is replaced by someone who may have their agenda or their image. That is also possible for innovation. How do you deal with that? You can't do much about it yourself, of course." -Interviewee 9*

One interviewee mentioned that the organization is changing to become more flexible towards these job rotations. This indicates that the attitude might be changing within the organization.

> *"We have made the agreement: we publish the military vacancies or military positions we have, but we look at the time when the selection will be made, for example at what exact quality we need. So, we publish something more generic, not linked to application period or technology area. Then we will look at the moment when the selection is further along in the process. What is the real quality we need? Does it fit within a certain bandwidth and how much? Where have I published [the position]? Do I need zero, or one or perhaps 3 of the same [positions], because there is a need at that moment, so we know how to use each other and the systems to arrange that necessary flexibility. And we did that internally." -Interviewee 5*

4.1.2. Public: culture, vision, and implementation

Culture, implementation, and vision are three concepts that appeared to closely align within the context of PPPs focusing on experimental development in the MoD. The culture of an organization concerns the 'implicit values, beliefs, and assumptions that employees infer guide behavior, and they base these inferences on the stories, myths, and socialization experiences they have and the behaviors they observe' (Schneider et al., 2013). The vision refers to the view of the innovation, and how the organization wishes to utilize it to improve on their goals. Lastly, implementation refers to the overall effectiveness of the implementation of the technology in the organization.

These codes are combined because the results of this barrier often came down to the same results: The innovation works, yet it is not embedded in the organization. Some interviewees describe this as a cultural issue, some as a lack of vision, and some state that implementation is the issue. This is a barrier that public officials cited much more as a barrier than private interviewees. This is logical since public officials are the ones that most closely see the actual use of the product of the innovation.

As an example, interviewee 8 describes it as a culture within the organization.

> *"What you see is that when you introduce something new in a large organization, everyone gets enthusiastic in the beginning, and you make many steps forward. At some point you're thrown back again, right? So, then you go back two steps or even three steps back. So that's something I've experienced. Certainly, in the beginning, you could make progress very quickly because it was new. After all, you had data here. You are accountable, so to speak, to the highest level within the Army. You are taking steps in that direction. At a certain point you see that you are automatically drawn back into the existing processes, which in turn causes a delay." -Interviewee 8*

As another example, interviewee 1 describes it as an implementation barrier:

> *"No one is responsible for implementation. And so, everyone is responsible for implementation. One role is for the short-cycle innovation center. One role is for the*

current business operations. One role is for the policy makers. The role is for the operational units. So, no one does [implementation]. So, we don't know who should do the implementation, but we also don't know how we should do it." -Interviewee 1

Interviewee 4 described vision as a success factor within their team. This interviewee mentioned that they were very proactive in creating a mission, vision, and strategy for each project until implementation. Even this interviewee did have to state that more disruptive innovations were harder to adopt in the organization. The implementation of successful innovation for the mission and goals of the public organization is perceived as often unsuccessful and a barrier within the public organization.

"So, you notice, they understand it when you explain it: "We also need to do something with AI and Machine learning." But embedding that final phase of adoption and bundling the profits from the project into the organization. With some more progressive innovation, which requires more changes from the internal organization, is a very difficult one. Horizon 1 (describing incremental innovation) is easier, easier to embed and adopt in the organization." -Interviewee 4

Interviewee 4 was the only interviewee to state a strategy for improving the implementation process. This interviewee recommended asking key questions before starting the project. This mindset would improve the eventual connection between

"What goes well, what helps us, is more in the program now that we have set it up. A clear definition and scope of mission, vision, and strategy, which is consistent, more carefully thought through. [It is] about what we offer, for whom, and in what way." -Interviewee 4

4.1.3. Private: scale-up

The scaling-up is the increase from a small number of products to a large production line within the private organization and is often perceived as an organizational issue within the innovation process of the private PPP. The main stated issue in organizational terms is the lack of scale-up ability in case an innovation is successful. The MoD, and even sections of the MoD, are major organizations. The size of their operation means that they have large orders which smaller parties are unable to fulfill. Interviewee 4, as a public official, states their strategy to this barrier is clear communication of expectation management so that the private organization can start setting up their production capacity.

"Having difficulty implementing and operationalizing outcomes from innovation also affects your relationship with your external partners, expectation management, for example. A successful project is completed. It is also attractive from a business perspective to be able to upscale. And why doesn't that work? We don't have many examples of this being successful. […] So, in expectation management as well or, on the other hand, externally your business strategy, it is essential that that final phase of upscale implementation can also happen." -Interviewee 4

Interestingly, interviewee 9 is just in a scale-up stage of development of their technology and describes the difficulty of the scale-up phase. Interviewee 9 describes that they are moving as fast as possible, showing that the expectation of the MoD might be too high for the change in business setup it requires. They mention that this requires a different business structure and experienced employees, which takes time, but is something they are actively doing. Interviewee 9 also describes that the company also needs to find different contacts for guaranteed sales for an initial scale-up, which is difficult.

"So now we are mainly looking for the entrance to the Koninklijke Marechaussee and I notice now in their organization, more funds are coming, but staffing and freedom are limited. Yes, making time for them is apparently difficult. We have had some conversations at this point, but it is not possible to follow through." -Interviewee 9

Strategies around this barrier often concern interaction-specific solutions. Two public interviewees state they overcome this barrier by actively engaging partners in long-term planning. They mention expectation management is central to making sure that scale-up happens properly. Expectation management would have to be accompanied by guarantees of purchase, which is likely the cause of this misalignment of interests. Interviewee 3 describes implementing scale-up properly as follows:

> *"Technicians sometimes want to worry about: "That has to be even better, even better!" But I say, well, hand it over properly, because then I can use it in a different way, because we can't just be developing all the time. It also simply needs to be tested and operated on. So, this whole concept is aimed at not only working on the main design step-by-step, but also immediately including the entire infrastructure of companies, things that need to be organized. And thus, in fact already pre-sorting, possibly for a later collaboration with those companies that may also be able to take control of production." -Interviewee 3*

4.2. Contextual factors

Contextual factors, the factors based on the legislative setting in which the PPPs operate, appeared to be quite essential in the shared experience of both the public and private organizations active in the PPP that focuses on experimental development. Three main legislative factors were stated by the interviewees: procurement law, privacy law, and technology-specific laws. Procurement is the most cited contextual factor to be named. This factor plays such a prominent role in cooperation, that it is separated into three smaller codes: general, prior knowledge, and perception.

Procurement law refers to the "process by which public authorities, such as government departments or local authorities, purchase work, goods, or services from companies" (European Commission, n.d.). Procurement law is set up to create a level playing field for businesses and to prevent corruption across Europe. Procurement law requires the public organization to send out a tender when the acquired product or service exceeds a financial size of € 140,000 (Your Europe, 2022). The PPP can exist without a tender if the financial side of the cooperation does not exceed this financial size. In a European tender, the public organization must specifically specify on what basis it will select the private organization, for example, price and specific quality parameters. The tender can include must-haves, such as a contact that is proficient in Dutch. Every European country can participate in the public tender, if they have the supporting documents, have equal access to information, and follow the review procedures. The public organization has the option to avoid purchasing through a tender when purchasing real estate, in cases of extreme urgency, security threats, or situations where there is only one supplier (Your Europe, 2022).

