Development of a knowledge sharing game to design collaborations in a hierarchical organisation

How innovation strategies can be implemented at the working floor throughout organisations

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by
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Thesis Committee

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Preface

Over the past year, I have worked on my master thesis in Science Communication with a major in Strategic Product Design. The report lying in front of you is the result of this project, but also my final milestone as a student at Delft University of Technology and my last step in my journey in Delft. Therefore, before I present you the results, I would be pleased to shortly share my journey during this thesis.

It was March 2017 when I started looking into graduation assignments. I remember walking around at The Delftse Bedrijvendagen when I met one of the founders of Defensity College. As a kid, the world of the Defence organisation always intrigued me, but it never came to mind to that I would actually be a part of it. The first time at the marine barracks at Amsterdam was an eye-opener. I was overwhelmed by the military personnel, something I had never encountered before. As it turned out, they are also just normal people, just like everyone else. Therefore, and for many other reasons, I was honoured to have the opportunity to graduate at the Ministry of Defence, in particular Defensity College.

The aim of this thesis project was twofold. First, it is part of explorative research to create a collaboration model for research purposes and second, the model had to be translated in a tool for practical purposes, namely for Defensity College, a start-up within the Ministry Defence. This has been enacted through the development of a dynamic communication support tool for interprofessional collaborations, to overcome the lack of sharing as a result of organisational power inequality.

This project was a bumpy ride sometimes. I have tried to contribute to research by an explorative model, aimed to help Defensity College to gain even more success by designing a dynamic communication tool and contribute to the Ministry of Defence by designing a program to get their innovation strategy implemented at operational level. As I discovered during my journey, managing people's opinions that are far apart, not having always enough participants for testing and struggling with the complexity of such a large organisation was at moments a challenge. However, walking around with three designer bags full of drawings to travel from one barrack to the other, experiencing war gaming, seeing fifty jet fighters take off are examples of experiences I wouldn't have wanted to miss.

This report presents the results of the theoretical and practical study. Clearly, without the help of many others, especially my supervisors, colleagues at Defensity College, fellow students, family and friends, this journey was such a learning experience. Thank you, for listening, guiding, supporting and laughing with me when I needed it. My expression of gratitude is further expressed in the chapter 'acknowledgements'. I would like to end with a quote that illustrates my experience:

"Graduation isn't a piece of cake, but it sure tastes like it once you finished."

Rolien Eleonoor

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This project was not possible without the help, enthusiasm, guidance and support from my research supervisors from the master SEC and SPD: Maarten, Steven and Erik Jan (EJ). Maarten, you put a challenge there for me: designing a model. There we were sitting on a table full of papers at 18.00 h, Friday afternoon, providing me suggestions how to do it even better. Steven, thanks for providing me suggestions and examples that are super concrete: I needed that. EJ, next to random talks about our common passion for sports, you helped me to state the obvious, why else would I do this research project for a year? To all of you, even when I had a dull moment, you kept motivating me and guided me through the process. Talking about commitment! To all supervisors, thanks gentlemen!

Also, I would like to devote my gratitude to the ARO's that participated helping me getting the job done and the staff of Defensity College for the fun moments. Then I would like to thank my fellow students from the 'afstudeerhok' and SPD who supported me with GIFjes, comfort food and tips & tricks.

Next, there are others that I would to express my gratitude to as they made me laugh and told me to 'just enjoy the last moments of being a student'. Anton, you have been there since the start of the project and provided me feedback where and when needed! My dear friends, who were there calling for hours or taking me out of my bubble for dinners, sports and fun. In particular, Rosanne, Michelle, Liset, Karlijn, Lieuwe, Rozemarijn, Tijmen, Thijs, Laurien, Jelmer, Josine, Niya, Hidde & Claire. Special thanks to Tobias and Rik, who have dragged me through the last mile.

Last, I would like to thank my family, who have not only challenged me to get the best out of myself, but also to make me realise that life is journey and you should take it as is comes. To my parents, Jos & Jan (the double J couple) thanks for all the lasagnes, hours of listening and inspiration. To Lex, thanks for your patience and support whenever I came home. To RJ, thanks for bringing in the positive energy. I am very proud of you and I hope to return the favour when both of you will graduate!

Rolien Eleonoor

Executive summary

There is an increasing need for structured methods that encourage effective knowledge sharing and collaborations at the working floor to implement innovation strategies, especially in case of employer - employee relationships. This research focused on knowledge sharing on the work floor during interprofessional collaborations to achieve durable innovation in hierarchical organisations using Communities of Practice. An integrative practical and theoretical study has been conducted. The research resulted in three parts: 1) A conceptual collaboration model that supports in knowledge sharing and helps COP managers to analyse the collaborations between COP members (Collaboration Analyser). 2) A tool that facilitates creative and collaborative thinking and open communication during the 'fuzzy front design stage' of the collaboration between two professionals at the working floor (C-Booster). 3) A program that facilitates COP management in the alignment with the innovation strategy with the collaborations at the work floor, using the model and tool.

Problem and Approach

The Communities of Practice (COP)-approach is widely known in Knowledge Management literature, but does not provide substantial insights into how to deal with knowledge sharing between professionals where power inequality is present. Researchers (Meyer & Zucker, 1989; Kerno, 2008) argue that "hierarchy and power issues might limit the community's potential if the majority of individuals are being more concerned about the hierarchal ordering than maximizing the organisational performance". occurs when COP members are not supported by their environment (supervisor and direct colleagues) to share (critical) information during interprofessional collaborations. As a result knowledge sharing as part of innovation implementation is inhibited at operational level (working floor), which makes COPs designed for innovation purposes useless. This directly results in implementation stagnation of the umbrella innovation strategy of a large organisation.

Aiming to solve (a part) of this problem, this research was meant to facilitate COP managers in their execution of the organization's innovation strategy via knowledge sharing in collaborations between two professionals (differing in hierarchy) on operational level. The main research question guiding this project was defined as follows: **How can 'Community of Practice' - managers facilitate knowledge sharing in the collaboration between professionals in hierarchical organisations to achieve durable innovation?** A design-based research approach (Double Diamond model) using an in depth-case study was executed to answer the main question.

The findings of this explorative research are used to improve the dynamic situation of a bottom-up initiated start-up within a large organisation, as part of the start-up's institutionalization process. In particular the interprofessional collaborations between their COP members and their employers.

Case study at Defensity College: A start up within the Dutch Ministry of Defence

The increasing threats of networked organisations ensure that the Ministry of Defence must grow from a hierarchical organisation (HO) towards a knowledge-driven organisation. The strategic concept 'the Adaptieve Krijgsmacht' is a required mean for the Ministry of Defence (at large) to continue protecting the Dutch citizens. The innovation strategy requires bottom-up initiatives to implement the strategy at all levels and departments within the organisation. Such an initiative is Defensity College.

Defensity College (DC) is a working floor initiative that aims to reconnect Dutch academic students to the Armed Forces by providing the students with a part-time job throughout all departments of the defence organisation. The start-up proved its first year to be successful. Therefore, since one year the founders focus on the institutionalization process within the Defence organisation. Their main promise is to deliver a contribution to the innovation strategy

'Adaptieve Krijgsmacht'. To make use of the innovation strategy potential, it is of importance that (newly) obtained knowledge is implemented on the work floor.
In the view of the COP approach, the students function as boundary spanners to share knowledge and thereby implementing the innovation strategy. Therefore, students should be supported in opencollaborative communication with his/her employer in the 'fuzzy front design stage' of the collaboration.

The analysis results of this research reveal that students are not always supported by their environment. This backfires, by means of innovation implementation, stagnation of the 'Adaptieve Krijgsmacht'. So, the goal of this research was to design a tool. The design goal was: **"Design a game that supports COP members to openly discuss how to create effective collaborations with their employer at the working floor during the 'fuzzy front design stage' of their cooperation. By developing a collaborative physical game that focusses on conceptual thinking about the collaboration into clear mutual agreements and concrete next steps."**

Conceptual model: Collaboration Analyser

Previous literature did not mention a model that focusses on the collaboration design between interprofessional collaborations (IPC) on operational level. The aim of this research was thus twofold: First, it is part of explorative research to create a collaboration model for research purposes. Second, the model had to be translated in a tool for practical purposes, namely for the founders of Defensity College (COP management).

First, to acquire relevant insights, an organisation analysis (in particular the Ministry of Defence's innovation strategy and DC) was conducted, followed by an introduction to literature about COPs under hierarchical circumstances. Subsequently, a literature study into IPC was conducted. The design goal of the model was therefore: **"Design a model that facilitates COP managers in organisations in knowledge in and between COPs on operation level and micro level, where a visible hierarchical organisation structure is present. By identifying factors that influence IPCs and stimulates discussion about factors in the COP that require attention."**

This resulted in the Collaboration Analyser, which is a conceptual collaboration model that supports in knowledge sharing between professionals differing in hierarchy and helps COP managers to analyse their COPs. The one pager helps COP managers to scope their COP strategic direction. Also, the model served as a base for the tool.

The strength of the model is that it (1) identifies points of improvement of the IPC on micro level and simultaneously (2) can be used by COP managers for COP strategy development to align the COP strategy with the organisations' innovation goals.

Tool: C-Booster

The C-Booster is the knowledge management game to facilitate professionals on micro level in the design-process to establish their collaboration. The tool offers a result-driven practical guidance (step by step) in the 'fuzzy front stage' of the collaboration between professionals.

The strength of the tool is that it creates creative and collaborative thinking and open communication between professionals of different ranks. This is based on test results highlighting most participant couples highly value the discussion to design their collaboration. The couples also valued the collaborative reflection on how they can best use their collaboration to achieve the innovation goals of the organisation. These results are considered positive for further development.

Program: Community Builder Program

The Community Builder Program (CBP) is the integrated program that connects the innovation strategists and COP managers during the implementation of innovation strategies with the executive professionals that work as 'boundary spanners' on the working floor.

The CBP is designed to facilitate COP managers in the discussion of their COP strategy development, which has to be aligned with the innovation strategy. It also structures the introduction meetings between professionals to create effective collaborations at the work floor and gathers feedback from the collaborations, to present the innovation strategists on how the strategy is being implemented in practice. The CBP contains the model, the tool and should be supported by a mobile application (app).

Scientific relevance of this study

The scientific relevance of this research can be found in exploring the interprofessional collaborations on operational level and proposing a conceptual model using the COP theory as a means to create innovation capabilities to implement abstract innovation strategies within HO.

To conclude, to expand the model and tool's contribution to science and to guarantee the scientific substantiation, both should be further investigated in terms of validity and reliability. However, the usability tests provide a first identification that 'hierarchy' does not have to interfere with knowledge sharing. In addition, the interactive game is perceived as 'encouraging' to achieve effective collaborations.

Content

Abbreviations

1. SPD	Strategic Product Design
2. SC	Science Communication
3. MOD	The Netherlands Ministry of Defence
4. DC	Defensity College
5. COP	Communities of Practise
6. SL	Social Learning
7. KM (in context)	knowledge management
8. KS	knowlegde sharing
9. DMO	Defence Materiel Organisation
10. IGK	Inspection General of the Armed Forces
11. KL	Koninklijke Landmacht, Royal Netherlands Army.
12.KM	Koninklijke Marine, Royal Netherlands Navy and Korps Mariniers, Marine Corps.
13. Klu	Koninklijke Luchtmacht, Royal Netherlands Air Force.
14. KMar	Koninklijke Marechaussee, Royal Military Constabulary.
15. ARO	Aspirant Reserve Officier, reserve officer cadet
16. AK	Adaptieve Krijgsmacht
17. MT	Management Team
18. DBR	Design Based Research
19. *CBP*	*Community Builder Program*
20. IPC	Interprofessional Collaboration

Glossary

Various concepts within this thesis will be explained once and henceforth used as general understood. Therefore, this chapter provides the list of definitions.

'Adaptieve Krijgsmacht': The 'Adaptieve Krijgsmacht' is a strategy to collaborate with society by means of "more exchange of people, equipment and services with companies, organizations and other authorities" (Ministry of Defense, 2017). . The 'Adaptieve Krijgsmacht' is a concept, based on the Total Force Concept, to involve society more closely with the Defence.

Knowledge sharing: The theory of knowledge sharing explains how information is considered useful (knowledge) by the perceiver and how this knowledge is conveyed between groups or individuals.

Social learning (SL) and Communities of Practice (COP): The social learning theory explains how individuals in social contexts interact to learn by sharing knowledge. The COP-theory is a practical approach of social learning and can be viewed as a practical mean, like 'build blocks' for social learning.

Interprofessional collaboration (IPC): This term explains how two or more professionals communicate and interact to achieve common goals. "It is often used as a means for solving a variety of problems and complex issues. The benefits of collaboration allow participants to achieve together more than they can individually, serve larger groups of people, and grow on individual and organizational levels" (Green & Johnson, 2015, p. 1)

Power: The concept of power based on the four layered framework design by Lukes (1964) and added by Hardy (1996): "The first layer is decision making power, by controlling scarce resources ('power over'). The second layer is about processes of restricting and extending access to decision making, and the third about how interest groups may 'shape perceptions, cognitions and preferences' by managing meaning and shaping the legitimate agenda. Finally, Hardy (1996: 8) adds a fourth layer, embedded in the 'organizational system that everyone takes for granted'" (Mørk et al., 2010, p. 579). *The researcher understood this definition as the 'decision-making power over, power to access processes, power to influence meaning and the power to be influenced by the 'largest', e.g. the organisational system.'*

The Start

Introduction and Research methodology

This thesis report presents the results of an explorative research, completed with the intent to obtain a master degree in Science Communication with a major in Strategic Product Design. A integrated program (including a model, a tool and a design brief for an app) is designed to facilitate Community of Practice (COP) managers in their challenge to implement the organisations' innovation strategy at the working floor by focusing on the interprofessional collaboration.

Chapter 1: The journey of this thesis project starts with a global introduction to this research project, including the problem, research goal, research question.

Chapter 2: To answer the research question, the research methodology and applied method will be presented.

1

Introduction

Knowledge management is a crucial asset in today's economy. Yet, managers struggle on a daily basis how to support their employees to share knowledge from one to another. What do we need?

1.1 Knowledge management being a crucial asset

Every organisation needs to adapt to the complexity of the dynamic world problems and innovate effectively to remain successful in today's economy (du Plessis, 2007). "The ability to build human capital and manage knowledge is therefore vital for [innovation and] success in almost any organisation" (Cabrera & Cabrera, 2005, p.720).

Through the increasing complexity of problems worldwide, organisations see they have to collaborate with others. Researchers argue that innovation is the base for organisational survival (Damanpour and Evan, 1984; Han et al., 1998; Hurley and Hult, 1998). Nowadays most sectors have adopted the theory of Open Innovation (Chesbrough, 2006), including the defence sector. Its main client, the Ministry of Defence, welcomes the creation of open architectures (Kerr, Phaal, & Probert, 2008): "For defence organizations open innovation happens in particular circumstances (e.g. one project or function) but they have not yet developed any coherent plan to roll out open innovation across the organization" (Mortara & Minshall, 2011, p. 591). Therefore, the MOD, but also many other organisations would benefit from a structured knowledge management tool to guide them towards open innovation.

1.1.1 Ministry of Defence and the need for knowledge sharing

After years of financial cutbacks and reorganization, in combination with opponents that operate as network organization, the Ministry of Defence (MOD)'s previous Minister Hennis-Plasschaert (2017) calls for the 'Adaptieve Krijgsmacht'. The 'Adaptieve Krijgsmacht' is a concept, based on the Total Force Concept, to involve society more closely with the Defence. "More exchange of people, equipment and services with companies, organizations and other authorities; [the] characteristics of the defence organization of the future" (Ministry of Defence, 2017).

MOD's strategic knowledge and innovation agenda (SKIA) for 2016-2020 consents on the general Defence policy and illustrates the need for strengthening knowledge and innovation. Three of the pillars are considered relevant for this thesis project, being the cause of the establishment of Defensity College, the case study. The three pillars contain;

- Collaboration: Cooperation, nationally and internationally. The aim is to strengthen cooperation with the Ministry of Security and Justice, with strategic partner countries and, through Dutch participation in the Preparatory Action for Defence Research, at European level;

- Knowledge Management: The aim is to strengthen the knowledge ecosystem;
- Focus on the future: Objective is the reinforcement of the anticipation function of Defence.

(Ministry of Defence, 2017)

1.1.2 Establishment Defensity College

The MOD called for social initiative's that would contribute to the 'Adaptieve Krijgsmacht' and the agenda points of the SKIA. Hence, the establishment of Defensity College is seen as a contribution (DC); a working floor initiative that aims to reconnect Dutch academic students to the armed forces. By providing the students with a part-time job throughout all departments of the defence organisation.

Defensity College aims to operate as a networked organisation (e.g. using students as brokers between the state-of-the-art academic knowledge and the armed forces). However, the management of Defensity College has its prior focus on the legal and regulation part of the institutionalization process of the program and has limited time to micromanage all students. Therefore, key account managers are included in the process. Also both the management team as well as the key account managers have no direct control over the 'knowledge sharing' of those brokers into the organisation. The management team and key account managers are not part of the daily interaction between the students, employers and colleagues. Students aim to solve problems themselves before asking for help of the community-support e.g. key-account managers of DC. In addition, there are no strict guidelines developed to guide students through the process of collaboration. Therefore, Defensity College functions as the practical context to learn how 'knowledge sharing' can be supported.

1.1.3 Mechanisms of knowledge sharing

There is wide range of mechanisms to encourage knowledge sharing. To support the case study with relevant literature, the mechanisms that could be applied are restricted to individuals transferring tacit knowledge. The mechanisms are informal interactions, formal interactions and a combination of both in the Communities of Practice (COP). Although all three mechanisms are worth exploring, the COP approach is most applicable to the case study, as the brokers (students) interact both on a very formal (structural meetings, masterclasses, Algemene Militaire Opleiding (General Military Training) way and informal way (lunches, small talks, afternoon drinks, talks with their mentors and conversations with their peers based on their personal and professional interests). These are typical examples of the COP approach and therefore the COP-theory will be used as the basic layer for the theoretical framework.

1.1.4 Introducing Communities of Practice

Known for its knowledge sharing, - interpretation and - creation is the Communities of Practice (COP) theory and has therefore become increasingly influential in management literature and practice (e.g. Allee, 2000; Barley & Orr, 1997; Lämsä, 2008; Noe et al., 2003; Perkins et al., 2007). Yet, managers face a major challenge on a daily basis: managing knowledge assets (Borzillo, 2009). ***How come?***

Communities of Practice (COP) are band together by agents that have mutual interests in problem solving in a specific domain (Wenger, McDermott & Snyder, 2002). Fisher (2001) argues that the 'similarity of agents emerges because they are facing similar tasks'. Those agents are practitioners or professionals and are usually referred to as 'experts'. The community operates more or less in a self-organized manner, where members produce and consume at the same time (Hafkesbrink & Schroll, 2011). These so called 'prosumers' exchange knowledge, behavioural attitudes, skills and values. In theory, this approach seems to overcome organisational boundaries and share knowledge between employees.

1.2 Problem introduction

Although the COP theory is valued for its knowledge sharing opportunities, in the paper Limits to Communities of Practice many researchers argue the limits of the approach in the management literature (Roberts, 2006). Duguid (2004, p. 115) for example stresses that the ability of sharing knowledge is mandatory, but the limiting factor is the 'willingness of people to actually share knowledge'. Ardichvilli et al. (2003) argues the importance of dedicated time in the early stages of any COP, as that is where trust between members is built, which is required for knowledge sharing between people. The allocated time that is required depends on the motivations of the members and the internal management, but could take up to several months or years (Pemberton, Mavin & Stalker, 2007). As one can imagine, for every organization is 'dedicating time' crucial factor as it always weights out the investment in other options (e.g. sunk costs).