Innovative procurement is used by governments to stimulate information and has been cited to be a useful tool for innovation, however, no interviewee said to have known anybody within the sector that has used the procedure. Even interviewee 7, who knew the most on procurement law, knew not one party. This type of procurement is set up around a need that does not yet exist in the market, and the private organizations that respond to the tender can respond with a plan to meet the innovative need (European Commission, 2021). Interviewee 7 mentioned that this would be a useful method to stimulate innovation.

4.2.1. Procurement: General

Public organizations are required to set up a tender when a project becomes a certain financial size, and this hard financial border is experienced to be a difficulty according to the interviewees. The inductive code 'procurement: general' was used when interviewees mentioned that the fact that a proper procurement had to take place was a factor. This would be an issue for the actors mainly for two reasons, the fact that no more financing could be given to a single party without the cooperation going to a tender, or since tenders take a lot of time to set up, perform and give away.

Interviewee 8 describes the tender procedures to take around 1,5 years, which, for experimental development, they experience to take too long. As interviewee 8 put it:

"So, if it is a very good idea, we can include it in the tender. Then you can still participate, but then you will have completely different parties. But when you place a tender on the market. Well, it will take 6 months at the earliest, so if I have a request from the MoD now, I might be able to start with it in a year, so it completely goes beyond the [experimental development], maybe not from a TRL level perspective, but in time before a question is asked and before you go ahead, you will be 1.5 years further." -Interviewee 8

Many interviewees had strategies to overcome the issue. Interviewee 10 described that they specifically described the uniqueness of their product. This allowed the tender to be more fitted towards their innovation, so the tender could more easily be granted to them. Interviewee 2 described this barrier as a 'given' and mentioned that as a public official you need to discuss this in a timely manner:

"But sometimes I also run into the tender rules. There we say: "Listen, I can't put more money into [the project]. Because putting more money in requires us to formally put it on the market using a tender. That influences my deadlines." But if I raise this [problem] well in advance and discuss it, it is not a problem." -Interviewee 2

Participants found certain strategies to overcome procurement regulations. Public officials mostly found a use in connecting the procurement expert in the MoD early with the private party. Requiring the tender to be in Dutch was another method to ensure the party of choice was chosen in the tender. Lastly, interviewee 10 would mention that it was important to stress the unique aspects of your product, to make sure they entered the tender, making it harder for other parties to enter the same tender:

"Well, that means that at the start, you must put in a lot of work, including with end users who will set it up, technical experts. [You must] also put certain requirements on paper, so that you have a greater chance of being chosen. As a party with certain requirements, for example, they know that they make your product quite unique. And that other parties may not have that yet. That you simply have a better chance of winning." -interviewee 12

4.2.2. Procurement: Prior knowledge

As previously stated, equal access to information is a requirement for participation in a tender and is a frequently cited contextual barrier to the innovation process. If one party has more information, they could excel more than others in the tender, and the party could be excluded from the tender procedures. If the party with prior knowledge does enter the tender and wins, the other participating parties in the tender have the right to sue to public organization. Defining what the grounds for a lawsuit are proves to be vaguely interpreted by the parties involved.

The possibility of being sued is a driver for hesitancy within the public organization to share information with parties they anticipate doing a tender with later.

"Procurement rules are also important to remember, especially if you continue with this project with an experiment. It often involves not very large amounts of money, but you can often arrange it in such a way that you start working with company X. But the moment your experiment is considered successful, and you say: "Now I want to scale up and I want to buy tens of thousands of them." Yes, company X has prior information, so they are often excluded from the European tender. And we are still looking for how we can set this up properly. -Interviewee 1

Interestingly, the interviews are unclear on whether they knew if such a tender procedure had once been the reason for a legal battle. Interviewee 7, with a legal background, said this had not happened. This would show that the barriers experienced regarding prior knowledge are more based on perception than legal issues. Many interviewees who cited procurement to be an issue, mentioned that they did not have the legal know-how to explain what the exact rules were.

Strategies to work with these legal rules were not often named. Interviewee 2, a public official, actively looked to connect procurement experts within the public organization with the private organizations.

4.2.3. Procurement: Perception

Interestingly, the perception of the contextual barriers in procurement procedures played an important role in the shaping of the process. This inductive code was given to statements by interviewees when they mentioned they themselves or their contact was operating with their interpretation of the law. Interviewee 2 describes this as follows:

> *"Sometimes it is also in people's heads, that legislative framework. Because I don't know whether [these acquisition rules] apply. You should discuss this with the procurement department, they know all those rules. And we also use purchasing for that. I don't know all those rules, but we often assume: "But that's not possible, because it's not allowed." While we don't really try, you just always hear: "Be careful, otherwise they will be excluded. If you try too much with one."" -Interviewee 2*

This perception could also be organized with the organizational factors; however, it is most closely related to the procurement procedures. Members of the public organization experience this barrier since they are hesitant to overpromise and underdeliver to the private organization. The private organization is consequently disappointed in what is possible. Interviewee 8 mentions that they see this barrier occurring, but mentions that it would not change outcomes:

> *"I hear this very often, But the formal tender starts the moment it goes out the door, right? […] Everything before that is in the pre-competitive stage or the pre-commercial stage. […] SMEs never [sue] among themselves, they simply don't have the time to dispute it if something is wrong. You only find that with very large Original Equipment Manufacturers, so that means orders worth millions, right? Well, you know, you know, you're not going to worry about €100,000, are you?" -Interviewee 8*

Interviewee 12 was active in the sector for a longer time and described that they were often the party that was informing the MoD on what was possible within procurement law.

> *" Informing is difficult. Ultimately, the difficult thing is that you cannot always do much about [perception of procurement rules], except ultimately look for people within that organization who ultimately do have good examples, where they do, where it turned out that it is possible and then actually use that example. That's kind of the idea." -Interviewee 12*

> *"Okay, so you use knowledge from your previous projects or previous connections to progress the conversation. Have I got that right?" -Researcher*

> *"Yes." -Interviewee 12*

Interviewee 13 considers a simple solution to be sufficient:

> *"I think that also has to do with the fact that there is always some kind of underlying fear that they are violating the procurement rules. But what I just indicated could be solved with a website. You can just create a website and then you say. You just put all the rules and all the arrangements there. Defense could also do the same as RVO (Netherlands Enterprise Agency) does for the rules of the Ministry of Economic Affairs. Defense could simply place that arrangement with the website of RVO." -Interviewee 13*

4.2.4. Privacy

Private organizations, significantly more than public organizations, mentioned that privacy regulation of data is a significant barrier to the innovation process that they encounter. Specifically, this refers to sensitive data within the Ministry of Defense, that they are unable to share with private organizations. Interviewee 13 describes how becoming part of more confidential projects has significant financial barriers and risks associated with it:

> *"As a company you can deal with state secrets, that is possible. That possibility exists. There are also several companies in the Netherlands that have that certification. They have them, but to get that certification, you need a nomination from Defense, and you need a significant investment. So, you must renovate your building, you must streamline your processes, but you also must have all your staff working on those secret projects screened. And you must pay for the screening, it is all expensive. So, if you are going to do that as a company, you are talking about an investment of €100,000." -Interviewee 13*

It is not just private organizations that find sensitive information difficult within the organizations. Interviewee 6 had similar issues.