Interestingly, contradicting arguments for various factors are given: hierarchy (Yanow, 2004; Pemberton et al., 2007, p. 68 - 69); power (Roberts, 2006, p. 628; Pemberton et al., 2007, p.67; Fox, 2000); authority (Swan, Scarborough & Robertson, 2002) and the wide applicability (Roberts, 2006, p. 634-635) are all considered barriers as well as enablers of the COP theory.

Others (Meyer & Zucker, 1989; Kerno, 2008) stress that hierarchy and power issues might limit the community's potential. For example, if the majority of individuals are

being more concerned about the hierarchical ordering than maximizing the organizational performance, it might negatively influence the purpose and the results of the community. It eventually might backfire towards the organization, as the organization's commitment to the community on grounds of (budget, time and employee allocation), becomes useless. Pemberton, Mavin & Stalker (2007, p. 71) argue that "future empirical research is necessary to investigate the power-political issues embedded within COP social interaction processes." Moreover, a critical statement by Fox (2000, p. 860) is given: "The community of practice theory tells us nothing about how, in practice, members of a community change their practice or innovate".

1.3 Research goal

This explorative research attempts to design a dynamic knowledge sharing tool focussing on innovation for scientific and practical purposes. As follows from the problem introduction, a lot has been written about the COP theory with regards to open innovation.

1.3.1 Current COP support models

Within literature empirical research can be found, including case studies that support the need for models that facilitate COP-managers. For that reason there are various models created to support COP-managers on organisational level. The models mainly focus on;

- Performance of the COP (e.g. Huberman & Hogg, 1995)
- Cultivation or evaluation of the COP (e.g. Loyarte & Rivera, 2007; Soto, Vizcaíno & Piattini, 2015; Frank et al., 2017)
- Causality between COPs and organisational performance (Millen & Fontaine, 2003)

Although those models provide guidance for COP-managers, 'most of those models are too abstract to be tangibly understood' (Huang, Wei, Chang, 2007, p. 610). The model Huang et al. (2007) proposed is an algorithm focussed on the knowledge diffusion between COP-members can be linked to budget and time helping the COP managers to plan, predict and improve. However, the model does not support nor facilitate the interaction between professionals on micro level nor have explicitly included the topic of power inequality between professionals.

To conclude, the argument to put forth is that the social learning theory is famed for its learning possibilities and knowledge sharing, but there are no practical tools that support at the start of the actual knowledge transition between professionals where one of the professionals feels limited by the hierarchy. The idea for a dynamic communication tool started when van der Sanden (2016) drafted an outline of a new constructive framework ('the circle of collaboration') for collaborative dynamic learning based upon the Communities of Practise theory in mind. Although at its present incomplete state it promised a good starting point for further development.

1.3.2 Research gap

Given the large influence of knowledge management in organisations, it is important that COP-managers can be supported in their attempt to share knowledge from their members, to members of other communities. Furthermore, any employee should see organisational power inequality as a given fact, but not feel restricted by it.

Therefore, the goal of this research is to provide the management with a dynamic communication tool. This tool is based on the COP theory to promote knowledge sharing between members at the boundaries of a community of practice. The research contributes to science by an explorative research into a knowledge sharing tool using the concept of power.

1.4 Research question and sub questions

Prior to the introduction of the research question (see Figure 1) and sub questions, the previous insights are put back into the context of COP-managers. Currently, many social initiatives are established as a community of practice. Many ideas are promising; however an issue can occur when managers cannot support their members that bridge boundaries between different communities. This will be explained in this paragraph.

A bottom-up established COP is a self-steering team which often starts without any form of organisation hierarchy (Wenger, McDermott & Snyder, 2002). Over time, COPs require a process of institutionalisation if they aim to become a 'learning' network of professionals (Hoadley, 2012) for organisations innovation purposes. During the institutionalization phase, COP-managers need to extend their focus from the core product to other fields that require attention, such as regulation, growth potential of the community and jurisdiction. Due to the switch in tasks, COP-managers have to divide their time (Pemberton et al. (2007) mentioned time is a critical factor). Therefore the allocated time to the facilitation of the collaborations between their members as boundary spanners and other employees of the organisation decreases.

If those boundary spanners (individuals that function as brokers between different fields of expertise and are the mechanisms to transfer knowledge from one domain to the other) feel restricted or limited by the organisation or

are not guided in what and how information should be transferred from one domain to the other, the knowledge is not used to its fullest potential. Then, the initial purpose of the COP-approach becomes irrelevant.

To conclude, the COP-approach might not be effective in terms of knowledge sharing when outside the community, members (when in practice) seem not to share their insights or do not use it. It is important to look into what keeps them from doing so and find ways to convince and support them. Given the prior insights, the research question explored throughout this thesis is:

How can 'Community of Practice' - managers facilitate knowledge sharing in the collaboration between professionals in hierarchal organisations to achieve durable innovation? *A case study at Defensity College, an initiative within the Ministry of Defence*

The research question is divided into sub questions that developed along with the project.

- (1) Which barriers occur in the case study?
- (2) Which factors influence knowledge sharing in and between communities of practice on micro level?
- (3) What are the preconditions that the tool must meet?
- (4) How are the usability and applicability of the prototypes perceived by employer and employee?
- (5) How does the final design work?
- (6) What are the implementation requirements for DC?

1.5 Research method

This research uses a design-based research approach as defined by Reeves (2006). The four design phases of the 'Double Diamond' of the British Design Council (2007) are used to describe the applied design process. For this thesis project, the Double Diamond method best reflects the approach of this research: A constant loop of divergent and convergent thinking, using both scientific and practical insights during the project. The Double Diamond is divided in the phases:

- Discover the current situation in practice
- Define the existing literature in light of the case study
- Develop the desired situation
- Deliver the outcome of this research

1.6 Report structure

This thesis consists of 14 chapters. The chapters in this research are related to the Double Diamond phases. In the following paragraph the contribution of the sub-questions to the research question are explained, followed by the outline of the chapters.

1.6.1 Contribution of sub questions to research question

To facilitate COP-managers in the first place, the barriers that those managers have to coop with in practice have to be outlined (SQ1). Simultaneously, a literature study takes us along the historical pathway of communities of practice and their purpose nowadays (in light of innovation). The

How can 'Community of Practice' - managers facilitate knowledge sharing in the collaboration between professionals in hierarchal organisations to achieve durable innovation?

A case study at Defensity College, an initiative within the Ministry of Defence

Figure 1: The main research question

introduction into the literature reveals that COPs are used as innovation-stimulation mechanisms by organizations. Organizations use the COP-approach to stimulate peer-to-peer learning and knowledge sharing in the workplace between professionals. However, little is known about which factors influence knowledge sharing between the professionals (SQ2) and which are required to understand how a COP-manager can facilitate its community. Having these theoretical insights, a conceptual model can be proposed to help COP-managers analyzing the community. This model can be used only by the management team (MT). To better understand how this model can be of use between two professionals in practice, it should be applied by means of a case study. A set of preconditions should be listed to design the prototype for the defined research context (SQ3). Knowing what the design criteria are, an initial prototype by means of a tool can be built and tested with (potential) users (SQ4). The tests are used as a guidance to understand how the tool can contribute to knowledge sharing without the COP-managers being present. After a set of iterations, the final design will be presented by means of the Community Builder Program. Its purpose and its method will be explained (SQ5). Finally, the final design should be implemented and ready for use for the case owners (SQ6).

Knowing the answers to the sub-questions, the implications, contributions and future research can be discussed for the case owner Defensity College (DC), and the fields Science Communication (SC) and Strategic Product Design (SPD). This thesis concludes with a conclusion to answer the main research question.

1.6.2 Research methodology

The completion of this project requires a structured research methodology. In this paragraph the methodology and method will be introduced. A full explanation of the research methodology, the chosen research method, the to-be-executed phases and steps will be explained in chapter two.

The research methodology considered suitable for this thesis is Design-Based Research (Reeves, 2006). This methodology is commonly used for designing processes and objects for learning purposes. Design-Based Research (DBR) is based on an iterative process existing of simultaneously conducting practical and theoretical research and supports the researcher in designing for the interventions between practice and theory.

There are various research methods that can be applied within DBR. The method that connects the most is the Double Diamond model, as it "entails emphasis on the problem analysis as the basis for creating a solution for an external client. The model is mainly used for structuring the path if external collaborators are involved and for user involvement in the solution(s) development" (***Seminar on innovation and entrepreneurship in education***, University of Copenhagen, 2013).

Knowing the purpose of the sub questions with regards to the main research question and knowing with research method will be applied to answer the questions, the report structure can be given.

1.6.3 Outline of chapters

To outline the answers of the sub questions, the report is divided into chapters along the Double Diamond model. To answer the sub questions, a research methodology is used with various phases and steps. The research methodology will be explained in chapter 2. In chapter 3, an introduction to the innovation types of COPs will be explained. In chapter 4, the facilitators and barriers in the case study will be discussed and linked to the innovation types of COPs. In chapter 5 the literature study will be done into factors influencing interprofessional collaboration. Chapter 6 outlines the development of the conceptual model. Then, the design criteria for the model to be applied in practice can be listed in chapter 7, followed by the design of the prototype of the support tool discussed in chapter 8 and the testing cycles in chapter 9. In chapter 10, the final design will be shown. In chapter 11 the implementation plan of the tool for the case owner will be discussed. The report finalises by respectively a discussion (chapter 12), conclusion (chapter 13) and reflection (chapter 14) of the research project. An overview of the how the Double Diamond phases are incorporated in the report and which phase captures which chapters is shown in Figure 2.

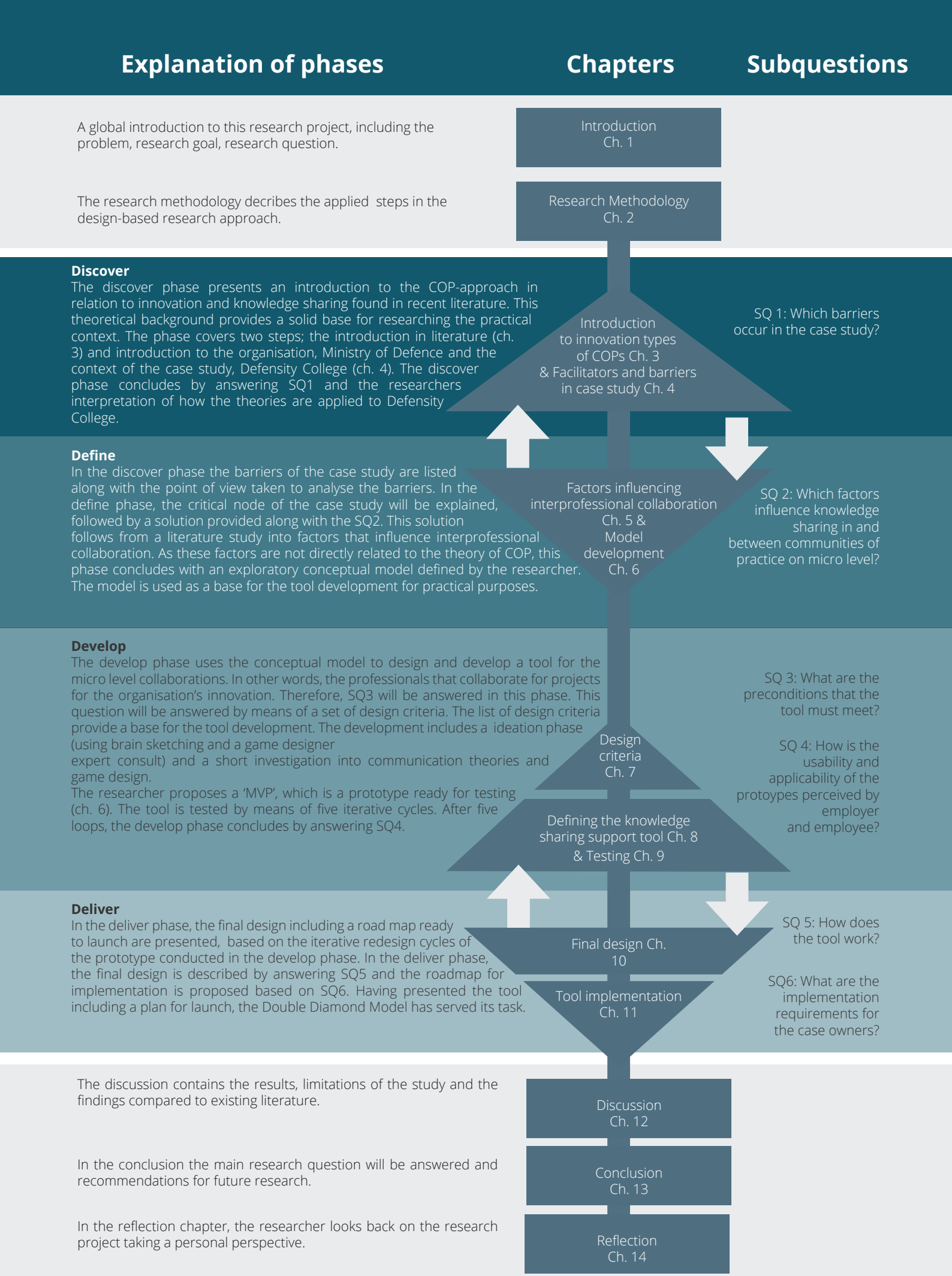


Figure 2: Project outline presenting how the phases of the Double Diamond model are integrated in this project report.

2

Research methodology

The former chapter explained the relevance of the research, the problem that will be researched, the research questions and the report structure. This chapter describes the research methodology and the research method including phases and steps used in this project.
First, the chapter introduces the design-based research methodology and the double diamond method (2.1). The next four sections outline the steps taken in the four phases of the Double Diamond model: The discover phase (2.2), the define phase (2.3), the develop phase (2.4) and the deliver phase (2.5).

2.1 Design Based Research (DBR) & Double Diamond Model

The research questions are investigated by means of a design-based research approach. The main research question was formulated as: **How can 'Community of Practice' - managers facilitate knowledge sharing in the collaboration between professionals in hierarchal organisations to achieve durable innovation?**
The sub research questions were formulated as:

- (1) Which barriers occur in the case study?
- (2) Which factors influence knowledge sharing in and between communities of practice on micro level?
- (3) What are the preconditions that the tool must meet?
- (4) How are the usability and applicability of the prototypes perceived by employer and employee?
- (5) How does the final design work?
- (6) What are the implementation requirements for DC?

The research question derived from the contradicting arguments (provided in the introduction) for the COP-approach being effective under unequal power relationships between members (professionals) from different communities. The goals of this research are to critically reflect on the COP-approach by researching a practical context in a hierarchical organization and contributing to practice by designing an intervention model based on the COP-theory to create a tool that can be applied for learning purposes in the case study. A research methodology that supports this goal is considered a suitable research approach for this project. Therefore, the research question and goal are investigated using the Design Based Research (DBR) methodology including an in-depth case study.

2.1.1 Design Based Research

Design-based Research is a qualitative research approach which contains simultaneously a practice- and theory-based research process. Cobb, diSessa, Lehrer, & Schauble (2003) suggested that design-based research results in the production of theories on learning and teaching, are interventionists (including a form of design), is placed in naturalistic context and is iterative. According to Hoadley (2002), this research method is especially important for establishing collaborative contexts, or activities and cultural structures that support collaboration leading to learning. According to Anderson & Shattuck (2012, p.16-18), a 'quality DBR study' is defined by the following:

- Being situated in a real educational context
- Focusing on the design and testing of a significant intervention
- Using Mixed Methods
- Involving Multiple Iterations
- Involving a Collaborative Partnership Between Researchers and Practitioners
- Evolution of Design Principles
- Comparison to Action Research
- Practical Impact on Practice

In this research, the originally perspective on the COP – approach (social learning theory) is placed in a naturalistic context (case study) and aims to design an intervention model by iterative testing.

2.1.2 The double diamond

The Design-based research methodology includes a wide range of research methods. The research method, Double Diamond model will be applied in this project. Although there are various models that can be used, such as; the organization IDEO's 'inspiration, ideation and implementation' (3I) model, or IDEO's 'human-centered design' (HCD) model, the Double Diamond model is most compete one as it captures both financial management and business' focus (income statement) and a designer's perspective (understood as a way of thinking which leads to transformation, evolution and innovation, to new forms of living and to new ways of managing business (Tschimmel, 2012, p.1).

The Double diamond model is a visual map of the design process as structured by the British Design Council (2007). The creative process a number of possible ideas are generated (divergent thinking), where after the ideas are refined and narrowed down to the best idea (convergent thinking). Hence, the diamond shapes. The 'double' part of this model indicated that this happens twice. First, to confirm the problem definition, then to create the solution. To create and discover the best ideas, the process is iterative. Ideas are developed, tested and refined. The ideas are filtered out if considered not contributing to competitive advantage for the case owner. Or, as the Design Innovation Group states "designing the right thing, designing things right". The Double Diamond model is represented in Figure 3.

Figure 3 shows how the two diamonds relate to the four phases and describe what steps are taken in each phase. It provides an overview of how each of the four phases (discover, define, develop and deliver) end with a list of activities.

The research starts by the problem statement, the problem 'owners' and the design challenge which are provided by the case owner or should be investigated by the researcher.

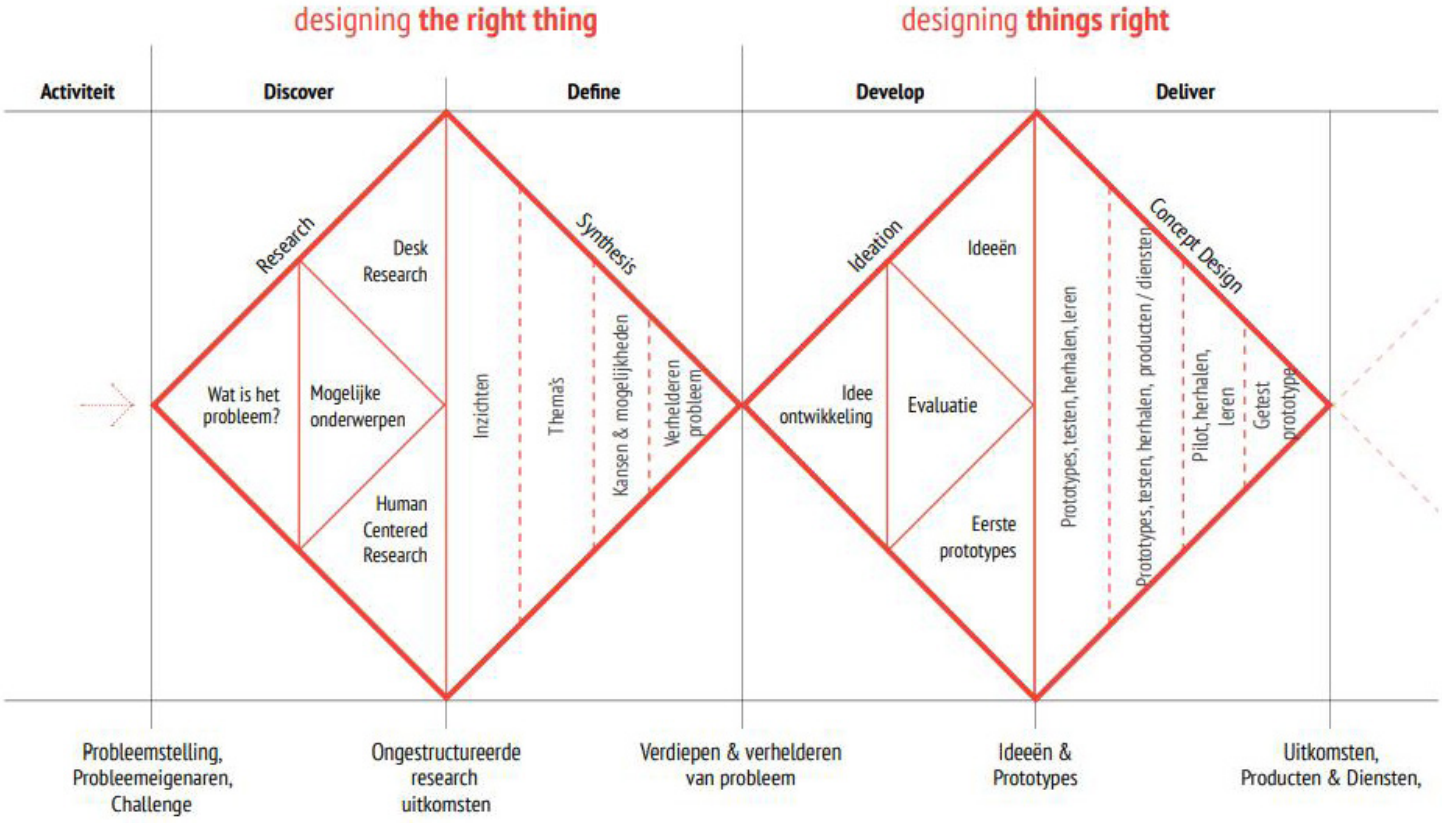


Figure 3: Double Diamond model (retrieved from the Design Innovation Group, 2013)

In any case, these will be explored and verified in the discover phase. This phase is diverging to understand all facets of the practical context in which the research is done.