> *"Yes, of course, it is often not allowed because you are within the MoD, so you have Defense data that you must deal with, so it is not allowed outside the MoD anyway, right? We are now changing that a little bit, so we are now looking at [privacy laws] case-by-case. That we can put data that is confidential, up to, and including, the departmental level, in the cloud, but then you still need permission. You must go through a bureaucratic process, but in principle, it is always within the MoD. You also have very strict privacy legislation these days, of course. You also must take this into account, not to mention ethical aspects, so there are quite a few elements that you must consider before you can put them outside the walls of the MoD. I would like to note that the situation we have now set up for us as an organization is no longer sustainable in the short term."*
> *-Interviewee 6*

No participant who mentioned this barrier has a strategy to overcome it, and all considered it to be more a given fact.

4.2.5. Technology-specific laws

Lastly, regarding the contextual barriers and success factors, some participants mentioned that the innovation they were working on was subject to legislation that prevented it from working to its full potential. For example, some rules on robotics prevented some interviewees from working on it to their full extent. Some interviewees gave interesting thinking-outside-of-the-box ideas to still work around these laws. For example, interviewee 9 mentioned that their company occasionally did tests outside of the Netherlands on large military bases, where more freedom was allowed. Interviewee 3 ran into technology-specific laws as well and mentioned that they immediately considered rules and regulations to be a 'track' on which a sub-team would work. They would also do tests on a smaller scale, to prepare the legislature for larger-scale operations. Quotes are left out of this section, since they often mention specific technology that might be traceable to individuals.

4.3. Innovation-characteristic factors

Statements are linked to innovation-characteristic factors when they are related to the technology itself, and not communication or organization. This was the least stated category of process factors, with only one code of significance: the uncertain outcome of innovation. This factor was frequently cited but was not seen as a barrier as most saw it as intrinsically linked to doing innovation. As interviewee 1 put it:

“If an experiment fails, to me it's still a success because we tried something new. We got people to look at their work differently and we discovered what doesn't work.”
-Interviewee 1

To mitigate the negative effects of the innovation characteristic factors, the participants employed different strategies. Interviewee 4 focused specifically on making sure a lot of work goes into the cooperation preparation, so the contract is prepared for expected and unexpected factors:

“Both the problem analysis, which is quite well set up, and the selection of the solutions and the partner behind the solution, [are well set up]. It normally takes quite a lot of preparatory work, so that you can contract or select such a partner with just a little more guarantee and can tackle this development process.” -Interviewee 4

Interviewee 2 described that, to get technology in the desired direction, bringing stakeholders together is essential. Interviewee 2 talked about development sprints to get the teams aligned, based on what is possible. Interviewees 10, 12 and 13 all described that communication is key during innovation uncertainty. They describe early and often that innovation is uncertain, and let the public sector know if the innovation is progressing.

4.4. Interaction-specific factors

Lastly, interaction-specific factors are, by the interviewees, unlikely to be seen as barriers, and are often cited as success factors. On top of that, interaction is often used to minimize barriers in other categories. Interaction-specific factors are barriers and success factors that refer to the communication and expectations that the public and private sectors have of each other. The interaction-specific factors are grouped into three codes: contact with the end user, shared understanding, and expectation management.

The literature indicated that interaction-specific barriers were the most frequently cited, while this was not the case in the findings of this research (Cinar et al., 2019, 2021). Instead of being named as barriers, interaction-specific factors were often cited as strategies to overcome barriers. Communication was generally perceived as going well. The reason that this went well, according to the private organizations, was because they knew the organization well. This created an interesting finding: all interviewees had a prior history with the Defense organization. In a further study, it could be researched whether there is a difference in experience between companies where the leadership has experience with the MoD and where they do not. Although no numbers on the percentage of the industry that is led by ex-military, the US Department of Defense has similar experiences, where over 80% of retired generals went on to work for the arms industry (Hartung & Fisher, 2023), showing that the Defense industry and Defense Departments often find themselves working on the other side of the PPP. This is reflected in the statements by interviewees.

4.4.1. Contact with the end user

Contact with the end user was cited as one of the main reasons for a successful innovation project, as stated by multiple interviewees. Notably, all private parties that were interviewed cited this as a success factor. It appears that interaction with the end user is also easily gained within the Ministry of Defense. As interviewee 10 put it:

“Because if you don't work with the end user, you will end up with a product that no one will use and, of course, we don't want that. We want them to make use of it so that it can perhaps be used more widely within the Ministry of Defense. Look, if you often look at maybe just a PVE (List of Requirements), then yes, you might be able to interpret it a certain way. But the user may see it a little differently. We try to coordinate this properly. I think that is also our strength because we are so small and accessible. And we know the organization well. That way you can also easily get in touch with the user.”
-Interviewee 10

Specifically, the private parties describe that there is a difference between the stated requirements and what the customer wants. They describe that the end user is essential in delivering a good product. The private organizations see this and want to ensure this goes smoothly. Interviewee 12 even mentioned it gives a significant boost in morale to the team, to meet the end user and see the technology at work.

4.4.2. Shared understanding

Some parties, specifically private parties, feel like there is a lack of understanding of each other's problems within the PPPs. Both interviewees 8 and 13 think that new private organizations should be guided through the Ministry of Defense since they consider the MoD to be hard to understand for new companies.

> *"And what doesn't help is all these innovation-suborganizations, that makes it incredibly difficult for the industry. I am often explaining to new companies how Defense works. That's crazy, isn't it?" -Interviewee 8*

In addition to this, some private parties feel like the public organization does not understand them. Interviewee 13 described an innovation session with multiple companies, where the ideas of that session were used in an innovation project with a larger established partner, which made companies in the sector hesitant to participate in these sessions again. In the same session, a public official would have said that no financial assistance would be available to work out these ideas, decreasing enthusiasm for cooperation further. This is, according to interviewee 13, the reason the same, small number of companies are active in the business. Interviewee 13 does provide recommendations for improvement, stating that it is important that the public sector should be open to innovation that does not use its jargon. They state that innovation competitions are often won by parties that are established since new companies cannot get a foot in the door due to them not speaking in military jargon.

Strategies revolve around finding, taking the time and coordinating together to improve cooperation. Interviewee 2 describes that they take extended time at the start of the PPP to come to a shared understanding. As previously stated, interviewee 8 sees a lot of value in having a connection that can explain the organization to you. This is something that the MoD has recently set up programs for, such as Frontdoor, which could help alleviate this barrier (Ministerie van Defensie, n.d.).

4.4.3. Expectation management

Expectation management is coded when parties cited that they had to specifically state what others could expect from them, or when they were surprised to learn information, they felt like they could have gotten it earlier. This barrier has been stated occasionally and could be a factor that requires careful consideration and open communication. Interviewee 1 mentioned that this can occasionally be an issue:

> *"Yes, that is of course communication again, tendering, but also a part: Who is responsible for what? Who makes which decisions? That's just not always clear. A bit of focus: What do we really find important? I think that as the Air Force we still have quite a few steps to take." -Interviewee 1*

As part of clear communication, some parties specifically stated the need for and application of an active expectation management strategy. Interviewee 6 described active expectation management too be important for the communication of contextual factors. Interviewee 4 also described how expectation management is important in creating an honest cooperation system. It appears that an increase in cooperation is central to alleviating this barrier as well.