The second 'define' phase converges the analysis insights, specific themes and opportunities found in the discover phase into the problem statement found by the researcher. In this report, the problem statement is referred to as the critical node. This is the end of the first diamond.

In the third 'develop' phase, potential solutions are developed using design criteria, an idea generation phase and building prototypes for testing. In the last 'deliver' phase, the prototypes are tested, evaluated, redesigned and tested again until the final design is proposed. When the presentation of the final design and the implementation roadmap are delivered, the second diamond is closed. In the next paragraphs, the steps applied per phase will be explained.

2.2 Discover phase

The aim of this phase is to discover how the COP-approach can be used to contribute to the institutionalization process of an initiative within a hierarchical organization. In this part the context of the social initiative, Defensity College (for which will be designed) will be explored by means of a case study. The barriers found in the case study provide an answer to the first sub question: Which barriers occur in the case study?
Parallel to this research step, a generic introduction in recent literature about the COP-approach, the relation to innovation and the limitation of power will be investigated to understand how the theory could be applied in the practical context.

The discover phase covers three research steps that support the answer of the sub question and an additional step to place the case study context in light of the theory. This includes the following research activities in the case study: an internal analysis, external analysis and in-depth interviews with the target group. The internal analysis included observations and the external analysis a desk research and pilot interviews. The insights were used for in-depth interviews. In the following sections, the case study is introduced and the research steps are explained.

2.2.1 Case study

This case study is conducted to analyze the barriers in practice taking the COP-theory as point of view. Therefore, the practical context needs to be explored (e.g. understanding the bottom-up initiative Defensity College taking a COP-approach). Also, the COP-theory needs to be introduced in light of the problems that occur in the case study.

Researching in practice is done by an internal analysis, external analysis and in depth-interviews (practical exploration). The generic theoretical base is introduced in a background literature study into the concept of 'knowledge sharing' in the relation to 'communities of practice' and 'power'. The insights from both theory and the case study (practice) are combined to limit the scope of this research.

The case study was conducted at Defensity College, an initiative developed within the Ministry of Defence. Defensity College (DC) is a bottom-up social initiative which offers a program to reconnect academic students to the Armed Forces. The establishment of Defensity College was a result of three employees of the MOD aiming to "let students experience just as instructive, adventurous and great time during their studies at the Ministry of Defense as we ourselves had and still have" (Goedhart, 2017, co-founder of Defensity College) and caused by the MOD's call for social initiatives that would contribute to the 'Adaptieve Krijgsmacht', a widely adopted concept to involve society more closely with the Defence.

The 'Adaptieve Krijgsmacht' is a strategy to collaborate with society by means of "more exchange of people, equipment and services with companies, organizations and other authorities" (Ministry of Defense, 2017). After years of financial cutbacks and reorganizations, in combination with opponents that operate as networked organizations, the Ministry of Defence suffers from too little personnel and high work pressure. Therefore, the Minister calls for the 'Adaptieve Krijgsmacht'. One of those initiatives is Defensity College, an idea that contributes to 'Adaptieve Krijgsmacht'.

The case study was conducted at the context of Defensity College to investigate how the Communities of Practice-theory could be applied in practice. First, the barriers in the Defensity College program needed to be detected, which will serve as a base for the critical node.

2.2.2. Internal analysis

The purpose of the internal analysis was to acquire understanding of the current situation in which Defensity College operates. This includes vision, mission, internal collaborations, developments and challenges of the program. The internal analysis is done by observations. A contribution to the internal analysis is made through informal talks with the founders, reading into documentation of Defensity College, participating in, and observing during various stakeholder-meetings of Defensity College.

2.2.3 External analysis

The (external) environment in which DC operates is analyzed by means of a desk research and four pilot

interviews with stakeholders (early-adopters) of the DC program.

2.2.3.1 Desk research

Desk research has been performed to explore which trends and developments are observed in the Ministry of Defence (MOD) concerning open innovation and communities, warfare threats and (implemented) solutions and political decision-making for investments in the MOD. The desk research involved reading articles/doctrines developed by the MOD. The articles read included the topics warfare development, adaptivity in relation to innovation in the MOD and MOD's strategic agenda retrieved from the Military Spectator and intranet. Additionally, letters to the parliament are read to understand the political decision-making process of developments in the Ministry of Defense.

2.2.3.2 Pilot interviews

The pilot interviews were conducted for three reasons: First, to identify stakeholder groups of Defensity College. Second, to find barriers perceived by stakeholder groups which could be supported by a communication support tool. Third, to analyse and describe the relationship between Defensity College and the Ministry of Defence.

The pilot interviews were conducted with participants who are reservists (both military and civilian employees). Four pilot interviews were conducted, each with one participant. The pilot interviews were non-structured. The participants were suggested by Defensity College, as they all have experience with the program, as well as the MOD. The participants were 1) a senior project manager implementation of character building programme in the Royal Netherlands Army (wing-commander), 2) the head of recruitment and appointment of personnel (wing-commander), 3) a student working at the Defence Materiel Organisation and 4) a mentor of the interviewed student.

2.2.4 In-depth interviews

Both the internal and external analysis provided insights for the in-depth interviews with the target group (students). The aim of the interviews was to gain understanding of the barriers and limitations of the Defensity College program perceived by the target group. An in-depth interview covers a sensitizing booklet and a semi-structured interview. Prior to the semi-structured interviews, the participants received a sensitizing booklet. The semi-structured interviews were based on the sensitizing booklet.

The four in depth interviews were conducted with one participant per interview. The participants differed from the pilot interviews and took approximately one hour. Two of the interviews are transcribed and validated; two interviews were via phone and were not transcribed.

The participants were four students who were participating in the DC program for at least three months and were not part of the pilot interviews. Except for these criteria, they were randomly chosen. The four participants of these interviews might know each other professionally. One of the participants was working as a civilian employee; the other three participants are as prospective reservists ("aspirant reserve officier" in terms of Defensity College).

2.2.4.1 Sensitizing booklets

Sensitizing booklets are a research tool for designers to "establish self-reflection on the part of the participants" (Sleeswijk Visser, Stappers, van der Lugt, Sanders, 2005, p. 125). The sensitizing booklets are part of sensitizing tools and can be viewed as diaries. The sensitizing booklet was designed to help participants critically reflect on the program of Defensity College and on the collaboration with the community managers (DC). The participants had one week to fill in the sensitizing booklet prior to the interview. The sensitizing booklets can be found in appendix A.

2.2.4.2 Semi-structured interviews

The semi-structured interviews were conducted with four students separately over a period of five weeks. The purpose was to gain the student's perspective, based on the answers they provided in the sensitizing booklet.

2.2.4.3 Validation of semi-structured interviews

The two of the interviews were transcribed which are included in the appendix B. Two participants were interviews on the phone and not transcribed on request of the participants. They did however, approve on using various quotes they said during the interview. Those quotes were written down and validated at the end of the phone calls. The transcripts were validated by participants based on e-mail correspondence.

The internal analysis, external analysis and the in-depth interviews formed the basis for the critical node of Defensity College' program, which is discussed in chapter four Facilitators and barriers in the case study.

2.2.5 Background literature study

At last, a generic understanding into the concept of 'knowledge sharing' in the relation to 'communities of practice' and 'power' is given in form of a background literature study. Chapter three serves as a background chapter to understand how the theory to be applied to the barriers found in the case study.

2.3 Define phase

The discover phase concluded with barriers of the case study and the point of view taken (perspective: COP-approach as a mean for organizational' innovation purposes). The define phase first introduces the critical node, the social problem statement and the design goal for the model and then aims to propose a conceptual model for the proposed critical node (chapter 5 up to section 5.4). The conceptual model is based on the answer of the second sub question: Which factors influence knowledge sharing in and between communities of practice on micro level?

The answer of the second sub question derives from a literature study (chapter 5 from section 5.5) that concludes with a list of factors that influence knowledge sharing in interprofessional collaboration. The core concepts of the COP-theory and the factors found in literature will be designed into a conceptual model. The model is substantiated by means of a search for articles that confirm a relation between the concepts and the factors. The conceptual model is tested with a participant from the target group of Defensity College.

2.3.1 Literature study

The literature study was conducted to find factors that influence knowledge sharing in and between COPs on micro level where hierarchy (as form of power) is evident. More specifically, factors that influence teams of professionals that collaborate and where a form of power inequality takes place. The literature study is based on three concepts that are the fundament for this research: Social learning and Communities of Practice, knowledge sharing and Interprofessional Collaboration. These concepts are explained:

- **Knowledge sharing:** The theory of knowledge sharing explains how information is considered useful (knowledge) by the perceiver and how this knowledge is conveyed between groups or individuals.
- **Social learning and Communities of Practice:** The social learning theory explains how individuals in social contexts interact to learn by sharing knowledge. The COP-theory is a practical approach of social learning and can be viewed as a practical mean, like 'build blocks' for social learning.
- **Interprofessional collaboration (IPC):** This term explains how two or more professionals communicate and interact to achieve common goals. "It is often used as a means for solving a variety of problems and complex issues. The benefits of collaboration allow participants to achieve together more than they can individually, serve larger groups of people, and grow on individual and organizational levels" (Green & Johnson, 2015, p. 1)

Literature found in the domain of knowledge management or communities of practice discussed the use of knowledge sharing in and between communities of practice and provided insights in the relation to innovation and power. However, no the definition or explanation of the concept of power was discussed in this literature domain. Also, there were no specific factors discussed for the collaboration between professionals on micro level in this domain. Therefore the concept of IPC is added to this study and is a definition of power adopted.

2.3.1.1 Literature study method

For the literature study, the systematic search procedure as designed by PRISMA statement (Liberati et al., 2009) is used. The main advantages of a systematic literature search for this research are that enhances the replicability of this literature research. To narrow the scope of this literature and find the most recent developments for communities of practice, the articles are searched in the Core Collection Database of Web of Knowledge in the time frame of 2010 – 2018.

Furthermore, exclusion of articles was based on the following requirements. Articles are excluded based on title and abstract.

- Impact factor should at least be 2,5 after 5 years. This is done to create a base for credibility of journals and the article published within the journal.
- Virtual communities were excluded (as space and time are environmental factors that differ from normal COPs)
- The search was based only based on the Web of Knowledge's Core Collection
- The articles written for other countries then countries that belong to Europe were excluded as the differences in language, culture and factors differ significantly.
- Two search terms were limited to review articles; (1) Interprofessional collaboration OR Cooperative behaviour with enablers and barriers, (2) Social learning OR Communities of Practice with brokering / boundary)

After the exclusion the articles are fully read.
The concepts previously discussed are related to key words that deal with 'power, innovation, enablers or limitations' or synonyms. Which keywords are used in relation to which concepts can be found in Table 1.

What I wanted to know	Search query	Key words	Found Literature
Social learning OR Communities of Practice	*(Social learning) OR (Communi* AND practi*)*	*Barriers and enablers / limits and facilitators*	*Aljuwaiber (2016); Pattinson, Preece & Dawson (2016); Jeon, Kim, & Koh (2011). McKellar, Pitzul, Juliana & Cole (2014).*
		Power/hierarchy	*Nowak, Koller, Andresen, Gross, Kreutzmann & Schulte (2016); Mørk, Hoholm, Ellingsen, Edwin, & Aanestad (2010).*
		Knowledge transfer, Knowledge sharing and innovation	*Bertels, Kleinschmidt & Koen (2011)*
		Brokering / boundary (only reviews)	*Contu, (2014); Borzillo & Kaminska (2013).*
Knowledge sharing	*(Knowledge AND shar*)*	*Enablers and barriers*	*Contandriopoulos, Lemire, Denis & Tremblay (2010); Alexopoulos & Buckley (2013).*
		Definition	*Bartol & Srivastava (2002); Wang & Noe (2010)*
Interprofessional collaboration OR Cooperative behaviour	*(Interprofessional AND collaborat*) OR (IPC) OR (Cooperative AND behavio*)*	*Power, hierarchy*	*Chung, Ma, Hong & Griffiths (2012)*
		Enablers and barriers (only reviews)	*Pfaff, Baxter,Jack & Ploeg (2014); Mulvale, Embrett & Razavi (2016); Supper, Catala, Lustman, Chemla, Bourgueil & Letrilliart (2015).*

Table 1: Literature study search concepts, search queries, keywords and literature found

In Table 1the literature study concepts and keywords which have been researched can be found. From left to right, the phase is presented in which the literature is used, including the key words related to the concept.

2.3.1.2 Literature results

The literature review concluded with a list of 23 factors influencing IPC on micro level. The factors derived from literature of the health care sector.

2.3.2 Model development

The factors found in the literature were added with factors found in practice and combined with the basic elements of the COP-theory and designed into a layout for a model based on the initial idea by van der Sanden (2016). Then, the researcher designed the relation between the COP-concepts and the factors using articles for the confirmation of the relationship. The model was validated in terms of acknowledgement of the variables in a pilot test. The model is used as a framework for the researcher, which forms the base for the tool development in the develop phase.

2.3.2.1 Article search for confirmation between COP-concepts and factors found in literature

To identify a relationship between the factors found in the literature study and the concepts from the COP theory, new literature has been collected. Quotes from this literature have been used to represent the relationship.

2.3.2.2 Pilot test

The pilot test was conducted with a target group participant (student) from Defensity College who already participated in the in-depth interviews. The test contained an explanation of the model and a discussion to what extend the participant acknowledged the factors as present in the context of the case study.

The participant currently is a PhD candidate at the University of Leiden Medical Centre and participant of the DC program. The participant is considered experienced both being familiar with research in the health sector and Defensity College. The background in health sector research is considered valuable as the factors have derived from studies on interprofessional collaboration in the health sector. The participant acknowledges the factors as being present in the context of the case study and added two factors: adaptability and mandate. Having the conceptual model, the next phase starts with the development of the tool for practical purposes.

2.4 Develop phase

The develop phase covers the development of the practical tool, including a set of design criteria, developing a prototype and testing the prototypes of the tool. The develop phase exists of two parts.

In the first part, the third sub question **what are the preconditions that the tool must meet?** will be answered by a list of design criteria that are based on the (in this phase) established design challenge, design goal and the insights provided by two wargame experts. Also, a literature study into the communication theories was conducted to understand how the game could be developed.

The second part exists of the iterative develop cycle. To answer the fourth sub question **how is the usability and applicability of the prototypes perceived by employer an employee?** the concept is created, prototyped, tested and iterated.

2.4.1 Part I: Design criteria for the interface of the tool

During the develop phase, the tool is developed by means of the content and the interface. The content is based on the conceptual model. The set of design criteria for the tool was based on the interview insights and theories. To design the interface of the tool, the researcher shortly investigated in communication theories from the book 'Theories of human communication' by Littlejohn and Foss and readings suggested after a meeting with two game design experts. Part I concludes with an answer to the third sub question.

2.4.2 Part II: Prototyping and testing tool

Based on the design criteria, the interface was created and prototyped into a Minimal Viable Product (MVP). A MVP is an early, 'stripped down' version of a product (an early state of a prototype), which determines whether that product is profitable. Part II concluded with an answer to the fourth sub question (see also the next paragraph 'test session's results').

Test set up

The test sessions were based on 'design thinking' (Plattner, 2009), which is the principle of building a MVP and then directly testing, evaluating, improving with and for the user. To test the prototype, five tests of approximately sixty minutes each session, are executed. Each test was conducted with two participants, except for test three (which included three participants). The tests, participants, location and background information can be seen in the appendix J.

Each test session started with an introduction to the tool, followed by an interactive session in which the couples played the game. After 50 minutes, the researcher started the discussion about the positive and negative features of the tool. Both participants were encouraged to provide constructive feedback. This was supported by the researcher using the probing questions: 'why should you not implement the tool?' and 'what are three benefits of the tool you can think of?'

2.4.3 Test session's results

Each test was recorded on speaker to gather insights from the participants. The insights are not validated by the participants. After every test, the feedback is included in the next version of the prototype.

The overall conclusion of the five iterative steps was that the game (board and cards) version of a knowledge sharing support tool was considered positive, as well as the structured approach to think on a conceptual level of how to design collaboration and putting those insights in mutual agreements and concrete steps. However, the prototypes were still very complex (sometimes even too complex) in its use and took longer than 60 minutes to answer all questions cards. The tool should therefore be easier in use and should be restricted to 45 minutes of playing time.

2.5 Deliver phase

In the last phase, the final design and the roadmap for implementation will be shown. The fifth sub question: **How does the tool work?** will offer guidance for the presentation of the final design. For the implementation of the tool for Defensity College, the sixth sub question creates the path: What are the implementation requirements for the case owners?

2.5.1 Integrating all products in final design

The final design, together with an implementation plan is the last steps of the double diamond model. After the phases, the conceptual model and the proposed communication tool are evaluated. Besides this, the overall research (process) is discussed and a general conclusion including recommendations is given.

2.5.2 Roadmap

The design of the roadmap (Kerr & Phaal, 2015; Phaal & Muller, 2009), e.g. the architectural framework and the visualisation of the roadmap are developed to define a path for implementation for Defensity College, over a time frame from June 2018 until December 2025 (until 2022 tasks have to be executed).

In summary, this chapter provided a generic overview of the process phases and steps of the Double Diamond model as the research method in this thesis and how this is applied in the project. Knowing the steps that have been taken by the researcher, this report continues with providing the answers to the research questions. Starting in the next chapter with investigation in the facilitators and barriers of the case study.

Figure 4: A young professionals day at the Defence Materiel Organisation (DMO) to learn how the department deals with young talent aiming to put the 'Adaptieve Krijgsmacht' into practice.

Discover

Case study and literature analysis

The discover phase presents an introduction to the COP-approach in relation to innovation and knowledge sharing found in recent literature. This theoretical background provides a solid base for researching the practical context. The phase covers two steps; the introduction in literature (chapter 3) and introduction to the organisation, Ministry of Defence and the context of the case study, Defensity College (chapter 4). The discover phase concludes by answering the first sub-question **Which barriers occur in the case study?**

Chapter 3: Introduction to innovation types of COPs.
Chapter 4: Facilitators and barriers in the case study.

3

Introduction to innovation types of COPs

The first step of the discover phase, is to create a base of the theories discussed in this thesis project. Therefore, this chapter describes the 'container' concepts: 'Knowledge management', 'knowledge sharing', 'knowledge', communities of practice and the relations between those concepts and innovation.

The introduction to the literature study starts by an introduction into knowledge management (KM) and the reason why organisations need to focus on knowledge sharing (3.1). Various mechanisms of knowledge sharing have been summarized (3.2), prior to the chosen approach in this study: Communities of practice (COP). The COP theory and its role in knowledge sharing will be explained (3.3). In the next paragraph (3.4) the different forms and purposes of COPs will be linked to innovation. The chapter concludes with a summary of the scope of this research (3.5). An outline of the concepts and theories and their relation discussed in this chapter is provided in Figure 5 and Figure 6.