> *"That you do not promise mountains of gold, even if there is expected increasing market demand. […] [It] is not yet in the major investment series, for example. So, let's be more honest or less positive about the big mountains. Simply: "I want to do this project with these goals with you for this money, for this time."" -Interviewee 4*

4.5. The setting of PPPs with innovative goals

The setting of the PPP with innovative goals was also asked to the interviewees, aside from barriers, success factors, and strategies. This was to test whether the individuals were active within the described research setting of PPPs with experimental development goals. Two interviews were not used, as mentioned in section 3.3, but all others were. Despite this, there is a difference between the types of PPPs with innovative goals that the interviewees regularly worked with. It is important to disclose this, because this means that not all data is created equal, and the quantitative numbering method of Table 6 provides a general overview but should not be interpreted as hard data. The affinity with the PPP with a focus on experimental development is based on three extra identified codes outside the categories stated from the theoretical framework. Firstly, ownership and responsibility will be discussed. Secondly, the technological maturity of the innovation process will be discussed. Lastly, supply and demand will be discussed.

4.5.1. Ownership and responsibility

Ownership and responsibilities of the public and private sides of the PPPs varied significantly across the interviews. While this study intended to analyze similar processes, this appeared to be different from the complex situation in partnerships themselves. Within the MoD, different ways of working with the private sector exist. Some participants had a relationship with the other sector that was described more as a client-supplier relationship, while others had agreements where both sides were responsible for the development of the final product.

Examples of cooperation in PPPs focusing on experimental development differed. Interviewees 4, 5, 6, 9, 10, 12 and 13 aligned closely with the stated expectations of PPPs with innovative goals: A cooperation where co-innovation was expected, and a specified deliverable was delivered. For example:

> *"Yes, so expect quite a bit. Millions are spent on such a topic, so of course reports and demonstrations, sometimes also simulations, things like that must be shared. A whole deliverables list must also be made in advance, and you will be kept to it. There is quite a good check from the EU." -Interviewee 9, when asked about project deliverables*

Some interviews differed in setup. For example, interviewee 1 mentioned that they rarely operated with PPPs, and therefore had difficulties naming examples of successful PPPs. Some interviewees did more projects in a consortium than in a PPP. A consortium is a group of organizations that cooperate to collectively work on an innovation. A consortium is a more complex organization, which could require another study.

Some cooperations were different from PPPs altogether. Interestingly, many private organizations stopped with further production at a demo stage. Interviewee 2, in the MoD, functioned in PPPs from the other direction, occasionally working in a co-innovation setup, but mostly working more in a customer-supplier relationship. Lastly, interviewee nr. 6, a public official working mostly with corporate cooperations in Information Technology, described his cooperation with the private sector to be mostly technology consulting:

> *"In this case, there is no financial flow between [private company] and us. For example, in this project, because we're at the intersection of science and technology, we're looking for use cases. Within Defense there are contracts with [private company] that involve consultancy hours and we draw on that, so they are allowed to supply consultants to Defense for X times 100 hours per year and we can then draw on that arrangement." -Interviewee 6*

4.5.2. Technological maturity

As is described in the literature review, most of the interviewees described their activities to be in a specific 'Technology Readiness Level'. The study focuses on experimental development since this is a crucial step in the innovation process with a clear research gap (Cinar et al., 2019). However, interviewees showed that this separation could not be made this easily. Most interviewees were in the range of experimental development but pinning this down turned out to be against the reality of the situation. For example, interviewee 12 made the following statement on their business:

> *"We are usually around 4 to 6, regarding engineering, when it starts. That is the 'push' [side of the business]. The 'pull' [side of the business] us more around 8 [and] 9."*
> *-Interviewee 12*

This interviewee described that the technology they create, in partnerships, needs to start at a lower level of TRL, "4 to 6", based on discussions with the public organization, and develops to "8 and 9". TRL-level four is a technology that is functional in a laboratory environment, where TRL-level 8 and 9 is a full-scale product. In a contextual study, differing cases can be compared directly. However, the fact that these cooperations were at such differing stages of technological maturity decreased their comparability.

4.5.3. Supply and demand

To understand the innovation project, questions were asked to determine the origin of the innovations. While the complex origin of the PPPs is too large of a question to answer within the time restraints of the thesis, a brief overview provides a helpful guide on the innovation landscape. From all interviews where the question was asked (11 out of 13), a setup was described that this was a complex interaction. However, the process tended to originate more from the public sector than from the private sector. Interviewee 13 described this supply and demand origin as follows:

> *"… usually, we come to them. We just regularly visit the various clubs we know, we just drop by for various reasons, it's been a while, we go for coffee. And then you get into the conversation: "What's going on now?" From our side, we try to keep a close eye on developments, in trends, in technology, which we should do. But we want to hear what they have in terms of new issues, experiences, and what they pick up in, for example, their international consultations. Pick up by calling out what they are up to and together you often come up with everything. It does not occur often that the MoD comes to us and says: "We have a problem. So can you do these types of solutions more often?"" - Interviewee 13 (Private)*

Public officials often described in detail how they set up the origin of innovation partnerships based on needs they identify within the public organization.

> *"Well, normally we formulate program objectives in an innovation plan, in problem definition from the operation. They then point to a danger or a capability gap. Sometimes about an organizational problem, sometimes a logistical problem. I have too little information and cannot organize it with the current method and resources. [The work is] often about quantitative and a qualitative shortage and translating that into a technical problem. We reflect on a solution against that: the desired situation. [For example,] ideally, we would like to see these effects arise both during the operation."*
> *– Interviewee 4 (Public)*

As an exception to the trend, interviewee 2, a public official, described their innovation process to be more supply-focused, and described it as a 'solution-looking-for-problem' situation. This interview is the lone exception to the trend where both private and public officials stated that the public organization and the end-used had the largest role in identifying issues and starting innovative partnerships.

"We just look at where this could be applicable. As you can see, this is a very solution-looking-for-problem situation. Yes, we just start looking at where and when it is used and when it is not. And it is also used during operations? Or only on inspections? Or is it more for maintenance than for during operations? And then you look to see which department it belongs to best. Then you look for a kind of sponsor, which is how we call it."
-Interviewee 2 (Public)

4.6. Revised conceptual model

The findings of the interviews are visualized in Figure 9, showing the inductively coded factors, and the strategies to work with these factors. The arrows indicate a relationship between the codes, not necessarily a positive or negative one. The central output variable, the 'perceived success of the innovation process' is unchanged from the conceptual model from the literature. However, major changes have been made to the input variables. The definitions in the strategies are not predefined codes, but instead the summary of a described strategy.

This model is based on the model in Figure 5, however is adapted to the research setting and filled with the inductive codes within the categories. The theoretical model had contextual factors around the other categories. The empirical setting refuted this, since contextual factors were not the source of a setting, but more like other barriers and success factors. Therefore, it is treated as another category.

Many strategies employed in all categories are interaction-based. This is visualized by the yellow strategies in Figure 9. Within this empirical setting, there was a generalizable strategy, that when barriers occurred, the participants would attempt to solve this through increased communication. Interviewees mentioned that they were very frequently in good standing with the other organization within the PPP. The impression was gained that these PPPs were less transactional than the PPPs in literature.