In Figure 5 can be seen how the communities of practice approach originally is valued in knowledge management, but has become increasingly valuable for innovation purposes.

Figure 6 illustrates how the concepts in this chapter will be discussed. The blue boxes indicate the line throughout this chapter and the scope of this project.

Figure 5: The COP-theory in relation to knowledge management and innovation

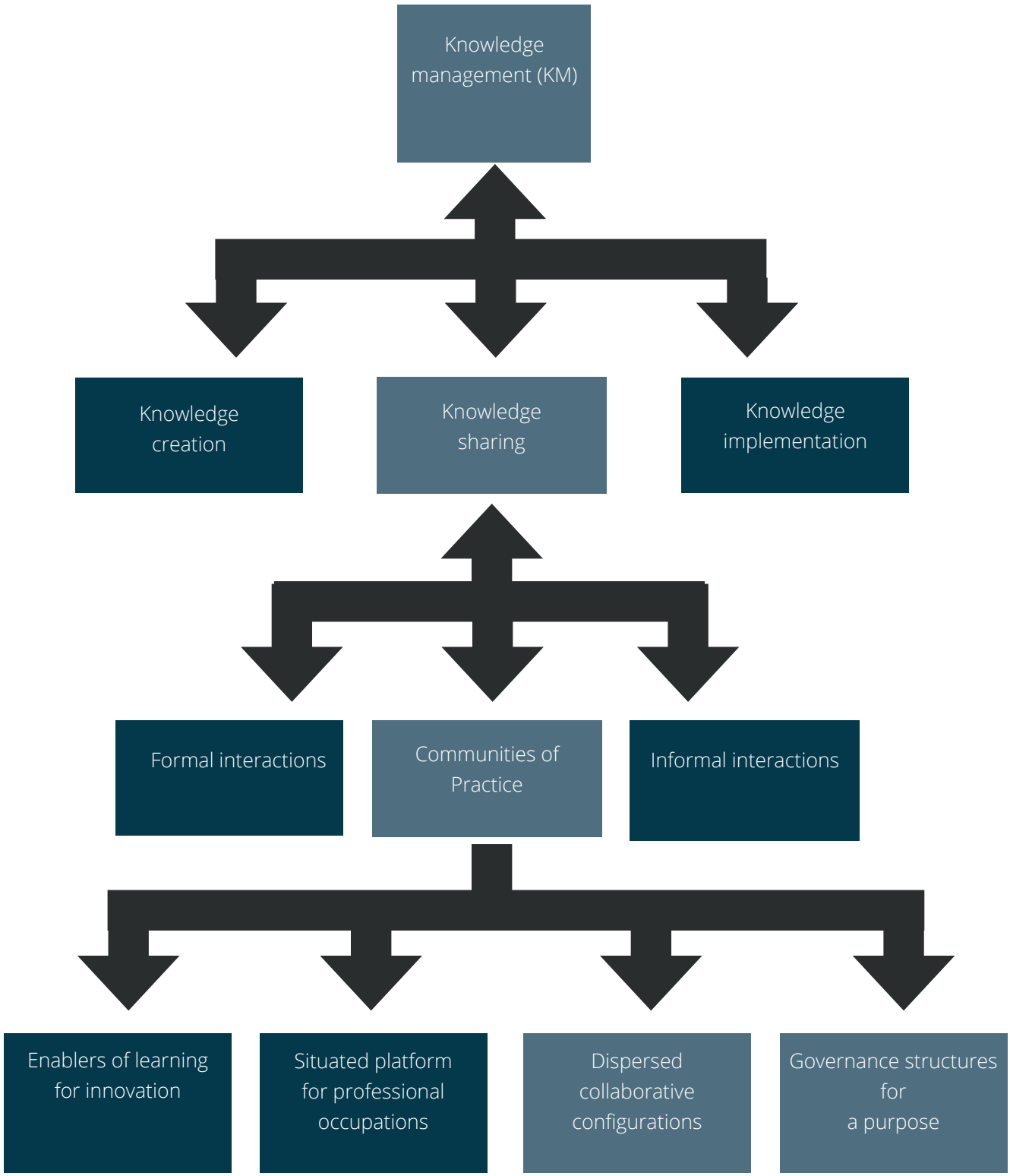


Figure 6: Structure of applied theories and concepts in chapter 3.

3.1 Introduction to knowledge management (KM)

"To gain sustainable competitive advantage in this complex economy, knowledge is a critical organizational resource" (e.g. Wang & Noe, 2010, Aljuwaiber, 2016). Managing knowledge, or, 'knowledge management' (hereafter KM), is a means for the survival of a company in a new competitive business world" (Awad and Ghaziri, 2007).

Research has shown that [knowledge management] is positively related to the reductions in manufacturing costs, time efficient new product development projects, team performance, firm innovation capabilities, and firm performance including sales growth and revenue from new products and services (e.g., Arthur & Huntley, 2005; Collins & Smith, 2006; Cummings, 2004; Hansen, 2002; Lin, 2007d; Mesmer-Magnus & DeChurch, 2009). Because of the benefits, organisations invested in knowledge management initiatives and systems to collect, store and distribute knowledge effectively. However, despite of the investments, estimated for 31.5 billion dollar by Fortune 500 companies, organisations failed to share knowledge effectively (Babock, 2004). Understanding knowledge and managing it has therefore raised curiosity for researchers and organisations.

The field of Knowledge Management (KM) "assists organisations to consider their knowledge assets and learn how to leverage them usefully" (Goh, 2002). KM exists of the knowledge-centred activities: creation, sharing and implementation. All contribute to the quality of knowledge management, but Wang & Noe (2010)'s research has shown that the success of knowledge management initiatives depends on knowledge sharing.

Being the driver of knowledge management success, knowledge sharing has caught up the researchers' attention to further investigate. The next paragraph therefore introduces the concept of knowledge sharing.

3.1.1 Defining 'Knowledge sharing'

Knowledge sharing (KS) is the influencing factor in knowledge management and is defined by the process (sharing) and the content (knowledge). First the process 'sharing' will be explained (and its difference with knowledge transfer), followed by the definition of the content, 'knowledge'. Then, the value of effective knowledge sharing is explained.

'Knowledge sharing' as a concept has been investigated over years. As such, researchers use various definitions of 'knowledge sharing' (Bartol and Srivastava, 2002). Bartol and Srivastava (2002) defined knowledge sharing as "individuals sharing organizationally relevant information, ideas, suggestions, and expertise with one another".

Knowledge sharing "is the fundamental means through which employees can contribute to knowledge application, innovation, and ultimately the competitive advantage of the organization" (Jackson, Chuang, Harden, Jiang, & Joseph, 2006). According to Noe and Wang (2010) "Knowledge sharing [taking the process perspective] refers to the provision of task information and know-how to help others and to collaborate with others to solve problems, develop new ideas, or implement policies or procedures."

Although Jackson et al., (2006) introduces the link with innovation, this research adopts the definition proposed by Noe and Wang (2010), as it focusses on the both the collaboration with others as well as the implementation of knowledge for organisational purposes.

Knowledge sharing differs from knowledge transfer and knowledge exchange. 'Knowledge transfer' deals with the movement of knowledge between organizational units, rather than the movement between individuals (Wang & Noe, 2010, p. 117). Hence, this distinction is made explicit. According to Wang and Noe (2010), 'knowledge exchange' contains both knowledge sharing and knowledge seeking (e.g. individuals searching for knowledge from others). Yet, knowledge sharing and exchange are used interchangeably in literature, but in this research knowledge, sharing is interpreted as both the exchange and seeking of knowledge by individuals.

3.1.2 Defining 'Knowledge'

Having the process of knowledge sharing defined, this paragraph explains the content 'knowledge'. 'Knowledge' is defined as the inclusion of 'information, ideas and relevant for tasks performed by individuals, teams, work units, and the organization as a whole' (Bartol & Srivastava, 2002, p. 65). Since the focus lies on the relevance of knowledge for the perceiver, this research adopts the definition provided by Wang and Noe (2010), whose research "considers 'knowledge' as information processed by individuals including ideas, facts, expertise, and judgments relevant for individual, team, and organizational performance" (e.g., Alavi & Leidner, 2001; Bartol & Srivastava, 2002).

There are two types of knowledge; explicit and tacit knowledge. Explicit knowledge refers to the articulated knowledge expressed in words and numbers and can easily be transferred among others. Tacit knowledge refers to skills, wisdom and personal experiences that are specific to an individual (Aljuwaiber, 2016; Bartol & Srivastava, 2002) and can therefore by definition not be generalised. For organisations, the sharing of both explicit as well as tacit knowledge is equally important. Yet, management focusses more on sharing of tacit knowledge, as this is harder to manage.

Researchers argued that, since' individuals are the prime movers of knowledge creation in an organisation (Nonaka, in Bartol & Srivastava, 2002), knowledge sharing among individuals assists in knowledge creation at a collective level' (Bartol & Srivastava, 2002, p.64). Effective knowledge sharing is therefore a valuable asset for organisations' vitality.

In summary, Knowledge Management (KM) is a critical means for organizations to survive in the new competitive business world. The success of knowledge management mostly depends on knowledge sharing (Wang & Noe, 2010). Effective knowledge sharing is therefore a valuable organizational asset. It became a reason for organizations to spend resources on the development of effective knowledge management. Knowledge can be tacit or explicit and, although equally important for organizations, the hardest form to manage is the tacit knowledge that needs to be transferred through individuals. Therefore, the next section discusses four mechanisms that encourage knowledge sharing between individuals focusing on tacit knowledge.

3.2 Knowledge sharing mechanisms

There is wide range of mechanisms that encourage knowledge sharing between individuals, such as informal interactions, formal interactions and the COP-theory (Bartol & Srivastava, 2002) who built on the work of Earl 2001). As we are gradually shifting towards a world of complex problems we encounter in a 24/7 economy, we are constantly surrounding ourselves with other to understand, learn and create knowledge to collaboratively encounter problem-solving. For that reason, [the formal interactions, informal interactions] and Communities of practices are being researched as these are an alternative for the traditional repository-oriented KM (Swan et al., 2000; Lesser and Stork, 2001; Wenger and Snyder, 2000), of which COPs can provide opportunities to break down professional and organisational boundaries (Ranmuthgala et al., in McKellar, Pitzul, Yi & Cole, 2014). *But what are the differences between those three and what is most desirable?* The different mechanisms will be explained before the answer to the previous question is provided.

- The first mechanism of knowledge sharing emerges through formal interactions. Interactions, such as periodic meetings take place in groups that contain people working within teams, work units or even whole departments or divisions (Bartol & Srivastava, 2002, p. 68)
- The second mechanism can be seen in organisations, such as McKinsey and American Express. They manage their knowledge sharing through informal interactions (Earl, 2001). Earl (2001) gives examples of companies such as McKinsey and American Express that have knowledge directories in which employees are identified for their areas of expertise. The aim of creating informal interactions within organisations occurs when experts share their knowledge when other employees approach them under more informal chats. The key element is based on trust (Bartol and Srivastava, 2002). Such informal interactions are usually not recorded, which makes it difficult to evaluate.
- • The last mechanism of knowledge sharing considered by Bartol and Srivastava (2002) is an approach that combines both informal and formal interactions. The communities of practice approach, in which employees within and across organisations interact socially and communicate topics of their interests to learn from one another in an informal setting (Aljuwaiber, 2016; Earl, 2001). COPs support reciprocal learning as a social process.

Although all three methods seem effective, the COP approach is considered most suitable as it helps to share knowledge both during office hours and in informal settings. In comparison, the formal interactions are limited by its formality, meaning possible outrageous solutions that are conceived outside working hours are not created together; hence, the 'Not Invented Here' limitation for innovations, as discussed in the introduction is often a result. Also in practice, a limitation follows from the organizational boundaries as part of the formality. The purely informal setting in which people share knowledge hinders them from saying the same in formal interactions. That is why a combination of these two is the most desirable for knowledge innovation.

As Communities of Practice is a tailored approach that enhances both knowledge sharing in formal and informal settings, innovation strategists prefer to use the approach as a mechanism for innovation implementation purposes. Therefore, in the next section the COP-theory will be thoroughly discussed.

3.3 The theory of 'Communities of Practice' as knowledge management approach

The Communities of Practice (COP) theory has become highly influential in knowledge management literature (Jean, Kim & Koh, 2011), because "modern knowledge management not only focuses on ways to capture, record and distribute knowledge in order to make it accessible to every employee. It also focusses on sharing, discussing and innovating knowledge" (Mittendorff, 2004, p. 5). In particular, sharing, discussing and innovating knowledge

occurs primarily in a social context and during the interaction of the individual with his environment (Wertsch, 1985). It is therefore, that the COP theory became a leading concept in the KM literature.

As resulted from section 3.2, the COP theory is considered an applicable approach for knowledge sharing between individuals within organisations. In this section the theory will be outlined and the general enablers and barriers will be discussed.

Since three decades, the Communities of Practice theory is an extensively explored concept. Originally adopted in education settings as a social theory of learning (Lave and Wenger, 1991), businesses embraced the theory as a KM-approach (Wenger, 2004; Huges et al., 2007).

3.3.1 Defining 'Communities of Practice'

'Communities of Practice', introduced by Lave and Wenger (1991) as 'groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly', the definition and applications evolved in different ways.

According to Wenger (2002) 'Communities of Practice have provided a vehicle for peer-to-peer learning among practitioners' and by interacting regularly, peers continuously learn how to improve and contribute to the community (Borzillo & Kaminska, 2013).

Although those definitions provide a general understanding of the concept, this research adopted the definition (McDermott, 2000; Wenger, 1998) as it explicitly mentions the professional discipline as a domain. Brown and Duguid (1991) adopted this definition in their research and discussed how COPs in organisational settings contribute to innovation through their flexible structures that constantly adapt to changing circumstances and membership. For that reason this research continues with the definition of Communities of Practice as: "Groups composed of members who share information, insight, experience and tools about an area of common professional discipline, skill or topic" (McDermott, 2000; Wenger, 1998).

To grasp the concept, an example is provided. *An example of a COP intended by Wenger (1991) is a group of hospitality entrepreneurs who are all dedicated wine lovers that learn and talk about wine during tastings and bring the gained knowledge back to their daily practices. That is, Bert uses Piet's knowledge about how the French grapes are maturing and Piet adopts Bert's vision based on years of experience on how to provide an authentic experience for customers.*

In light of innovation, the researcher perceives the concept as groups of people that learn about innovation techniques and the latest developments in science and technology. They spread the word and take action to bring those lessons into practice in the organisations. This is based on Probst and Borzillo (2008)'s research which indicates that by exchanging tacit knowledge through COPs can reduce the learning time for new employees.

3.3.2 Social capital & dimensions

As can be seen in the examples, COPs are identified through their positive influence on firms' social capital. A small side step will be made to explain social capital and its dimensions, as those dimensions help to understand how COPs are built up. Social capital is referred to as the "sum of actual and potential resources embedded within, available through and derived from the network of relationships possessed by an individual or social unit" (Lesser and Storck, 2001, p.833). Nahapiet and Ghoshal (1998) broke social capital down into three dimensions:

- The cognitive dimension focusses on issues such as shared understanding, the nature of knowledge, mental models and shared values and common goals among actors.
- The relational dimension focusses on the interpersonal characteristics of the COP. It deals with the history of interactions between actors which are often described in terms of trust, reciprocity, and identification with the COP and the quality of personal relationships with the COP.
- The structural dimension focusses on the overall structure of connections between actors, meaning the technology infrastructure and the social interaction ties.

The relational dimension is the connection between the cognitive and structural dimensions, however, in practice; this has been integrated in such a way that is can hardly be disassembled.

3.3.3 Dimensions of Communities of Practice

Taking this to Communities of Practice: There are three required components identified in any COP: the domain, community and practice (Wenger, 1998). Figure 7 provides a schematic overview of these components.

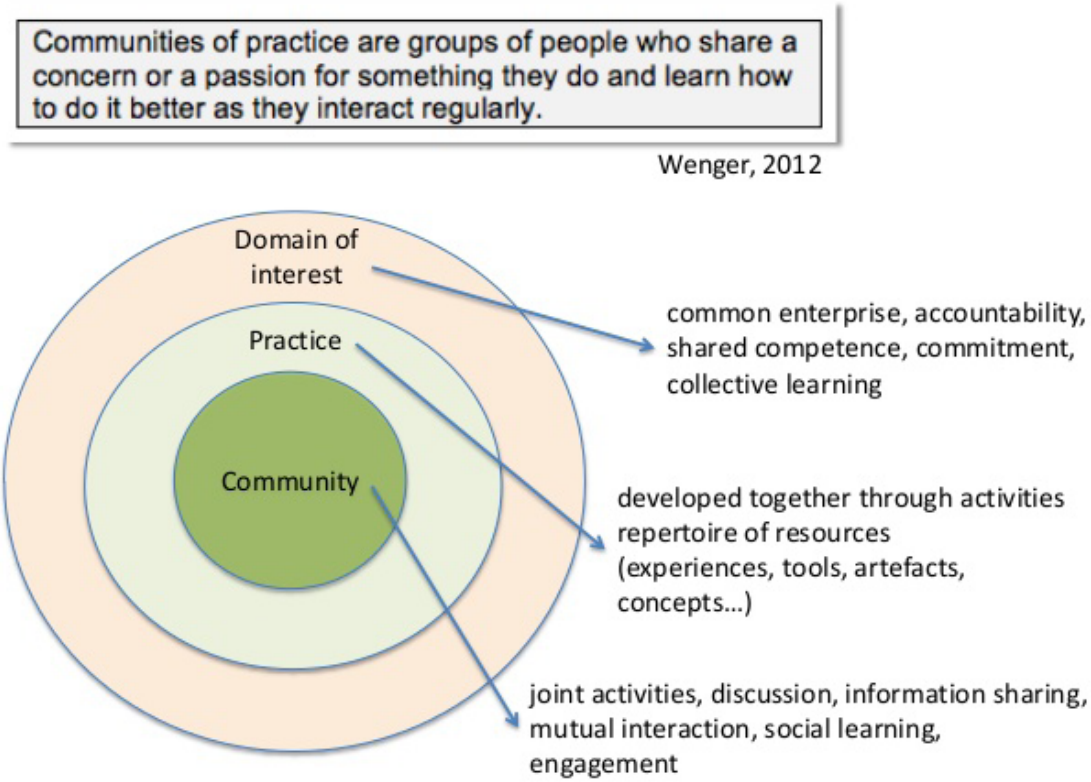


Figure 7: Schematically illustration of a Community of Practice (retrieved from Wenger, 2012)

Figure 7 provides the schematic illustration of a community of practice as it was intended by Wenger (1991). Based on Figure 7 the three components are formulated as;

- **Domain:** The members are brought together by the need for learning they share (it is undefined is the shared learning is explicit or tacit and if learning is the motivation of their get together or a by-product of it.)
- **Community:** The group of people that, as a result of their collective learning bonds them over time (based on experience not on a source of homogeneity).
- **Practice:** Their interactions produce resources that can be effective in their domain (Wenger, 2002, p. 27).

In other words, COPs are composed of people that are bond together and form a community. They come together in their field of interests, e.g. their domain. Those people develop together sets of repertoire that they can use in their daily practices (Lesser et al., 2002).
What also can be seen Figure 7 is that COPs are shown as circles closed from other parts and thus defined by boundaries. Those boundaries, in comparison with organisational boundaries are fluid and not easily identified/ visible. When different communities interact, the grey area of the boundary between those groups is where knowledge sharing can occur, this process is called boundary spanning (Wenger, 2000). Individuals from different communities that interact with others are called 'boundary spanners' (Brown & Duguid, 1998) and have two different roles, acting as "organizational translators" or intermediates.

There are three dimensions that contribute to knowledge sharing on boundaries: alignment, engagement and imagination (Wenger, 2000, p. 227). These characteristics are associated with the social capital dimensions (Borzillo & Kaminska, 2013).

- **Alignment:** This involves making sure that our local activities are sufficiently aligned with other processes so that they can be effective beyond our own engagement.
- **Engagement:** Engagement is achieved through doing things together, for example, talking and producing artefacts (sic).
- **Imagination:** It involves constructing an image of ourselves, of our communities, and of the world, in order to orient ourselves, to reflect on our situation, and to explore possibilities.

To illustrate how this works in practice, an example is given: *A fashion designer is not very likely to connect for professional purposes with a researcher that investigates complex space exploration algorithms. Here's why: There might be a form of engagement as they acknowledge each other as professionals. Yet, there is a lack of imagination. There is little change a fashion designer fully comprehend all complexity of the space exploration research. The research will probably not see any form of alignment between his/her own practice and the fashion industry and is therefore not able to use the knowledge in daily practices.*

What is also of importance is the level of participation, as that partly defines effectiveness of the Community of Practice. This is illustrated in Figure 8.

Figure 8 presents the various levels of participation (e.g. core group, active members, occasional members, peripheral members and transactional members) The levels are explained using Wenger and Trayners (2011)'s explanation:

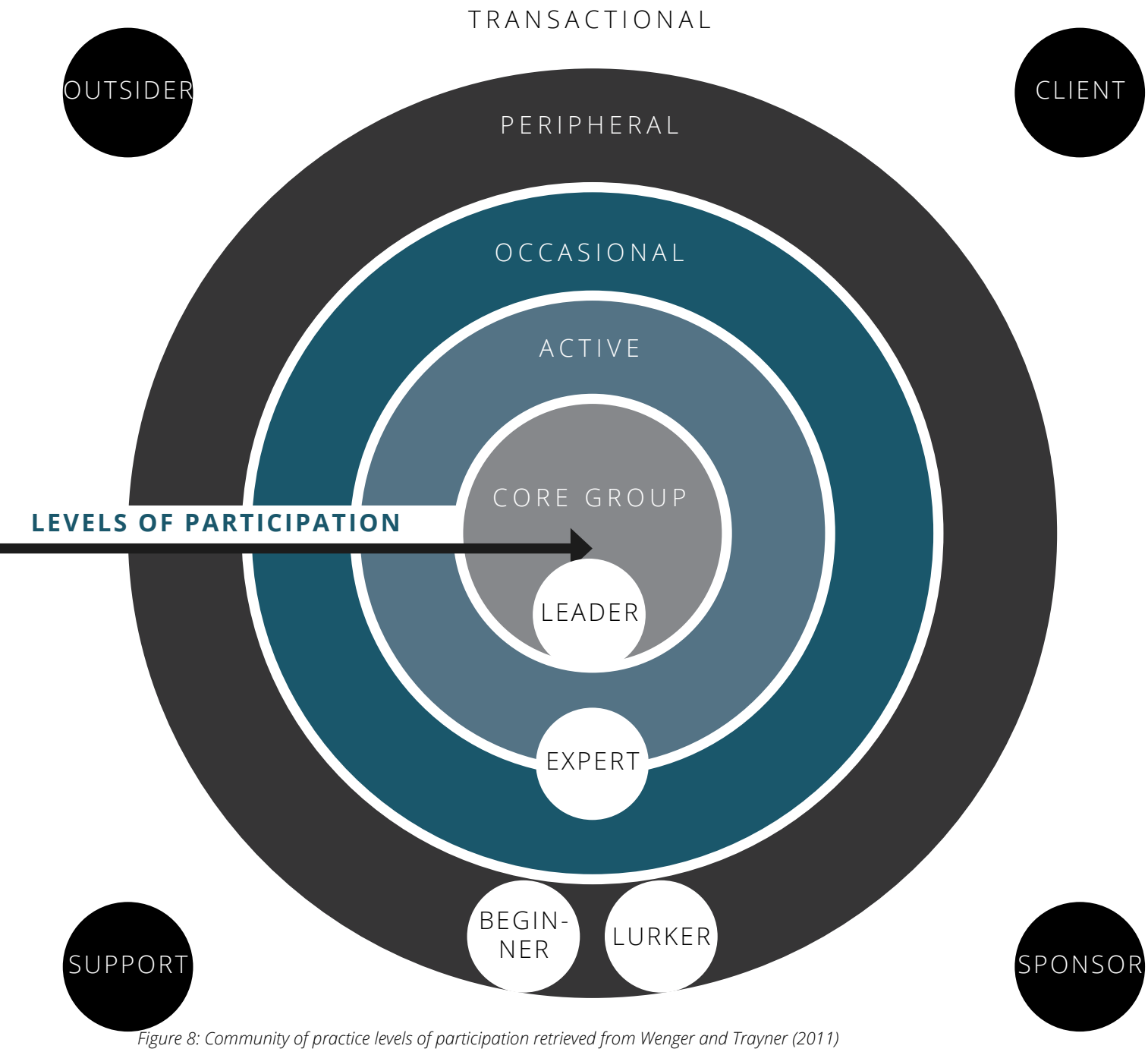


Figure 8: Community of practice levels of participation retrieved from Wenger and Trayner (2011)

- **Core group members:** A small group who nurture and energize the community by their passion and engagement. Leaders within the core group guide the community.
- **Active members:** Persons that are recognized practitioners who define the community. Active members are those, who over time, become experts in practice and therefore develop the COP.
- **Occasional members**: Those persons are only participation in the community when the topic is of special interests, they have something to contribute or when they are involved in a project related to the domain of the community. This group often adds specific expertise to a sub domain (of the domain), making them a relevant group for knowledge creation and development within the COP.
- **Peripheral members:** people that have a sustainable relationship with the community but are les engagement and have less authority (either because they are newcomers or their level of commitment to the practice is not as much as others). These people are often active elsewhere and carry the learning to these other places (boundary spanners). As they are grasping the knowledge developed within the community but are not actively participating or at least not long enough, they are considered beginners. The 'lurkers' are those who move along with the community knowledge, but are not participate. Although it has often has a negative connotation, 'lurkers' can be reconstructed as potential members that are listening and learning and might move towards the middle of the circle over time (Riedel, 2013).
- **Transactional participants:** Outsiders who interact with the community occasionally without being members themselves, to receive or provide a service or to gain access to artefacts produced by the community, such as its publications, its website, or its tools.

Having a general understanding of the concept of communities of practice, the most mentioned factor, power, in relation to COPs will be discussed. Power is both a limiting and facilitating factor of knowledge sharing and knowledge implementation (e.g. Roberts, 2006; Yanow, 2004).

3.3.4 Dimensions of 'Power'

Lave and Wenger (1991) stressed the importance of systematically including power into the analysis of communities of practice. Yet, power has not been sufficiently emphasised in the organisational learning literature (Antonacopoulou, 2006; Mørk et al., 2010). Also, power and knowledge are inextricably intertwined (Gaventa & Cornwall, 2008. p. 172). As a result, many researchers investigated the concept of power in relation to COPs (e.g. Contu and Willmott, 2003; Blackler and McDonald, 2000; Fox, 20000; Swan and Scarborough, 2005). Since the concept of power has already caused a lot of controversy, a paragraph is dedicated to the explanation of the concept based on the work of Mørk et al. (2010).

Mørk et al. (2010, p. 589) "examined how practices perform power effects by tracing the unfolding of power relations in two medical innovation projects". They argue that the master-apprentice relationship is less of a given fact than previous literature suggested. Their conclusion in summary is that power is fundamentally related to organisational learning. Therefore, "one needs to acknowledge that practices are open-ended, fragile and that changing practices may be highly political" (Mørk et al., 2010, p. 589).

Power: The traditional concept of power is restricting ('power over'). However, this concept is extensively researched. As a full understanding of power is out of scope of this project, the concept of power based on the four layered framework design by Lukes (1964) and added by Hardy (1996): 'The first layer is decision making power, by controlling scarce resources ('power over'). The second layer is about processes of restricting and extending access to decision making, and the third about how interest groups may 'shape perceptions, cognitions and preferences' by managing meaning and shaping the legitimate agenda. Finally, Hardy (1996: 8) adds a fourth layer, embedded in the 'organizational system that everyone takes for granted'" (Mørk et al., 2010, p. 579).

The researcher understood this definition as the 'decision-making power **over**, power **to access** processes, power **to influence** meaning and the power to be influenced by the 'largest', e.g. the **organisational system.**'

In summary, a community of practice is built up from a group of people (community) that work collaboratively in a domain of interest. They create and share knowledge based upon created tools and repertoire (practices). Those people engage through interacting together and create the image of the community, themselves and the world around them by using their imagination. To share and implement the knowledge effectively, there has to be a form of alignment over boundaries, the grey area between two different communities and decision making power in form of the creation of meaning, access to processes and power to influence meaning. Knowing the concept of a COP, this study looks at different COPS in the light of innovation to further scope this literature study.

3.4 Types of COPs in light of innovation

There are different ways to implement KM in organisations, but COP is the suitable theory for this research, as identified in the previous section. In this section the theory of COP will be explained as an innovation strategy implementation mechanism into practice.

Empirical research supports the benefits of communities of practice regarding innovation and organisational performance (Brown and Duguid, 1991; Lave and Wenger, 1991). Initially proposed as an approach to elude all forms of managerial control, they have increasingly been viewed as "productive structures" (Josserand in Borzillo & Kaminska, 2013). Managers can play a role in steering the COPs (Thompson, 2005; Borzillo et al., 2008). *But in what way?* Figure 9 provided by Wenger, Trayer & de Laat (2011), shows how a community of practice can be used as a strategy to create value for organisations.

Figure 9 represents how a (in this case an innovation) strategy can be implemented using communities of practices, by first defining domains that require innovation, support and facilitate professionals (from different departments or even outside the organisation) to establish knowledge sharing and form a community. Once they start 'sharing knowledge for problem-solving and implanting innovation' practices (e.g. artefacts) will be created and they start to perform. The outcomes will help them to learn, share their insights (learnings) and offer stewardship to the management of what does (not) work on the working floor. In such a way, the management can provide additional attention to specific parts of the strategy, which closes the circle. This illustrates how COPs have changed from 'intentional' COPs, designed by Wenger (1991), to mechanisms that are part of innovation capabilities for organisations.

Since the modification of the intentional COP, various types of COPs have been established. Saint-Onge and Wallace

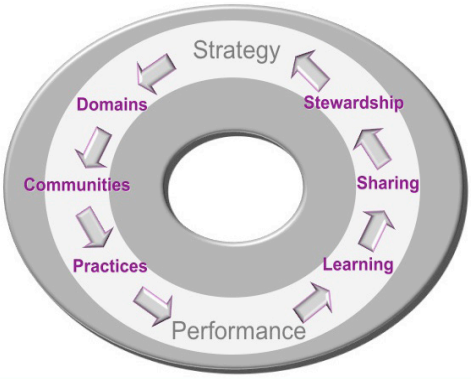


Figure 9: A schematic view of using COPs to implement strategies to create value within the organisation, retrieved from Wenger, Trayner & De Laat (2011)

(2003) divided COPs into three different categories: informal COPs supported COPs and structured COPs. Supported and structured COPs are like strategic communities, which are described above (see Figure 9). They are formally authorised and supported by the organisation itself (Jeon, Kim and Koh, 2011).

Although there are initiatives such as the CoPEH (COP ecosystem approaches in health), which was established by and for researchers and practitioners as a desire to share knowledge and experiences (McKellar et al., 2014), most COPs were initiated and structured by the organisation itself. Because more and more COPs were initiated by organisations, researchers adapted their focus of knowledge sharing from naturally originated COPs towards the optimal use of COP for innovation and how organisations could support those COPs. Recently, researchers (Pattinson, Preece & Dawson, 2016) shifted the attention of COPs from a concern how to deal with knowledge sharing in general towards their possible advantage of COPs' innovation potential. The innovation potential, in their literature review is defined as the "process of building relationship and sharing expertise in the creation of new ideas that support the development of new processes and product" (Hagedoorn and Duysters, 2002).

The four pathways in which COP enable and constrain innovative capabilities are distilled as;

- 'Enablers of learning for innovation'. Those enablers are venues for practice-based learning that facilitate knowledge sharing and in turn serves as a catalyser of innovation capabilities,
- As 'situated platform for professional occupations', which are described as hierarchical, protective communities that are closed to familiar stakeholders outside of the group (power-political inhibitors of collaboration),
- As 'dispersed collaborative environments', which are communities within and across organisations based on collaborative relationships built on reciprocity and trust. Or,
- As 'governance structures designed for purpose'. A purposely established and structured community to stimulate the use of brokers and sponsors and are easily to regulate by the organisation(s).

To conclude, the COP-approach is not only a pop-up of groups of people aiming to solve problems based on common interests. It is also increasingly used as a mechanism for organizations to enhance innovation implementation within their organizations by encouraging knowledge sharing between professionals from different departments. Yet, little is known – partly because this is

such a new perspective in literature, how managers of a COP can provide guidance to the professionals so that the knowledge sharing contributes to the innovation goals of the organization. An analysis model how to build, maintain and improve communities of practice in such a way that professionals contribute to the organisations' innovation goals would therefore be of added value in social sciences.

To develop a model, a case study on a social initiative which functions as a community of practice is conducted. The case study is used as a development platform for the conceptual model.

3.5 Conclusion

In this chapter, the container concepts 'Knowledge management', 'knowledge sharing', 'knowledge', 'communities of practice' and its link to knowledge sharing and innovation are explained including the relation between those concepts.

The shift from communities of practice as self-steering groups towards organizations' mechanisms to encourage innovation implementation, illustrates the need for an analysis model to build, maintain and improve COPs in such a way contribute to the organisations' innovation goals. Knowing these concepts and understanding the need for a model that analysis communities, the next chapter describes the case study, which facilitate the practical context for which the model has been developed.

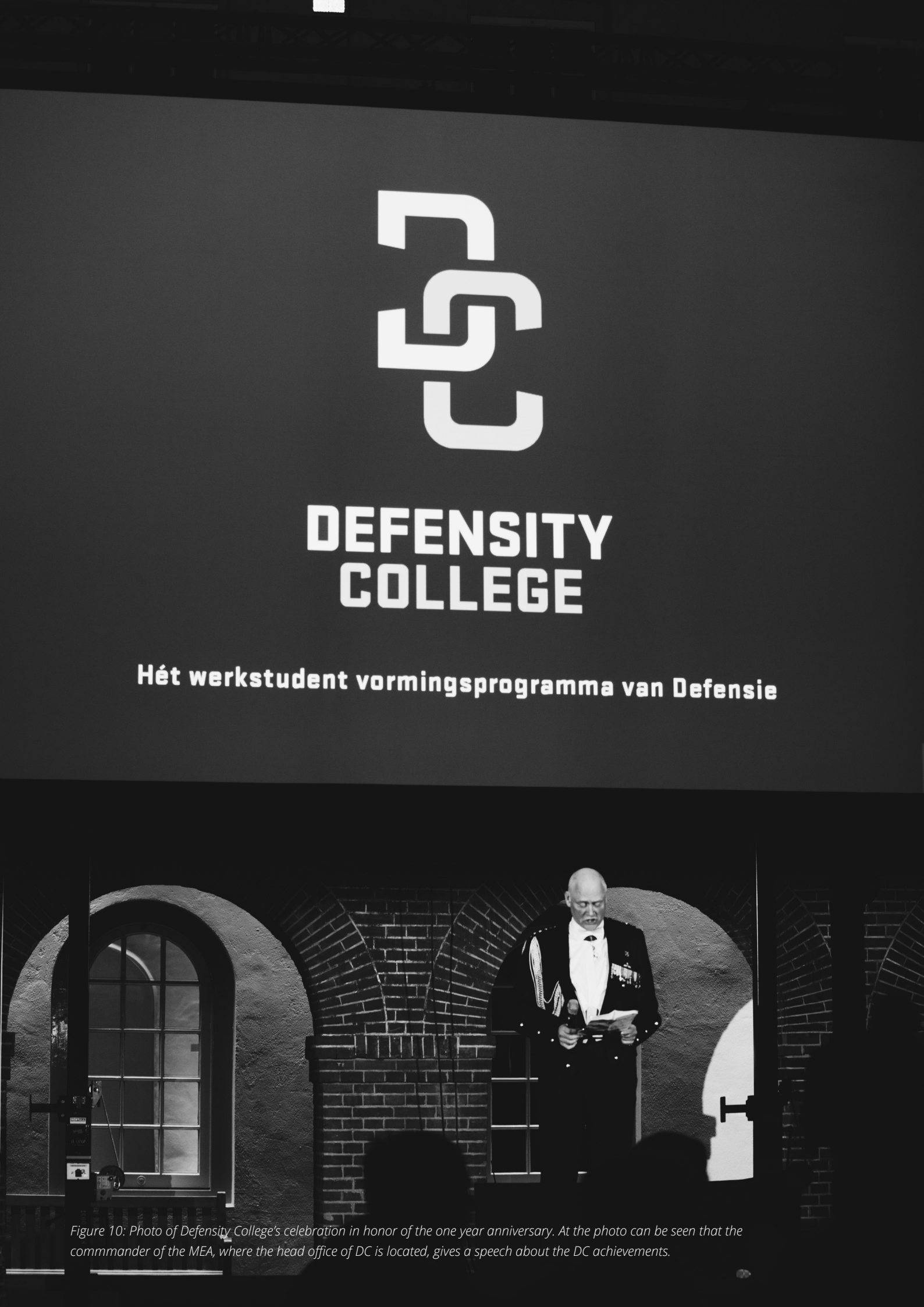


Figure 10: Photo of Defensity College's celebration in honor of the one year anniversary. At the photo can be seen that the commmander of the MEA, where the head office of DC is located, gives a speech about the DC achievements.

4

Facilitators and barriers in the case study

The design of a model that facilitates in analysing COPs and supports knowledge sharing between professionals is developed based on a case study. Therefore, this chapter describes the context of the case study (i.e., Defensity College as a bottom-up social initiative in the Ministry of Defence) as a social innovation in a large organization, during it institutionalization process.

This chapter first introduces the organisation, the Dutch Ministry of Defence (4.1), followed by the developments with regards to a hybrid and crowd warfare and the adoption of the strategy 'Adaptieve Krijgsmacht'. In the next section (4.2) Defensity College will be introduced, including the program it offers (4.3). The following section (4.4) describes the facilitators and barriers of the analysis, which is used as insight for the SQ1: Which barriers occur in the case study? The chapter finalizes with an answer to SQ1 (4.5).

4.1 Introduction to the Ministry of Defence

The Netherlands Ministry of Defence (MOD) is the Dutch defence organisation which is committed to peace and security and humanity of the Dutch citizens worldwide. In practice, that means that the Ministry of Defence is responsible for the proper functioning of the Armed Forces of our country. 'The Armed Forces serve to defend and protect the interests of the Dutch Kingdom. In addition, the Armed Forces serve to maintain and promote the international legal order' (PDC, 2017).

In addition to protection against possible external threats, employability is also available for foreign operations in the NATO, UN or EU context. Examples are the military contributions in Mali and the anti-piracy missions in the waters around Somalia.

The MOD has around 56.000 employees (NOS, 2017), of which 39.500 counts for military personnel, according to pilot interview participant A. The organisations is therefore one of the larger employers in the Netherlands. The government institution comprises one policy department (Central Staff); four executive departments (Royal Netherlands Navy, Royal Netherlands Army, Royal Netherlands Air Force and Marechaussee) called the Armed Forces and two supportive departments (Support Command and the Defence Materiel Organisation). The organisational structure can be seen Figure 11.

The MOD has similarities with any other large organisation (pilot interview participant A): the bureaucratic processes and hierarchy are not unfamiliar restricting factors (pilot interview A, B). However, the crucial difference is their core product: military personnel. Therefore, safety and security is in their core of existence.