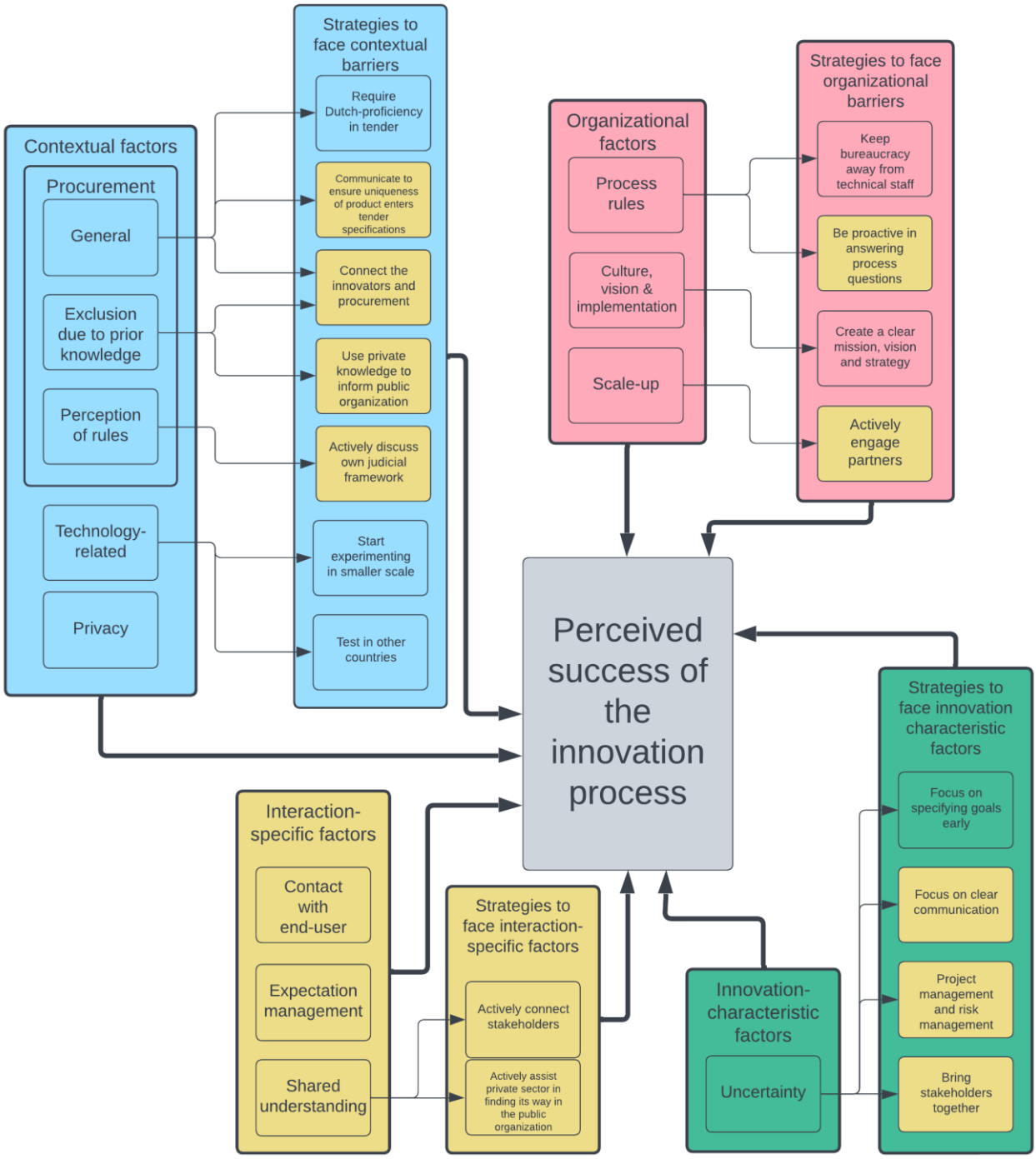


Figure 9: The revised conceptual model based on the interviews performed. The colour signifies the category of factor or strategy. Blue: Contextual. Red: Organizational. Yellow: Interaction-specific. Green: Innovation-characteristic.

5 Discussion & conclusion

The PPP focusing on experimental development has, despite the many barriers named in this study, been an effective cooperation method between the MoD and companies within the Defense industry. To improve and expand on this phenomenon to solve academic questions and practical problems, this study has provided a unique insight into the complex cooperation that is usually hidden behind closed doors.

Within the intended understanding and possible improvement of the PPP focusing on experimental development, most of the research has gone into getting an understanding of this phenomenon. The complexity of the cooperation made categorizing barriers, success factors and strategies difficult. As barriers, some issues were accepted as a 'given', such as the uncertainty of innovation, where others were seen as manageable, such as expectation management. Similarly, success factors and deciding which codes were *not* barriers, was a challenge. Therefore, the results bundled these findings together under the term factors. Similarly, strategies were defined as actions to overcome, and could therefore be separated. Regardless, the complex situation of these 'factors' made each categorization based on bias and subject to interpretation.

In reflection, and with the results of Figure 9, it is valuable to look back on the research question to discuss the implications of the findings and the limitations of the results. This research focused on the following question:

*What are the **barriers** and **success factors** in **public-private partnerships that focus on experimental development**, and how do its participants **cope** with the barriers, and **utilize** the success factors?*

In the setting of the Dutch MoD, in a PPP that focuses on experimental development, organizational and contextual barriers appeared to be the main source of barriers. Innovation-characteristic barriers were not experienced as major barriers. In the interaction-specific category, success factors and barriers were identified.

Organizationally, the main barrier experienced was 'process rules'. This was overcome by strategies of an organizational kind and of an interaction specific kind, such as the communicating of organizational expectations with regards to scale-up. Contextually, most barriers were experienced regarding procurement. Strategies employed would mostly revolve around the increased communication between the parties.

Innovation-characteristic barriers were experienced the least of all categories. Only a single code was identified in this category, being 'uncertainty', which most participants dealt with by actively discussing their innovation progress. Lastly, within interaction-specific factors, participants mentioned contact with the end-user frequently as an important aspect to the collaborative innovation process. Again, strategies revolved around increasing communication.

5.1. Theoretical implications

While researching this new setting for PPPs that focus on innovation, the main theoretical implication is that interaction-specific barriers, which are most prevalent in literature on this subject, are less prevalent in the Dutch military setting. Ineffective communication was at the center of most barrier-related research, while in this setting communication was rarely an issue for the innovation process. In line with the research, however, communication is more frequently used as the solution, however not on this scale. Interviewees mentioned that all parties viewed each other very favorably and communication was easy. Many private organizations had many people working within their organization that were previously active within the MoD. It appears that this setting has a uniquely easy route for communications. It must be stressed that is only

the case for established private organizations. Interviewees mentioned that new private organizations had a hard time getting contacts within the MoD.

The importance of the interaction-specific factors in line with research on clustering and proximity impact on innovation. Findings of the research align with the research by Oerlemans & Meeus (2005), which argues that organizational and geographical proximity improves the performance of firms. Their research aligns very closely with the shared opinion of the private parties. Their contacts with the end user were central to their innovative performance. Interviewee 3, as a public official, mentioned that they were actively nudging sub teams to interact more:

> *"We are not there yet, because we are growing, so now, for example, tomorrow they will test at [Location]. […] a few weeks ago, I said to the other team, well, go to [the same location] every Wednesday, then you'll meet each other, and that meeting is not about looking at what the other person is doing. Well, it is as well, but you also get to do your own thing. So, I am making sure, tomorrow, the two teams will meet at [Location]. Well, I don't so much try to direct, but I am organizing and conditioning to ensure that they meet each other automatically." -Interviewee 3*

In contrast, organizational and contextual factors proved to be more troublesome to the PPP with innovative goals in this setting. The Dutch MoD is notorious for the amount of organizational barriers, due to being a public organization that has a monopoly on violence (Ministerie van Defensie, 2023b), and due to being a hierarchical organization (Van Eetveldt & Olsthoorn, 2019). It can be argued that the 'newness' of the PPP for the MoD would be a reason for the cited barriers. Many interviewees said that this process is very new for the MoD, which would require time to adjust.

The theoretical model required the separation of strategies and factors and showed interaction-specific strategies to address all types of barriers. This is visualized in Figure 9. Compared, to figure Figure 5, set up in the theoretical framework, it is much more complex. Compared to the framework set up by Brogaard (2021), the figure includes strategies, exemplifying their interconnectedness. Figure 9 is the results of this specific qualitative study and is generalizable to a limited extent. The results from this study could be used in literature reviews similar to the ones by Brogaard (2021) and Cinar et al. (2019).

The identified comparative studies in the Dutch PPP setting are markedly different and this study provides useful context to this PPP-phenomenon in the Netherlands. Four of the five studies have sample sizes larger than 100, leading to generalizable data, but fewer context (Edelenbos et al., 2011; Klijn & Edelenbos, 2013; Steijn et al., 2011; van Meerkerk & Edelenbos, 2014). Also, all four studies are by the same group of professors, decreasing the universal applicability. Klievink et al., (2016) provides a qualitative comparison case study, however the study focuses on IT related issues. This study would not have coded the same issues since they would not be generalizable enough with the other interviewees. During the interview 6 issues such as IT-capacity came up, but these were not included in the result section due to this being the only time this innovation characteristic barrier was named.

5.2. Limitations and further research

In this qualitative contextual study on PPPs that focus on experimental development, the research setting of both the Dutch MoD and the private organizations play a central role in shaping the study's relevance and findings. The main reason for this appeared to be the goals of the Ministry of Defence. The goal of innovation for the MoD is operational edge, which is reflected in the interviews. However, operational edge in a military organization in peacetime proves to be hard to measure. This means that the measurement of improvement by innovation is near impossible to quantify. This added difficulty meant that interviewees in the MoD had to decide for themselves what successes and barriers were, without many tools to define what successes were. This was a consideration when deciding to go with semi-structured interviews, where the interviewee had freedom to interpret their own definition. The reliability of the data is fully dependent on the ability of the interviewee to correctly identify success, despite there being no quantitative data to prove success. However, since there are qualitative signs of successful innovation process, such as use by the

end-user, satisfaction of the end use with the product and budget use for example, we can assume that the perception of the success of the innovation is closely aligned with the actual success.

Within the analysis of the stated codes, there was difficulty separating barriers, success factors and strategies. The literature is often vague in separating the definition of what constitutes as a ‘barrier’, ‘success factor’ or ‘strategy’. This research sees an opportunity for further research in analyzing the wider literature on innovation dynamics and attempting to provide clear guidelines for the development of barrier-related research. Providing uniformity within definition within interviews would facilitate the comparison of barrier-related research.

The reason for the increased interaction-specific strategies and success factors is hinted, but this study was not set up for this finding. Research on the origin and effects of the interaction-specific strategies would be well suited for a single-subject, or comparative case study. Between the eleven analyzed interviews the application of interaction-specific strategies varied, however private parties had previous experience with the MoD. A comparative or single subject case study with, for example, two private parties that have experience and have no experience with the MoD, could be valuable in explaining this deviation from the literature.

The time limitation of the interviews in this study limited this thesis in verifying speculative information. This was attempted to be mitigated by setting the lower limit for inductive coded to two mentions in two different interviews. Still, with a total of twelve codes, a follow-up interview would be able to verify whether the interviewees ran out of time during the interview to mention certain barriers. The interviewees were clear about which barriers they found to be relevant, and which were not. However, to prevent the interviewees from mentioning minor barriers in the same regard as major barriers, the interviewees could be asked to state what the top barriers of the inductive codes were. Further research should keep this validation step in mind.

This study strikes a balance between generalizability and contextual detail, which is suited for setting and research gap. The combination of a new setting for research, PPPs with innovative goals in the MoD, and the research gap, barriers, success factors and strategies within the PPP, provided a research background with little established research. Therefore, finding a middle ground was fitting. This is reflected in other studies. Out of the studies on PPPs with innovative goals identified by Brogaard (2021), 52% used qualitative methods. Most used case studies, however, and as can be concluded from this study, there are prominent differences between the PPPs. Therefore, this would have decreased generalizability.

There has been a range of technologies assessed, from IT to Robotics. There is a significant difference between the problems in cooperation that different technologies face. For example, interviewee 6 experienced more privacy barriers than other interviewees. This interviewee was active in AI in public space. Another interviewee, interviewee 12, who was active in virtual reality and had none of those problems. Because the technology is different, other contextual factors affect the process. In case a comparative case study is done, it is recommended that two organizations are chosen that are active in a similar technological field.

Since PPP with innovative goals are so different based on setting, it is recommended that more research areas are explored. It is recommended that this research be compared to other Dutch research on PPPs (Edelenbos et al., 2011; Klijn & Edelenbos, 2013; Steijn et al., 2011; van Meerkerk & Edelenbos, 2014) and be expanded to other Dutch government branches. Specifically in government sectors which are hard to measure, such as the Ministry of Education, Culture and Sport. As mentioned in section 2, PPPs are a collaboration structure familiar to the infrastructure industry, but this expansion in research has proven a valuable insight.

The research could also be expanded to non-Dutch MoD, which could be used for comparative analysis. No similar literature on this subject was identified. Multiple interviewees recommended performing the same study in other countries, specifically France. Interviewees mentioned that they felt contextual factors regarding procurement were barriers to a lesser amount in France. One interviewee said the following.

"When you see what is happening in France... There is simply a European rule that, based on national interest, for Defense applications, you can tender things in a different way without it happening publicly. You may simply award contracts privately. That is allowed to go up to millions of Euros. France does that all the time, the Netherlands never, ever does. People look at this from other countries with a bit of cynical view, but also a bit of a smile, that the Dutch must always be the 'best boy in the class' (Dutch saying meaning somebody who is a strict rule-follower). -Interviewee 13

This insight could give more context to contextual factors, and how to approach these within the PPPs. Comparing France and the Netherlands could therefore be an analysis in two extremes of the interpretation of European law and could give valuable insight for policymaking.

The selection of mostly medium-sized companies affected the results of the study. As can be seen in Figure 7, the Dutch Defense industry has several large players and a plethora of start-ups that were not interviewed. There is difference in the experiences that small and large companies have with working with the Dutch MoD. For example, companies with a size of 0-25 employees rate the assessment of government support to achieve innovation goals a 3,9/10 where the largest companies (>2500 employees) rate this a 6,0/10 (Schotel et al., 2022). This is likely to be due to the barriers they experience, which therefore has a large effect on the results of this study. Further research could set out to include larger parties in the research, to determine whether those companies experience other issues.

5.3. Practical implication

This thesis provides several practical implications that could be used by policymakers, managers, and innovators in public and private organizations. The main practical gain for both sides is that the findings provide an insight into the thinking of the other side of the PPP that focuses on experimental development. Some findings in specific are valuable to these policymakers, managers, and innovators.

This research showed that some parties experience barriers in a lack of shared understanding and a lack of expectation management. This research showed that interaction-specific strategies are effective in overcoming barriers. By acknowledging the implications of communication and acknowledging its importance in the PPP with innovative goals, the PPP will have a better chance of success. This study also pointed out the importance of contacting the innovator with the end user, which all private parties considered essential in creating an innovation that could be used. Companies who are looking to start PPPs with innovative goals should start discussing the practical application of their innovation with end-users.