4.1.1 New types of warfare caused the new strategy

Conflicts today are characterised by fundamental uncertainty. The hyper connected (sic) and dynamic world in which we live makes security risks more complex, more

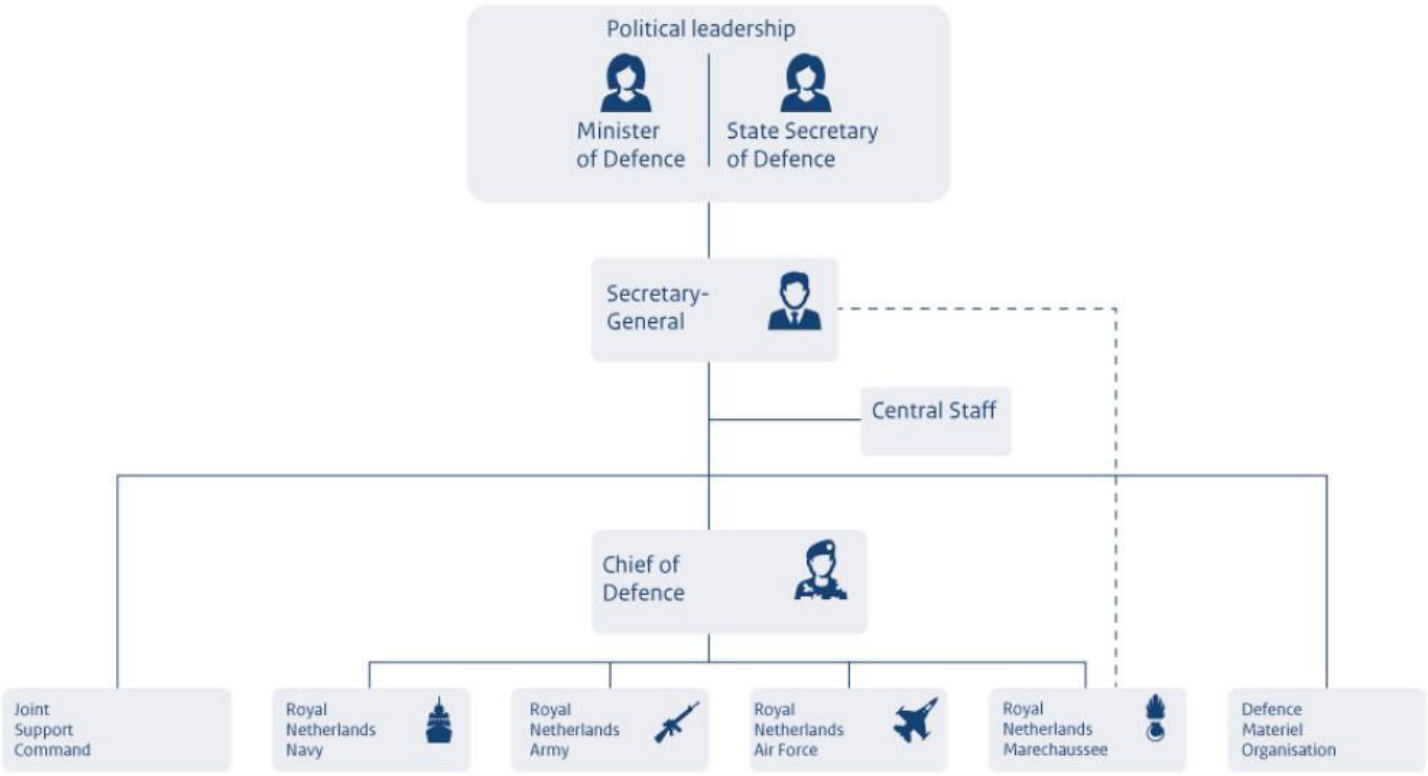


Figure 11: Organisational diagram of the Ministry of Defence

diffuse, and, therefore, very difficult to predict. Since it is impossible to foresee every eventuality, and systematically embed every required capability in the required quantity within a Defence force, adaptability is essential to continue to operate effectively (Van 't Hart et al., 2016, p. 340).

Technological developments determine the context of 'hybrid' and 'crowd' warfare which have extensive consequences on how the Defence should act accordingly and adapt its organisational strategy to keep up the pace with opponents.

- Hybrid warfare: "'Conflicts are increasingly characterized by a hybrid blend of traditional and irregular tactics, decentralized planning and executing, and non-state actors', the strategy states, 'using both simple and sophisticated technologies in innovative ways' (Conway, Roughead and Allen in Hoffman, 2007, p. 7)

- Crowd warfare: "This is a phenomenon in which networks and individuals, inspired by an idea, unite" (Dekkers, Van Dalen & Van de Boor, 2016). Primal variations are movements like Occupy, Otpor, Pegida and Anonymous. Their success varies, but these kinds of movements are a precursor to what lies ahead and can become much more powerful. There are also 'armed' examples, like the worldwide recruitment and management of jihadists, such as ISIS and Al Qaida that proven they succeeded.

According to Geveke (2016) it remains important to invest in broad knowledge base and constantly follow technological development through explorations. However, even more important is the strategy that provides a pathway for the use of the technological explorations. The MOD's strategic knowledge and innovation agenda (SKIA) for 2016-2020 is an important guideline.

4.1.2 The strategic agenda 2016 - 2020

The SKIA 2016 – 2020 consents on the general Defence policy and illustrates the need for strengthening knowledge and innovation. The agenda should stimulate a new organisational culture where knowledge is explored and used, using modern types such as open innovation in ecosystems and where innovation are clearly translated to military doctrines (Dekkers, Van Dalen & Van de Boor, 2016), "which comprises fundamental principles which Armed Forces use to direct their actions" (de Haas et al., M., 2005). Only then, can one benefit from all the possibilities offered by the technological revolution of today to prepare the Armed Forces for the future (Geveke, 2016).

The focus of the SKIA 2016-2020 focusses on open innovation in ecosystems, end user as innovator, fast innovation cycles, collaboration, knowledge management and focus on the future. The six pillars contain;

- **Open innovation in ecosystems:** Goal is to strengthen innovation as core process of the defence organisation;

- **The end user as innovator:** The goal is to improve embedding Concept, Development & Experimentation;

- **Fast innovation cycles:** The aim is to accelerate innovation within Defence and therefore creating awareness and working faster innovation cycles;
- **Collaboration:** Cooperation, nationally and internationally. The aim is to strengthen cooperation with the Ministry of Security and Justice, with strategic partner countries and, through Dutch participation in the Preparatory Action for Defence Research, at European level;
- **Knowledge management:** The aim is to strengthen the knowledge ecosystem;
- **Focus on the future:** Objective is the reinforcement of the anticipation function of Defence.

(Ministry of Defence, 2017)

Based on the policy of the Ministry, the other Defence departments need to align their organisational structure and - culture on the long term, while being able work on the job on a daily basis. A warrant; While struggling with the implementation of a new organisational structure, the MOD also need to deal with current issues such as high work pressure, unfaulty materiel and highly educated personnel as a result of the financial cuts throughout the years. Even though the tables are turning and the Dutch parliament votes in favour of investments, the remnants are still visible. The policy the MOD adopted is based on the strategic concept called the 'Adaptieve Krijgsmacht'. The strategy 'Adaptieve Krijgsmacht' is a translation of the 7S model developed by McKinsey (Waterman, Peters and Philips, 1980) applied to the Armed Forces.

4.1.3 Strategy 'Adaptieve Krijgsmacht'

According to Hennis - Plasschaert (2013), the previous Minister of Defence, "the aim of the 'Adaptieve Krijgsmacht' is for the preservation and deployment of the potential (personnel and material) operational capacity in Dutch society, which is sustainably organized, flexible, decisively and effectively integrated."

According to Dijkhoff (2017), temporary acting Minister of Defence of Rutte III, the principles of the 'Adaptieve Krijgsmacht' are:

- Timely availability of capacities takes precedence over ownership (material) or permanent employment (personnel);
- Magnification and scalability capabilities prevail over fixed capacity;
- In addition to added value in the field of safety, the initiative must also have social or economic added value for the Netherlands and thus contribute to the anchoring of the Armed Forces in society;
- The initiative aims to increase the responsiveness of the Armed Forces and with that the sustainable readiness and employability;
- The initiative is aimed at promoting the effectiveness and efficiency of the Armed Forces.

From strategy to practice

In summary, technological and social developments continue faster than ever before. Therefore the MOD had to adapt its strategy to become a knowledge-oriented network organisation where adaptivity is central, to deal with danger and network-oriented opponents.

To realize these abstract goals, the Ministry of Defence called for initiatives from the working floor (bottom up approach) to bridge the gap between the current situation and the future scenario. One of those initiatives is Defensity College. In the next section, the initiative Defensity College will be discussed and used as a case study for the tool development.

4.2 Defensity College

Defensity College (DC) is a working floor initiative that aims to reconnect Dutch academic students to the Armed Forces by providing the students with a part-time job throughout all departments of the defence organisation. The start-up proved its first year to be successful. Therefore, since one year the founders focus on the institutionalisation process within the defence organisation. The structure of Defensity College will be explained based on the depicted COPs' 'level of participation', which is presented in Figure 12. What can be seen is how all DC stakeholders are mapped into the model designed by Wenger and Trayner (2011).

- **Core group members**: The core team (and leaders) exists of the DC management team (e.g. the three founders).
- **Active members:** The group of active members are considered the students that are currently working for the MOD as 'part time employees'.
- **Occasional members:** There are two groups, the employers of the MOD and the innovation strategists of the MOD. The employers of the MOD that adopted the program by offering students an assignment to work on. They are also referred to as the 'early adopters'. They have less authority on the community at large, but are crucial in further development of the COP. The group of the innovation strategists of the MOD have more authority on strategic level, but do not have any

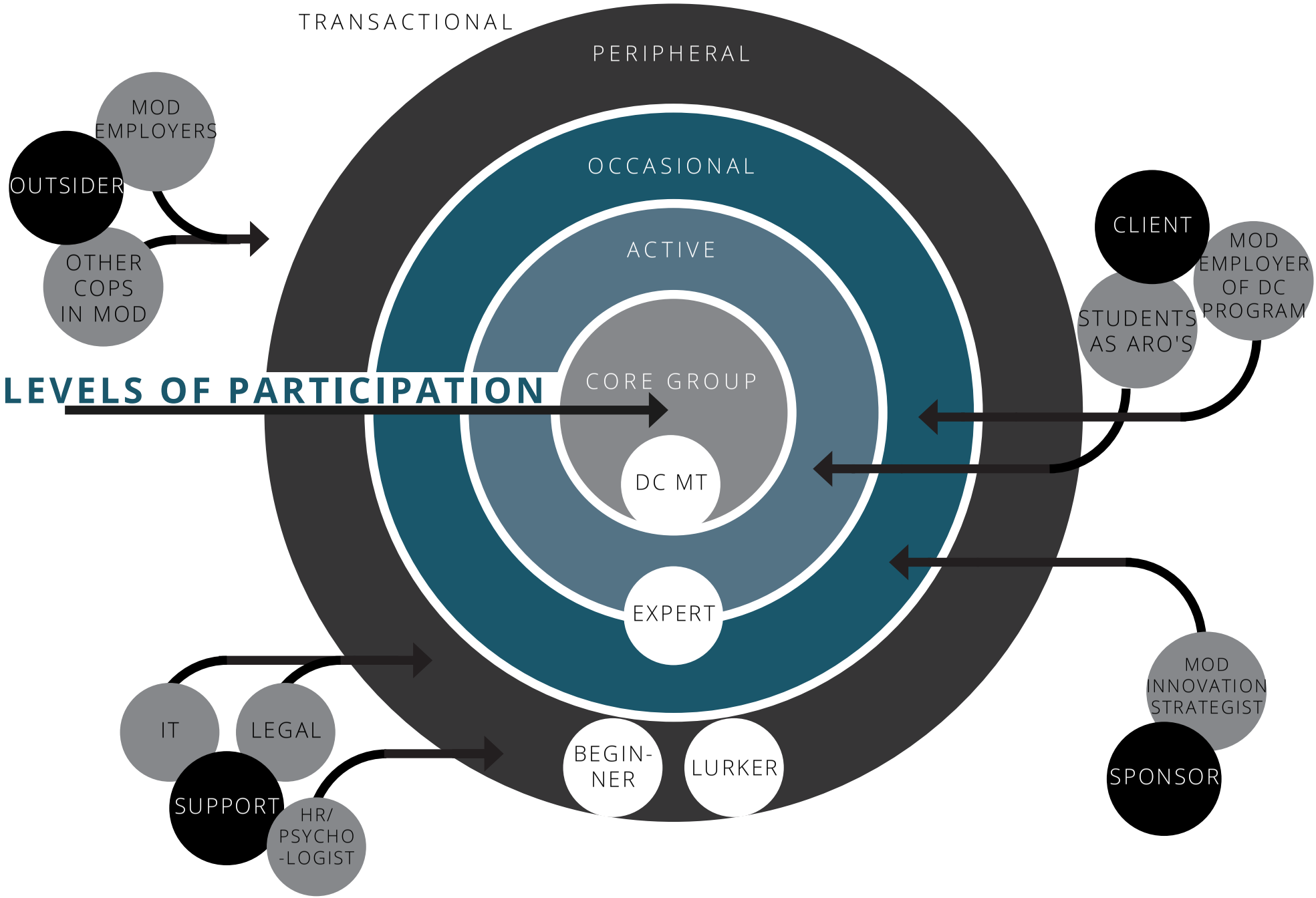


Figure 12: The schematic overiew represents DC as a COP in terms of levels of participation, based on the scheme of Wenger and Trayner (2011)

influence on tactical nor operational level. This last group however, should be considered as a sponsor who provides the organisational commitment.

- **Peripheral members:** Defensity College has members that are focussing on the IT, legal, HR and psychological parts of the program. Although they are part of the core group in terms of participation, their level of authority and their active participation elsewhere in the organisation makes them replaceable. This is considered positive given the flow of community members and thus the knowledge shared in and beyond the community (boundary spanners).
- **Transactional participants:** Other employers within the defence organisation as well as other communities of practice members / managers that might want to 'sail along' on the knowledge of Defensity College in the future.

4.2.1 DC mission

Defensity College aims' are two folded for both the MOD and the student.
The MOD gains' are divided in three elements:

- Knowledge: access to widely applicable specialist knowledge and the filling of functions that defence needs.
- Support: visibility and anchoring within student cities and higher education institutions.
- Innovation: developing and flexibility of knowledge and resources.

The students' opportunities are created by:

- Part-time job: the student gains relevant work experience within Defence (and Armed Forces) while working on average one day per week.
- Usefulness: The student is socially involved and contributes to peace and security as a reserve officer cadet (ARO).
- Development: the student develops skills such as leadership, teamwork and perseverance and can take courses at the Dutch Defence Academy (NLDA).

(Defensity College, 2017)

4.3 Defensity College's program

DC attracts academic students and employ them as reserve officer cadets (Dutch 'Aspirant Reserve Officer, ARO') within their specific field of discipline. The program of Defensity College is shown in Figure 13 on the next page. The illustration is presented in Dutch, but all steps will be explained in this paragraph. The customer journey is written from the students' perspective from the initial context with Defensity College until the student finishes his/her studies.
The program will be discussed using the depicted figure. Students from all different disciplines can apply to the program, once they passed their first year of university. Two examples of students and their jobs are given: One has a background in both aeronautical engineering and law. He works in the department DMO on the regulation of aviation systems. Another student with a bachelor in human resources also works at DMO supports management by improving the intranet for the department and organizing a big event (Top200) with a focus on integrity and inclusiveness.

From initial contact to the first day of work, five steps need to be taken:

- the selection procedure
- a safety research (in Dutch 'Verklaring Omtrent Gedrag')
- the inspection period
- a matching-meeting with the potential employer
- two weeks of general military education

To become part of the program, university students have to pass the selection procedure. A preselection is based on a letter of motivation, character, capacities and resume. Students of all fields of studies are welcome to apply. After the preselection, the students' background check is done by the MIVD. Meanwhile, the students are invited for the inspection period. The inspection includes a psychological and a medical test.

After the student has successfully passed the examination, the student will get familiar with a potential workplace. In practice, this is often an organic process. Defensity College promises a guaranteed match on both knowledge content and personal level. If there is assumed to be a match, the student will be appoint as reserve officer cadet at the Armed Forces or DMO. One of the remaining requirement is the completion of the General Military Education (Algemene Militaire Opleiding, henceforth referred to as AMO). During this two-week trajectory, the students learn the basic military skills, such as shooting, compass - and map reading and marching. Some basic skills are also taught with regard to First Aid in Accidents (First Aid) and discipline is imparted.

If the AMO is successfully completed, the students are 'ready' to start their part time job. In practice, most students already started their job before completion of the AMO as a result of bureaucratic processes (e.g. prior to the start,

various documents need to be accepted).
The students normally work one or two days a week for eight hours, depending on their employer, their own studies and spare time. Most jobs require a minimum of four months and a maximum of 1,5 years (according to Defensity College founders).

Once the students started working, they designated a mentor of DC for sharing personal and professional stories, struggles or ideas to help them to become familiar within the organisation.

Also, DC invites students for masterclasses, the yearly prom and other forms of community events. After their first job, students are required to find their own 'new' place within the organisation where they will work until they graduate or leave the organisation.

Currently, the founders are exploring opportunities such as a 'DC gap year', exchange with international students and the transfer possibilities as a professional military. These ideas are promising, but require time and effort. However, due to the bureaucratic mechanisms and lack of mandate, often these promises are made by the COP management, but are not (yet) fulfilled.

Although the process of first contact to getting students doing a part-time job is well-developed, the start-up has no grip on the collaboration between the students and the employees they collaborate with.

4.4 Enablers and barriers of the case study

In the previous section, the program designed by Defensity College and its potential future plans are discussed. This section outlines the enablers and barriers of the program in relation to the MOD and the concept 'Adaptieve Krijgsmacht'. This will be done by means of identifying all highlighted barriers and enablers of the program in relation to the Ministry of Defence's 'Adaptieve Krijgsmacht'. An overview is presented in Figure 14. The overview presented is the result of the analysis based on the conducted internal analysis, external analysis and in depth interviews.

What can be seen in Figure 14 is an overview of the relation between the MOD, the concept of the 'Adaptieve Krijgsmacht', the establishment of Defensity College and the influence of the institutionalization process. The white boxes correspond with the steps taken in the process. The

red, orange and green lines symbolize a positive, neutral (or slightly negative) or negative effect on the innovation goals of the Ministry of Defence. In the next paragraphs, the boxes are discussed on being a barrier or enabler. The numbers in the figure are only added for reading purposes. In the next paragraphs, the steps are discussed.

Explanation of steps (facilitators and barriers)

- **Step 1:** The MOD need t is considered a bureaucratic and slow organisation, according to all interviews and observations. This is not possible to ignore, neither to solve easily. The complexity of the organisation requires processes and structures to work together. However, the bureaucracy is considered a major problem, not only because it is time consuming, but more important is the answer 'computer says no, so I can't help you' that is very often used. In comparison with opponents, the MOD is lagging behind in the transition to a knowledge-oriented network organization. This results in threatening situations for Dutch security systems and the safety of citizens.
- **Step 2:** In the past two years, MOD made the news a lot for both internal problems and external threats. Over the past two years, much has been reported about the MOD' internal issues and external treats. Internal issues, such as cutbacks and reorganisations have led to, among other things, poor packing of soldiers, a lack of (military) personnel and defect materiel. Not surprisingly, current personnel complains about the high work pressure. The organisation itself stresses that it desperately needs internal stability and growth. External treats, on the other hand (and which might even be more important), are becoming more complex, dangerous and harmful to the Dutch citizens every day. Hybrid warfare has taken over other forms of war and requires new strategies for the MOD to take care of our nation. Hybrid warfare requires another structure of organisation, according to van 't Hart et al. (2016). They pledge for a networked organisation. In short, it is a structure where people work how they want to, rather than how they need to. It is an explicit or implicit partnership that is characterized by semi-stable relationships between autonomous organizations.