Regarding interaction-specific factors, private interviewees all stated that they were active within the sector for a longer period, and that they saw few new entrants. This could be a reflection point for the Dutch MoD. The private organizations mentioned that it was hard to gain initial contacts or win competitions if the company or start-up is unfamiliar with the MoD. The MoD has recently started programs to address this, so monitoring these programs could be vital. Especially since 'scale-up' is a barrier that the MoD experiences on the private side. With a larger, diverse Defense industry, this barrier will become smaller.

Organizational barriers were the most cited barriers within this setting of PPPs with innovative goals. Especially examples like the citation in section 4.1.1. on the 22 signatures show that a public organization is quick to come up with rules and regulations to prevent loss (Ministerie van Defensie, 2023b). It could be valuable for the Dutch MoD to review their collaborative innovation process for unnecessary controls that hinder the process. It is likely that the Dutch MoD has many, since the many budget cuts over the years has left a culture of hesitancy when spending capital, which is something the MoD is aware of (Ministerie van Defensie, 2022a).

The code 'perception' within the contextual factors is due to organizational limitations or communicative limitations within the MoD, while the effect on the innovation process is significant. Besides that, it gives established corporations an advantage since they are aware of the exact regulations. The MoD should investigate methods to improve this. Another contextual opportunity lies in other legislative routes. Many

private organizations brought up France, in which, they mentioned, they manage to legislatively support the French Defence Industry by buying French frequently. This should be an opportunity, if the Dutch MoD wants to take a step towards closer collaboration with the Dutch Defense Industry. Other legislative routes can be explored as well, such as innovative partnership.

Lastly, the setting of PPPs focusing on experimental development within the Dutch MoD, could be applicable to other countries facing similar problems. Especially in NATO, Defense budgets have increased, and many governments are looking for more collaboration with private industry. This thesis has given a unique insight into the Dutch military PPP space, which could be compared to the innovation landscape of other countries.

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Appendices

A.1. List of figures

A.2. List of tables

A.3. Interview protocol

Two interview protocols were set up, the first was used during interview 1 to 4, which can be found in appendix A.3.1, after which the interview protocol was revised to the protocol that can be found in appendix A.3.2.

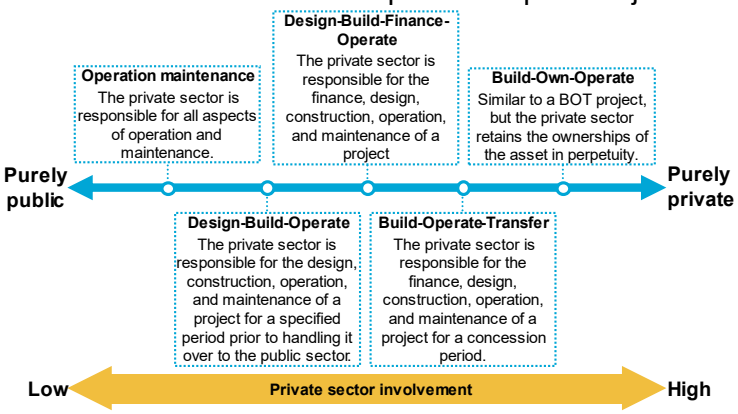
A.3.1. August 7th to August 11th

Onderdeel introductie: 10 minuten

- Introductie mijzelf,
- Uitleg doel van het onderzoek
- Uitleg doel van dit interview
- Uitleg Human Research en Ethics regels, tekenen Informed Consent.

Onderdeel algemeen Actors and context: 15 minuten

- Wat is uw rol en verantwoordelijkheid binnen kort-cyclische innovatie?
    - *Kort-cyclische innovatie is de term die Defensie gebruikt voor 'experimental development' en overlapt grotendeels.*
- Wat zijn andere actoren die betrokken zijn in de PPP? Wat zijn hun rollen?
- Bent u ook betrokken bij de samenwerking met private partners voor kort-cyclische innovatie?
- Hoe zijn PPPs binnen uw afdeling vaak opgezet, sluit de uitwerking daarbij aan?
    - Waar zou u innovatieve PPPs plaatsen op deze lijn?



    -
    - Hoe zorgt u dat het contract daarbij aansluit?

Onderdeel barrières, succesfactoren en strategieën: 25 min

- Kunt u een specifiek project in gedachte nemen dat u begeleid heeft?
    - Met welke barrières kreeg u te maken tijdens het uitvoeren van dit project? En
    - Welke barrières hebben een invloed op het succes van het project gehad?
    - Hoe ging uw organisatie met deze barrières om?

    - Met welke succesfactoren kreeg u te maken tijdens het uitvoeren van dit project?
    - Welke succesfactoren hebben een invloed op het succes van het project gehad?
    - Hoe ging uw organisatie met deze barrières om?

    - Indien tijd: Werkt u hetzelfde bij andere projecten?

- Indien tijd: U noemt niet (organizational, interaction-specific, innovation-characteristic, contextual). Heeft dat een reden?

- Indien tijd: Heeft uw organisatie andere strategieën in het verleden toegepast voor PPPs?

Onderdeel afsluiting 5 min:

- Kent u private partijen waar ik mee in gesprek zou kunnen, die in het verleden met u samengewerkt hebben, om een volledig beeld van de samenwerking te krijgen?
- Kent u andere publieke partners waarmee ik ook in gesprek zou kunnen rondom dit onderwerp?
- Afsluiting

A.3.2. August 28th to September 18th

Onderdeel introductie: 10 minuten

- Introductie mijzelf,
- Uitleg doel van het onderzoek
- Uitleg doel van dit interview
- Uitleg Human Research en Ethics regels, tekenen Informed Consent.

Onderdeel algemeen Actors and context: 15 minuten

- Wat is uw rol en verantwoordelijkheid binnen kort-cyclische innovatie?
  - *Kort-cyclische innovatie is de term die Defensie gebruikt voor 'experimental development' en overlapt grotendeels.*
- Wat zijn andere actoren die betrokken zijn in kort-cyclische innovatie? Wat zijn hun rollen?
- Bent u ook betrokken bij de samenwerking met private partners voor kort-cyclische innovatie?
  - **Opzet**
    - Hoe is deze samenwerking ontstaan?
  - **Organisatie**
    - Hoe zou u de samenwerking met de publieke en private kant beschrijven?
    - Hoe ziet de rolverdeling bij dit project eruit?
    - Hoe zijn de verantwoordelijkheden binnen het project verdeeld?
  - **Financiering**
    - Kunt u wat vertellen over de financiële relatie tussen beide partijen?
  - **Contracteren**
    - Wat zijn wettelijke afspraken en contracten die u beide bent aangegaan?
  - **Communicatie**
    - Hoe heeft u afgesproken elkaar op de hoogte te houden van ontwikkeling?
  - **Afronding**
    - Hoe zit de afronding van de samenwerking in elkaar? (Gaat het over in een ander contract? Wat als het bedrijf niet kan leveren?)

Onderdeel barrières, succesfactoren en strategieën: 25 min

- Kunt u een specifiek project in gedachte nemen dat u begeleid heeft?
  - Met welke barrières kreeg u te maken tijdens het uitvoeren van dit project? En
  - Welke barrières hebben een invloed op het succes van het project gehad?
  - Hoe ging uw organisatie met deze barrières om?