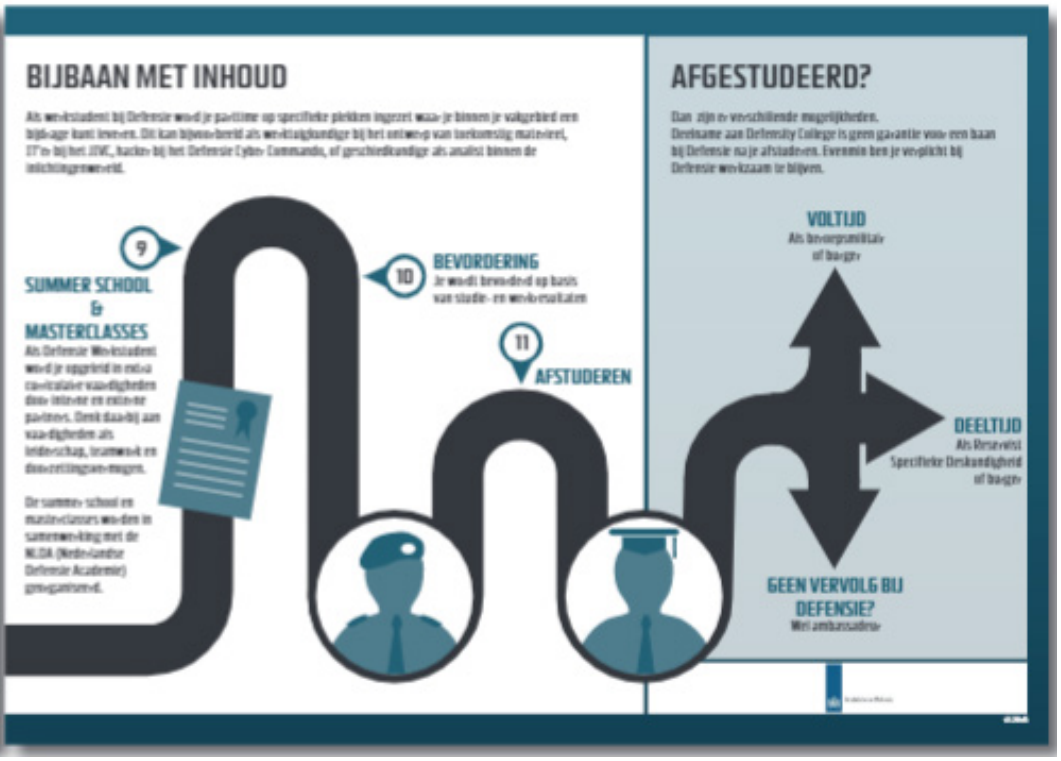


Figure 13: "The road of the students" is a visualised map of all steps taken in the process of the program Defensity College offers for new students (part time employees working at the Ministry of Defence).

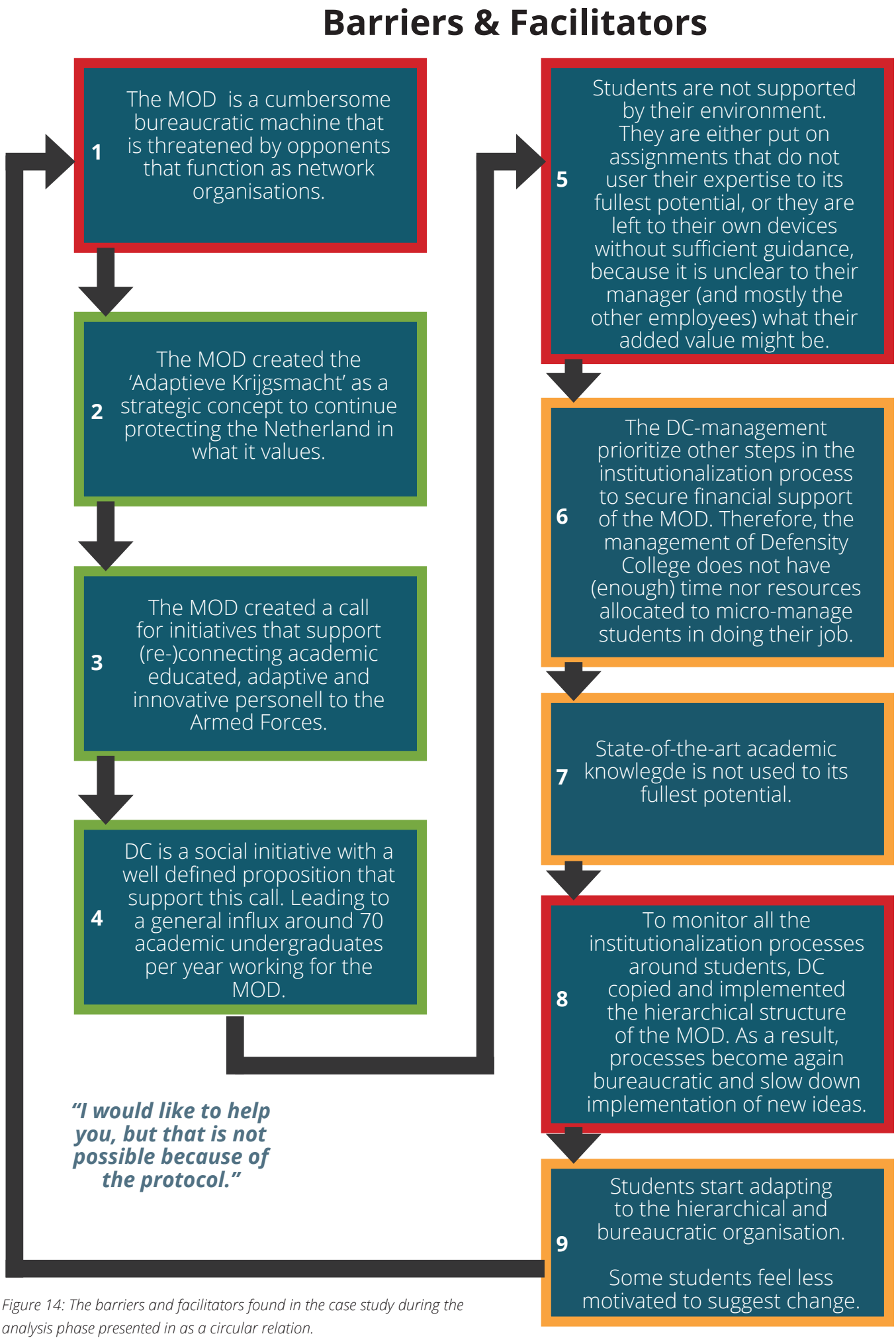


Figure 14: The barriers and facilitators found in the case study during the analysis phase presented in as a circular relation.

It is therefore, that opponents like ISIS and Anonymous, who are based on this structure, are hard to track down.
The defence organisation adopted the strategic concept 'Adaptieve Krijgsmacht' in the attempt to fight equally to those opponents and secure the safety of Dutch citizens. The 'Adaptieve Krijgsmacht' is a strategy based on connected communities that form a network to integrate a mixture of personnel, consisting of professional military employees, civilian workers, reservists, hired personnel and strategic partners.

- **Step 3:** As part of the strategy, the MOD calls for (bottom-up) initiatives to reconnect academics and companies to the Armed Forces to strengthen the network internally as well as externally.

- **Step 4:** DC as an initiative, fits in this picture. With a students' acceptance rate of 1 out of 4 and around 70 students a year, the MOD not only becomes an attractive employer, it should also gain state-of-the-art academic knowledge.

- **Step 5:** A network organisation requires cognitive authority (based on knowledge), rather than hierarchical authority. Expertise does not always relate to organizational hierarchy, but this is not how it is experienced by most staff members, especially those who are not academically educated. So, if a student, who has the status ARO becomes part of the team, they are sometimes not assessed on expertise, but on their rank. The result is that colleagues with the same rank (or a rank below officer level) do not sufficiently appreciate the student's expertise. 'Unknown makes unloved', so they say.
  As a result, students are not supported by their environment. They are either put on assignments that do not use their expertise to the fullest extent, or they are left to their own devices without sufficient guidance, because it is sometimes unclear to their manager (but mostly the other employees) what they can do.
  This is based on the interviews with DC students. During this phase, various students have been interviewed based on a sensitizing booklet. Various statements (which they wrote in their booklets) are shown as an illustration of this problem (see Table 2).
  Table 2 provides insights (in Dutch) of the answer of four participants to two different questions. Those answers show the trajectory and possible limitations of the program and suggestions for improvement for the interaction and collaboration with Defensity College as a COP.

- **Step 7:** In step six was concluded that students are not always placed as intended. Yet, the so required up-to-date knowledge is not used to its fullest potential. Many students have been 'complaining' or at least make a notification of the situation, yet there is no sustainable solution.

- **Step 8:** To keep track on the students, the DC manager copied and implemented a hierarchical structure which is coherent to the MoD's organisational structure. There is currently a group leader, also called commander with a few students under him. Again, the more students the more lines you have to communicate according to. (These students have not been working on the same places in the organisation yet.)

- **Step 9:** According to multiple interviews, students feel less motivated to do their job (they still do their work!) and adapt themselves to the current organisational culture and structure. This brings us back to the first step of this loop.

4.5 Conclusion

In this section, the answer to the first sub question **what are the barriers of the case study?** will be provided. The summary of the case study is given, which leads to the three barriers of the case study.

Over the last forty years, warfare has been changing tremendously. The terms 'crowd warfare and 'hybrid warfare' are no longer a pipe dream for the Ministry of Defence and stress the importance for a new organisational structure (a network structure) and - culture (knowledge-oriented) of the Dutch Defence organisation. The applied strategy, 'Adaptieve Krijgsmacht' strives towards the vision of a knowledge-oriented network organisation that can easily adapt and respond to the crowd and hybrid warfare. However, 'just' a strategy does not solve the problem: *Effective collaboration through knowledge sharing at strategic, tactical and operational level is required to put the 'Adaptieve Krijgsmacht' in practice.* Therefore, the MOD calls for (social) initiatives that practically support the pathway towards this vision. One of those initiatives is Defensity College, a bottom-up social initiative to bring in state-of-the-art scientific knowledge for the Defence by reconnecting academic students to the Armed Forces.

Defensity College (DC)'s program has been proven its first year to be a successful practical implementation of the 'Adaptieve Krijgsmacht'. Now, DC's managers forecasts to hire around 70 students annually.

The student is deemed to use his/her creative academic ability in departments of the MOD to realize innovation in the field of expertise. However, from conducted sensitizing booklets and interviews with students, it can be stated that various students complained about their assignments, mostly because of;

- Students often have to wait a long time because of hierarchical decisions;
- The assignment is not clearly formulated, or it is not clear what the student can or may do; or what the student can contribute;
- The bureaucracy within the Defence organisation slows down processes considerably, so that in practice it happens that a student has to wait until 10 months (!) for clearance levels (to be assigned and able to work).

The identified barriers

As a result, there are **three barriers** found in the case study analysis.

- (1) The organisation Ministry of Defence is considered bureaucratic and hierarchic. In comparison with opponents, the MOD is lagging behind in the transition to a knowledge-oriented network organization. This results in threatening situations for Dutch security systems and safety of citizens. Yet, the problem is already taken care of by the policy makers at The Hague, who incorporated the 'Adaptieve Krijgsmacht' strategy in the organisation. Hence, designing a new communication strategy would be redundant.
- (2) Students are not supported by their environment. They are either put on assignments that do not user their expertise to its fullest potential, or they are left to their own devices without sufficient guidance, because it is unclear to their manager (and mostly the other employees) what their added value might be. The initiative DC is has an annual growth of 70 students per year, which leads to increasing steps in the institutionalization process to roll out the program throughout the organisational at large. Clearly, that requires different processes (e.g. hiring process of students, maintaining financial support, finding work spots) and steps to be taken by the managers. As a result, the managers do not have time nor resources allocated to micro manage the students at the work place itself.
- (3) To monitor all the institutionalization processes around students, DC copied and implemented the hierarchical structure of the MOD. As a result, processes become again bureaucratic and slow down implementation of new ideas.

To conclude, an answer to the first sub question is given in light of the theory of COP for innovation and the case study. The introduction to the theory and the insights of the case study will be combined in the next phase in form of defining the critical node. The critical node helps to define a social problem statement and a design goal.

Questions/ Assignment provided in the sensitizing booklet	Answer given by the reserve officer cadets (students)	Participant
Write down very concretely what you have been up to now. This can be done at the workplace as well as the trajectory process to it.	*"Toen ik op gesprek kwam bij deze werkplek werd mij achteraf gezegd: doe maar gewoon, want dan ben je maar binnen. Dus totaal niet of dit een opdracht was waar ik enthousiast van werd. Ik moet daarom ook eerlijk zeggen dat mijn werkplek tot nu toe weinig tot niet aansluit bij mijn interesses. Het is allemaal heel technisch en erg gericht op [hidden for privacy purposes], waar ik geen affiniteit mee heb. Gelukkig komen er projecten langs waar ik kan aanhaken, maar dat ligt geheel aan mezelf. Los daarvan is de opdracht [hidden for privacy purposes] ook niet echt een intelligente opdracht."*	*Participant C*
	"Geen concrete opdracht en (onvoldoende) begeleiding"	*Participant D*
	"Geen duidelijke begeleider, dit is nog steeds niet opgepakt. Ik vind dit vervelend omdat, ik geen duidelijk aanspreek punt heb. Dit had voorkomen kunnen worden door beter af te stemmen met DCHQ en werkplek. Ik ben op deze plek gekomen via op [hidden for privacy purposes], maar heb geen duidelijke taken dan wel werkzaamheden die bij mij passen."	*Participant E*
	"I) In eerste instantie had ik een [hidden for privacy purposes] screening nodig om aan de slag te gaan. Dit heeft lang geduurd voordat ik mijn [hidden for privacy purposes] screening had. Helaas verviel mijn werkplek bij het [hidden for privacy purposes] op het moment dat ik een [hidden for privacy purposes] screening had dus die heb ik nu wel binnen maar niet per se meer nodig. II) Het heeft bijzonder lang geduurd voordat de [hidden for privacy purposes] mij losliet en toestemming gaf voor een [hidden for privacy purposes] bij DC. In principe had ik alle keuringen + amo al gedaan en heeft het bijna 10 maanden geduurd tussen aanmelding DC en dat ik uiteindelijk op mijn werkplek zat. III) Het heeft 3 weken geduurd voordat ik mijn accounts had voor alle software die ik nodig heb. Ik moest namelijk beheerrechten van [hidden for privacy purposes]krijgen. Toegang tot het pand moest mij ook verstrekt worden maar dat is logisch dat het allemaal wat langer duurt."	*Participant F*
What could be better about the interaction and / or collaboration with Defensity College and your employer in the workplace?	*"Een evaluatie na een x aantal weken met je mentor inplannen hoe het gaat en hoe beide kanten het ervaren (wellicht dan wel losse gesprekken)."*	*Participant C*
	"Duidelijker beeld wat er allemaal mogelijk is, meer aangeven van mogelijkheden tot ontwikkeling en opleiding(en). Volgende werkplekken aanbieden of onder de aandacht brengen."	*Participant D*
	"Vooraf bezoek DC aan werkplek, voordat een student begint. Bezoek student aan werkplek, om kennis te maken. Bezoek met DC aan werkplek samen met student om concrete afspraken te maken. "	*Participant E*
	"In principe denk ik dat de samenwerking nu goed gaat. Het enige wat ik lastig vind is dat ik momenteel 3 managers heb. Vanuit [hidden for privacy purposes], Defensity College en me werkplek. Ik vind het vreemd dat er vanuit de [hidden for privacy purposes] nog iemand is opgestaan. Ik zie verder niet echt inhoudelijk wat DC kan bijdragen op mijn werkplek. Het is momenteel mijn taak om daar vooral heel veel te leren dat ik snel een aanwi[n]st kan zijn voor het team."	*Participant F*

Table 2: Questions of the sensitizing booklet answered by different students currently employed as reserve officer cadets

Define

Literature study and Model development

In the discover phase, the case study was explored as an approach to see how the theory of COPs for innovation can contribute to solving the critical point of the loop Defensity College prohibits from moving forward in the institutionalization process.

In the define phase, the critical node of the case study will be explained, followed by the social problem statement and the design goal. Henceforth will be discussed what types of COPs for innovation can be applied to Defensity College. These insights serve as input to start answering the second sub question: **Which factors influence knowledge sharing in and between communities of practice on micro level?** The answer determines on what grounds a model should be established so it supports the collaboration between professionals in and between COPs in favour of knowledge sharing. The answer is based on a literature study into factors that influence interprofessional collaboration. The goal was to define the factors and relate them to the COP-approach in a model to facilitate COP managers. Once the model is established the tool will be developed in the develop phase.

Chapter 5: Factors influencing Interprofessional Collaboration.
Chapter 6: Model development.

5

Factors influencing Inter-professional Collaboration

Chapter five scopes the research by describing the critical node of the analysis (5.1), the type of COP for innovation applied to the case of Defensity College (5.2), the social problem statement and design challenge (5.3) and the design goal for the model (5.4). Then, the literature study provides a theoretical background for the solution (5.5) to the second sub question. Next, the answer to the question will be provided (5.6).

5.1 Critical node of the analysis

In the previous phase, the barriers and enablers of the case study are discussed. In this paragraph will be discussed why **step 5** is considered the critical node. The critical node is the step in the analysis that maintains the vicious circle and prevents development of DC's program on the long term. The critical node is part of the network analysis. The network analysis is a technique used in social sciences for behavioural change programmes "to identify those that most optimally span the network" (Borgatti, 2006). The goal of the critical node is to create an intervention to break the vicious loop (see Figure 14 presented in chapter 4). From the previous phase, two barriers have been considered crucial for further development of DC in its institutionalization process.

- ***(Step 5)*** Community members (students) are not supported by their environment. They are either put on assignments that do not use their expertise to its fullest potential, or they are left to their own devices without sufficient guidance, because it is unclear to their manager (and mostly the other employees) what their sadded value might be. Students are then acting as boundary spanners, but are failing to share community knowledge in practice.
- ***(Step 8)*** Monitoring all students became too much of a challenge, so DC management copied and implemented the hierarchical structure as known in the MOD. As a result, processes become again bureaucratic and slow down implementation of new ideas.

Borgatti (2006) suggested that the most critical nodes for behaviour change programs can be identified by finding those that most optimally span the network. Therefore, this research focusses on the first problem: 'Students are not supported by their environment'. This is illustrated Figure 15. From the conducted interviews with students, the participants complained about their assignments, mostly because of;

- Students often have to wait a long time because of bureaucratic decision-making processes;
- The assignment is not clearly formulated, or it is not clear what the student can or may do; or what the student can contribute;
- The bureaucracy within the Defence organisation slows down processes considerably, so that in practice it happens that a student has to wait until 10 months for clearance levels (to be assigned and able to work).

In step 5, the students interact as 'boundary spanners' (for an explanation of boundary spanners, see chapter 4) of

the DC-community. In this phase, students can open the conversation in such a way that it supports knowledge sharing with their employer. Also, other colleagues in the organisation can benefit from the students capabilities. If they are guided/supported well in their collaboration with their employers and their colleagues, their potential of boundary spanners can be used to the fullest. Having the critical node defined, the next step is to define how Defensity College as a COP can be perceived, as this will serve as input for the social problem statement, design challenge and design goal.

5.2 Which type of innovation COP would apply to Defensity College?

Defensity College can be viewed from many COP perspectives, but for the scope of this research, Defensity College is perceived as a COP designed as dispersed collaborative configuration and as a COP designed as governance structure for innovation implementation purposes for the organisation.