    - Met welke succesfactoren kreeg u te maken tijdens het uitvoeren van dit project?
    - Welke succesfactoren hebben een invloed op het succes van het project gehad?
    - Hoe ging uw organisatie met deze barrières om?

    - Indien tijd: Werkt u hetzelfde bij andere projecten?

    - Indien tijd: U noemt niet (organizational, interaction-specific, innovation-characteristic, contextual). Heeft dat een reden?

- Indien tijd: Heeft uw organisatie andere strategieën in het verleden toegepast voor PPPs?
- Is er een barriere, strategie of successfactor die voor uw organisatie belangrijk is geweest, waarvan u nog niet de kans heeft gehad deze te noemen?

Onderdeel afsluiting 5 min:

- Kent u private partijen waar ik mee in gesprek zou kunnen, die in het verleden met u samengewerkt hebben, om een volledig beeld van de samenwerking te krijgen?
- Kent u andere publieke partners waarmee ik ook in gesprek zou kunnen rondom dit onderwerp?
- Afsluiting

A.4. Code book

Table 7: Code book for organizational factors

Factors	**Factor definition**	**Code description**	**Example**	**Public**	**Both**	**Private**
Process rules	Discussions on the internal rules of the MoD that hinder progress of the innovation process	The process rules of the MoD can be experienced as a cause of delay and uncertainty that inhibits the freedom to innovate or gain certainty of support by the MoD.	“A very good example is that we still had to put in 22 signatures to make a requirement statement and to release the money to start up an innovation. It was in the process, because someone with training had to look at it, someone with staff, someone had to study for that, etc., etc.” -Interviewee 8	2,3,4,5, 6	8	9,10,13
Culture, vision & implementation	Discussion on the newness of the PPP innovation to the MoD and foresight of the MoD on the use of the new product or service	Culture, vision, and implementation appear to be frequently connected by having similar results: the technology is developed, but the innovate is not followed through towards use.	“No one is responsible for implementation. And so, everyone is responsible for implementation. One role is for the short-cycle innovation center. One role is for the current business operations. One role is for the policy makers. The role is for the operational units. So, no one does [implementation]. So, we don't know who should do the implementation, but we also don't know how we should do it.” -Interviewee 1	1,2,4		9
Scale-up	Discussion on the inability to continue to the next phase of innovation: production	The MoD frequently wants to continue with the innovating party, wanting to purchase an increased quantity, although the private party is often unable to do so for various reasons	“We once started with startups. Yes, it is very smart, very innovative, but now try to set up a production line, with a start-up, or from a start-up that can meet a larger defense need.” -Interviewee 5	3,4,5	8	9

Table 8: Code book for contextual factors (1/2)

Factors	Factor definition	Sub-code	Sub-code description	Code description	Example	Public	Both	Private
Procure-ment	Discussion on the European Procurement regulations that are required at purchases of €140.000 and up	General	Discussions on the change in cooperation due to it entering tender-cooperation-regulation	The cooperation changes, which can be a cause of hesitancy, change in cooperation style or simply an end to the cooperation because a tender is unwanted	“But sometimes I also run into the tender rules. There we say: “Listen, I can't put more money into [the project]. Because putting more money in requires us to formally put it on the market using a tender. That influences my deadlines.” But if I raise this [problem] well in advance and discuss it, it is not a problem.” -Interviewee 2	1,2	8	9, 10
		Prior knowledge	Discussions on the sharing of information and associated exclusion of the innovating partner from the tender	The MoD is hesitant to share information because the innovating party could be excluded from the tender.	“Procurement rules are also important to remember, especially if you continue with this project with an experiment. It often involves not very large amounts of money, but you can often arrange it in such a way that you start working with company X. But the moment your experiment is considered successful, and you say: “Now I want to scale up and I want to buy tens of thousands of them.” Yes, company X has prior information, so they are often excluded from the European tender.-Interviewee 1	1,2	8	
		Perception	Discussions on the understanding of the procurement law within the organization	The MoD is hesitant to share information because the innovating party could be excluded from the tender.	“Sometimes it is also in people's heads, that legislative framework. Because I don't know whether [these acquisition rules] apply. You should discuss this with the procurement department, they know all those rules. And we also use purchasing for that. I don't know all those rules, but we often assume: “But that's not possible, because it's not allowed.” While we don't really try, you just always hear: “Be careful, otherwise they will be excluded. If you try too much with one.”” -Interviewee 2	1,2		12,13

Table 9: Code book for contextual factors (2/2)

Factors	**Factor definition**	**Code description**	**Example**	**Public**	**Both**	**Private**
Privacy	Discussion on the European privacy regulations regarding sharing data or working for the MoD.	The MoD is unable to share some data due to European privacy regulations	“But to get that certification, you need a nomination from Defense, and you need a significant investment, so you must renovate your building, you must streamline your processes, but you also must have all your staff working on those secret projects screened. And you must pay for the screening, it is all expensive. So, if you are going to do that as a company, you are talking about an investment of €100,000.” -Interviewee 13	2,6		12, 13
Technology-related	Discussions on limitations to the innovation process caused by laws and regulations regarding their technology category	Laws affecting a specific technology are limiting to innovation, since the parties are unable to keep developing in a category	“And if you start too late at the front, you will soon have very nice technology, but you are not allowed to [use] it. Something you often see in the current situation, right? We want to [use the technology], but it is not allowed yet. Yes, so one of my tracks is that it is also certified.” -Interviewee 3	3		9

Table 10: Code book for innovation-characteristic factors

Factors	**Factor definition**	**Code description**	**Example**	**Public**	**Both**	**Private**
Uncertainty	Discussions on the uncertain outcome and progress of innovation processes due to technology	Both organizations cannot predict with certainty how an innovation will develop over time, which could lead to issues.	“If an experiment fails, to me it's still a success because we tried something new. We got people to look at their work differently and we discovered what doesn't work.” -Interviewee 1	1,2,4	8	10,12, 13

Table 11: Code book for interaction-specific factors

Factors	**Factor definition**	**Code description**	**Example**	**Public**	**Both**	**Private**
Contact with end-user	Discussions on the contact with the end-user and its effect on the innovation process	Contact with the end-user is necessary for the innovation to find applicability within the MoD	“Because if you don't work with the end user, you will end up with a product that no one will use and, of course, we don't want that. We want them to make use of it so that it can perhaps be used more widely within the Ministry of Defense. Look, if you often look at maybe just a PVE (List of Requirements), then yes, you might be able to interpret it a certain way. But the user may see it a little differently. We try to coordinate this properly. I think that is also our strength because we are so small and accessible. And we know the organization well. That way you can also easily get in touch with the user.” -Interviewee 10	2,3,6	8	9,10,12, 13
Shared understanding	Discussions on the awareness of the perspective of the other party in the cooperation	Both organizations find it useful when the other party understands its perspective and find it a problem when this is not the case.	“And what doesn't help is all these innovation-suborganizations, that makes it incredibly difficult for the industry. I am often explaining to new companies how Defense works.” -Interviewee 8	1,3,4	8	13
Expectation Management	Discussions on the assumptions that an organization has on the other organization within the cooperation	Expectations within a cooperation are normal, yet expectation require communication to prevent wrong expectations to occur	“Yes, that is of course communication again, tendering, but also a part: Who is responsible for what? Who makes which decisions? That's just not always clear. A bit of focus: What do we really find important?” -Interviewee 1	1	8	