5.2.1 COPs designed as dispersed collaborative configurations

The assumption that Defensity College can be viewed as a COP designed as a 'dispersed collaborative configuration' derives from the establishment of Defensity College. The case study (see chapter 4) reveals that Defensity College is established bottom-up and aims to put state-of-the-art knowledge in via the boundary spanners (the students) into practice. Dispersed collaborative configurations are in particular of use for organisations that want to encourage individuals to act as brokers and boundary spanners. "External knowledge and expertise can be drawn into the organisation for the purpose of enhancing its absorptive capacity" (Pattinson et al., 2016, p. 13). According to Bertels, Kleinschmidt and Koen (2011) "Communities of Practice help business units with proficient dispersed collaboration to perform better in the front end of innovation", when

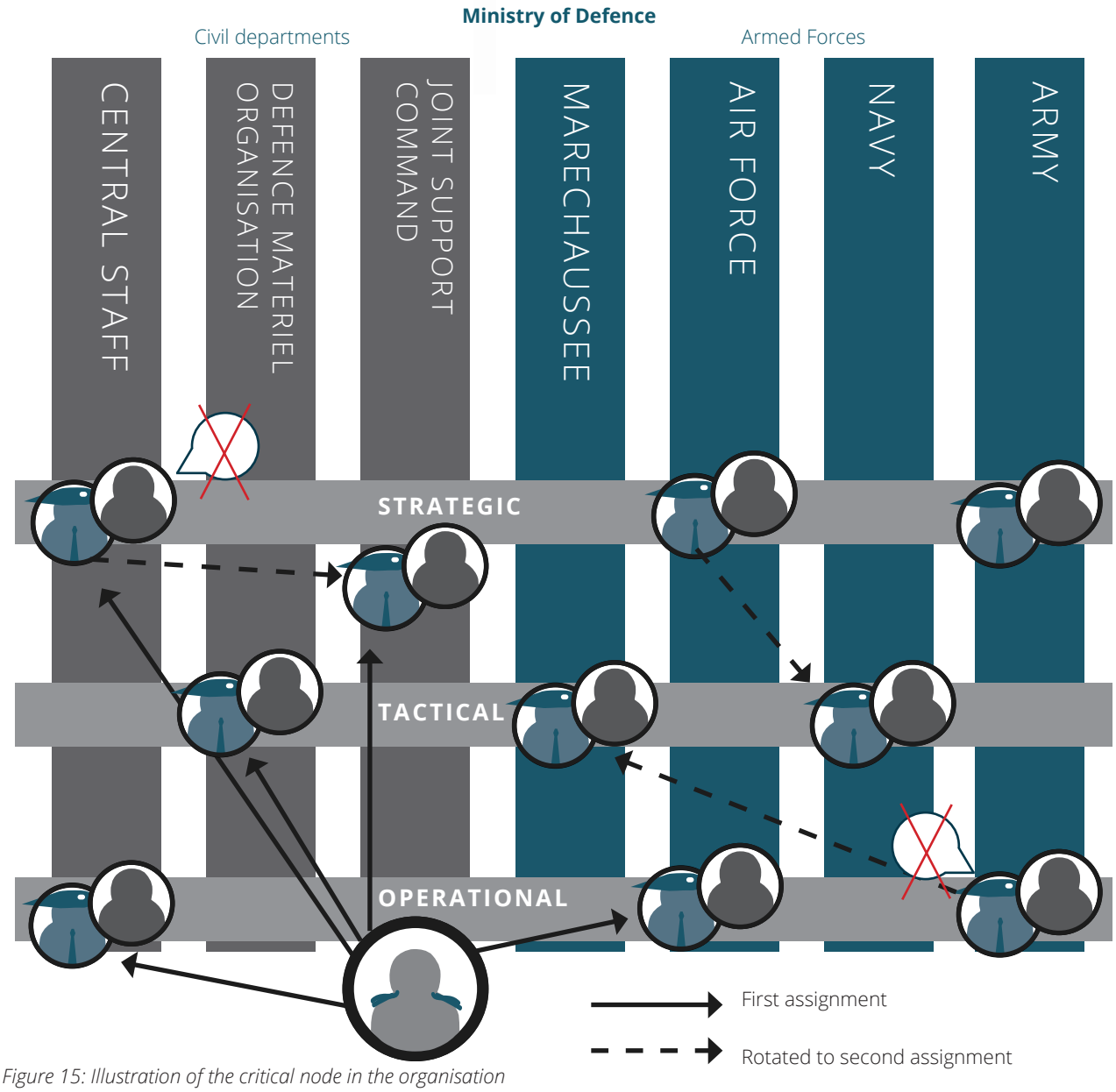


Figure 15: Illustration of the critical node in the organisation

Social Problem Statement

"COP members are not supported by their environment

How is the problem created?

(their supervisor and direct colleagues) to share (critical)

information during interprofessional collaborations.

Where is it a problem?

As a result, Knowledge Sharing as part of innovation

implementation is inhibited at operational level (work

When is it a problem?

floor), which makes

COPs designed for innovation purposes useless.

What is the problem?

This directly results in implementation stagnation

of the strategic concept 'the Adaptieve Krijgsmacht'

Why is there a problem?

which is a required mean for the Ministry Of Defence (at

Who has the problem?

large) to continue protecting the Dutch citizens."

Figure 16: Social Problem Statement

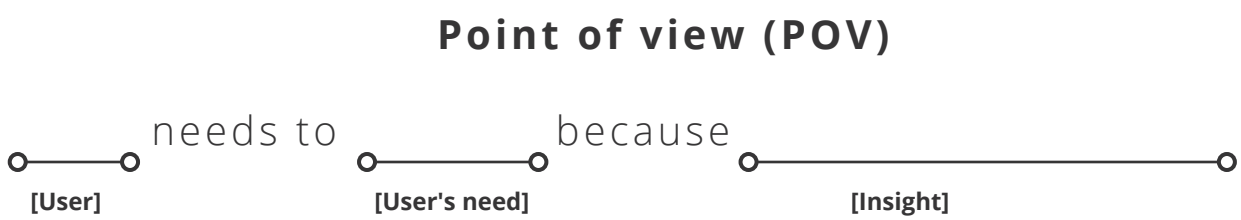


Figure 17: Point of view method retrieved from Plattner (2015)

COPs are supported in the organisation. The, in literature described use of COPs, is observed and proved its potential in the case study and by the previous minister of defence, Hennis-Plasscheart (2017). This indicates that the initiative works as a collaborative configuration, taken the 'bottom up' side of the Defensity College.

5.2.2 COPs designed as governance structures designed for a purpose

The other perspective taken is seeing Defensity College as a COP designed as a 'governance structure designed for a purpose'. The reason is that DC is one of the solutions requested by the MOD. The organisation called for social initiatives that contribute to the 'Adaptieve Krijgsmacht'. An initiative, in form of a COP, is then insinuated for a purpose and functions as a governance structure for innovation implementation, e.g. top-down approach.
According to Pattinson et al. (2016) such COPs can be "developed and fashioned through purposefully designed governance structures which draw upon appropriate forms of infrastructural support (such as tailored reward structures and the use of brokers, sponsors and innovation champion) to stimulate collaborative activities and open up previously constrained approaches to improve innovative capabilities."

Although the MOD requested initiatives such as DC, there is a lack of sponsoring in human capital. The collaborations in which both professionals have experienced the collaboration as positive, are based on a student-mentor who is an innovator champion (in the Defence called lean/ innovation managers) or have fulfilled multiple broker-positions (e.g. a military who did a master education on top of his/her military education).

Yet, there are collaborations (see sensitizing booklets and quotes, chapter 3) in which one of the professionals experienced the cooperation as non-positive (neutral or negative). The employees that are currently mentors are 'early-adopters' of the programme and therefore are in favour of the concept. *The question arises, can we influence those collaborations between an employee and employer and if so, what are factors that influence the interprofessional collaboration?*

In summary, this research focusses on COPs that function as dispersed collaborative configurations (such as Defensity College, driven by its founders) and purposely designed governance structures for innovation implementation (driven by the management department for MOD's human capital strategies for social innovation implementation). Within those communities, defining factors that influence the collaboration between two professionals (one having a subordinate position of power) might answer the question how we can influence the interprofessional collaboration. However, answering the 'how' of this question becomes a design challenge. Therefore, in the next section, the social problem statement and the design challenge are formulated.

5.3 Social problem statement & design challenge

The social statement (Levy and Ellis, 2006) is based on all previous insights combined and comprises the following questions: Why is it a problem? What is the problem? Who has the problem? Where is it a problem? When is it a problem? How is the problem created?

The social problem statement, presented in Figure 16, is based on continuing to guarantee the safety and security of the Netherlands in this new complex world against networked knowledge-oriented opponents. The strategic concept the Ministry of Defence has devised to encounter this mission, is 'the Adaptieve Krijgsmacht'. Effective collaboration through knowledge sharing at strategic, tactical and operational level is therefore required. This development has led to the design challenge based on Plattner (2015)'s model, which can be seen in Figure 17.

The Point of View (POV) method is used to create the design challenge for this research. The design challenge can be seen as the problem for which should be designed. The structure is used in this thesis accordingly and led to the following design challenge;

Design Challenge
The Ministry of Defence needs to create adaptive professionals and effective innovation and knowledge sharing groups (COPs) because that integrates the concept of the 'Adaptieve Krijgsmacht' at strategic, tactical and operational level.

Having the design challenge defined, the design goal is a presented Figure 18 to guide the design of the model towards solving the given design challenge. The design goal can be seen on the next page.

Design Goal

Design a **model that facilitates COP managers** in organisations **in knowledge sharing in and between COPs** on operational level and micro level**,** where a **visible hierarchical organisational structure** is present. by identifying factors that influence interprofessional collaboration and **stimulates discussion about factors in the COP that require attention.**

Figure 18: Design Goal formulated for the model development

Having defined the design goal, the following sections will dive into the theoretical background required for the design in chapter 6.

The next section will therefore discuss the factors that are often mentioned in interprofessional collaborations found in literature and experienced in the case study.

5. 5 Literature study

The design goal required theoretical background in factors that influence interprofessional collaboration. Therefore, a literature study was conducted to answer the second sub question: Which factors influence knowledge sharing in and between communities of practice on micro level?

This literature study aims to identify factors that have an influence on the collaboration between professionals having an employer-employee relationship (power inequality based on hierarchy). Those factors form a list that will be used as design criteria during the define phase. Also, the insights are used to understand van der Sanden (2016)'s initial draft called the 'Circle of Collaboration' and to propose a model that meets the design goal.

5.5.1 Literature method

Taken this perspective, the aim of this literature study is to find factors that influence the collaboration with other professionals. The collaboration of those professionals is based on an employer-employee relationship, in which the 'boundary spanners' have a subordinate position of power (e.g. lower rank or position of authority). A theory that is widely accepted for this specific context is 'Interprofessional Collaboration'.

For the sake of general understanding, interprofessional collaboration (hereafter referred to as 'IPC') could be defined as "an interpersonal process characterized by healthcare professionals from multiple disciplines with shared objective, decision making, responsibility, and power working together to solve patient care problems; the process is best attained through an interprofessional education that promotes an atmosphere of mutual trust and respect, effective and open communication, and awareness and acceptance of the roles, skills and responsibility of the participating disciplines" (Pedri 2010 in Chung et al. 2012).

5.5.1.1 Arguments of using the interprofessional collaboration theory

The interprofessional collaboration theory (hereafter referred to as IPC) is extensively researched in literature, mainly in the health (care) sector. Factors that are found in this literature can be adopted as there are many similarities between the health care sector and the defence sector. The similarities are formulated as;

- Employees in both sectors have a strong social responsibility and carry a lot of personal responsibility due to their profession (surgeons, doctors, nurses and soldiers, generals, special forces, but also phycologists since they decide whether or not someone is suitable for deployment);
- The focus is the same for both sectors, e.g. both are humanitarian and the result is paramount;
- Innovation is desperately needed, but there is little

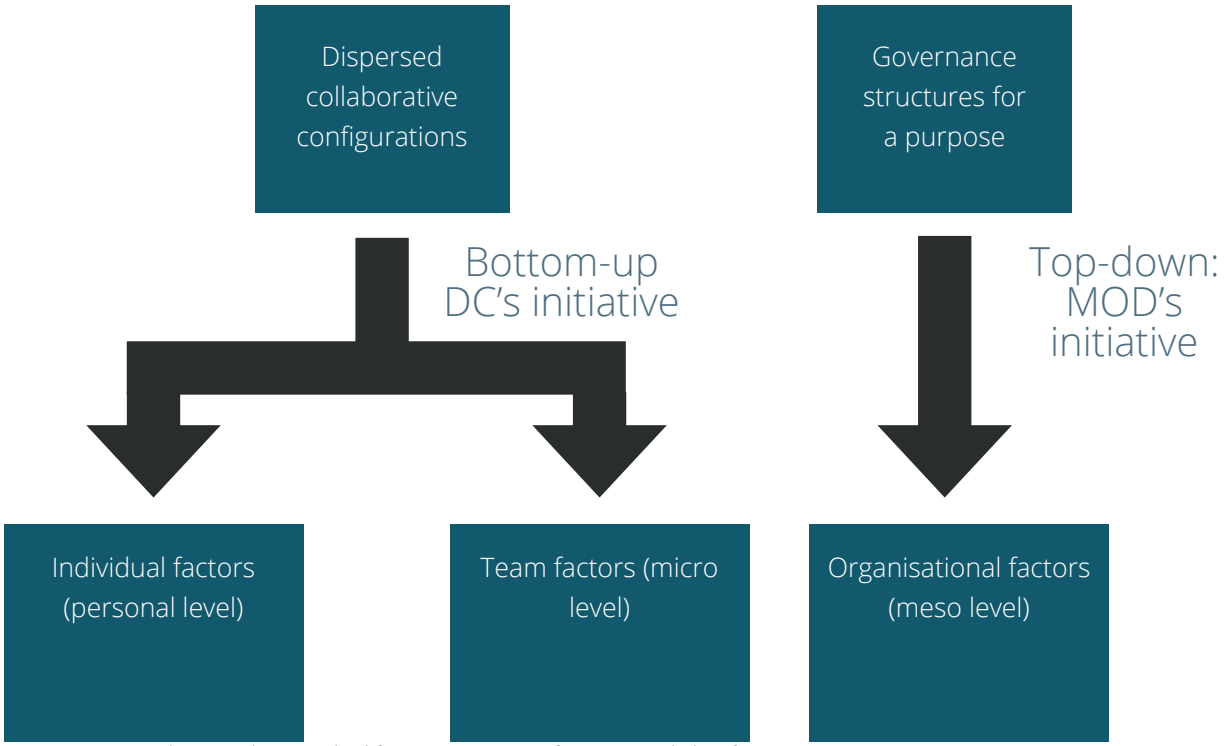


Figure 19: Factors that are distinguished for Communities of Practice in light of innovation.

room for this due to the high degree of and strict safety regulations and data confidentiality;

- Large organisations in both sectors require a form of a hierarchical organisational structure and currently have to adapt their culture and structure towards knowledge-driven a networked organisation;

- However, the hierarchical organizational structure is necessary in emergency situations (First aid or military operations against terrorists).

Therefore the IPC-theory is considered applicable to this literature study. In this explorative research, a first attempt to create a link between the individual and micro factors are to COPs that are designed as dispersed collaborative configurations (bottom-up) and the meso factors to COPs that designed as governance structures designed for a purpose (top-down). The structure is shown in Figure 19.

Figure 19 presents how the relationship between factors and COPs' innovation types are linked in this thesis. This figure is used as a guideline for the literature study.

5.5.1.2 Literature search method

Literature about interprofessional collaboration (IPC) is extensively researched in the health sector domain. However, as this does not fit in the scope of this research, this literature study was limited to two search terms, which resulted in five articles. The search terms for this literature study were:

- TITLE: ("Interprofessional collaboration" OR "cooperative behaviour" OR "interprofessional relations") AND TOPIC: (enabler* OR facilitat* OR barrier* OR factor*), in Web of Knowledge Core Collection, timespan: 2010 – 2018, only reviews. Amount of hits: 9.
  After reading title and abstracts, exclusion was based on: I) no focus on factors that influence IPC on micro level, II) no focus on the professionals, but on the patients (or animal species), III) articles that have a subordinate focus on IPC factors or strategy development , but focus on (for instance) technology in relation to IPC. After full reading, amount of hits: 3.

- TITLE: ("Interprofessional collaboration" OR "cooperative behaviour" OR "interprofessional relations") AND TOPIC: (power OR hierarchy), in Web of Knowledge Core Collection, timespan: 2010 – 2018, only reviews. Amount of hits: 4
  After reading title and abstracts, exclusion was based on the same requirements as written above. After full reading, amount of hits: 1.

- The researcher added 1 article by Jeon, Kim and Koh (2011). Total articles included: 5

5.5.1.3 Arguments in favour of used articles

For the development of this model, the following articles contribute to the model development as;

Articles related to factors in interprofessional collaboration:

- *Interprofessional collaboration in primary health care: a review of facilitators and barriers perceived by involved actors* provides an overview what is known about the facilitating and limiting factors on the topic of interprofessional collaboration which accounts for various actors.

- *'Gearing Up' to improve interprofessional collaboration in primary care: a systematic review and conceptual framework* discusses the relationship between macro, meso, micro and individual level and provide a conceptual model that lists IPC factors accounting for one or more level.

- *An integrative review of the factors influencing new graduate nurse engagement in interprofessional collaboration* revealed in the analysis several barriers and facilitators to new graduate engagement in interprofessional collaboration. This is considered relevant as nurses are at the bottom of the hierarchy and are freshmen in the organisations. This shows similarities with the students (COP members)'s position and state.

Article related to power:

- *Organizational Determinants of Interprofessional Collaboration in Integrative Health Care: Systematic Review of Qualitative Studies* identifies organizational strategies that facilitate the process of interprofessional collaboration between professionals in the same COP.

Article related to knowledge sharing in COPs:

- *An integrative model for knowledge sharing in communities of practice* is "one of the earliest formal field studies on COPs, and is designed to foster an understanding of the most critical aspect of COP activities: knowledge sharing" (Jeon , Kim and Koh, 2011, p. 264) and focusses on the socio-psychological factors of COP members.

5.5.2 Factors that influence interprofessional collaboration

The factors arise from the articles of the literature search discussed in paragraph 5.1. The 25 factors found are listed in Table 3. The table (Table 3) discusses the perspective,

#	Perspective	Theory	Factor	Interpretation of factor
1	*Team*	*Social learning*	*Reciprocity*	*Reciprocity is a highly valued concept in favour of COPs (e.g. Jeon, Kim and Koh, 2011; Pattinson et al, 2016) and is based on a perceived feeling of trust in relationships between individuals. Reciprocity is here defined as "a social morality of duty", hence the feeling of responsibility.*
2	*Individual, Team*	*Communities of Practice (COP)*	*Expertise*	*The knowledge and expertise that individuals bring along and share during their interaction with other, is the base of every COPs' existence. "Expertise can be drawn into organizations for the purpose of enhancing their absorptive capacity" (Pattinson et al. 2016, p. 518) and supports the development of COPs as dispersed collaborative configurations.*
3	*Team*	*Interprofessional collaboration (IPC)*	*Cognitive authority*	*Hierarchy is a functional form of power, which is only a limiting factor when it is perceived by individuals (Supper et al. 2014). The researcher argues that perceived authority of a person is of importance. In particular "when new procedures differ markedly from the traditional practices, and would possibly challenge the established masters' authority" (Mørk, 2010, p. 582)*
4	*Organisation, Team*	*COP*	*Practice*	*The 'practice'-orientation deals with the sharing of knowledge retrieved from local practices and are translated into experience-based knowledge, as experiential knowledge is an enabler for knowledge sharing between teams (Chandler, 2012).*
5	*Team*	*IPC*	*Recognition*	*Supper et al. (2014) identifies a need for the recognition of the role of a professional in teams. If professionals lack definition of what another is doing, is not aware of the duties of role, there is might be increased conflicts of interest a result of misunderstanding. Therefore, recognition of one's profession is important to align one's ideas to others.*
6	*Individual*	*IPC*	*Self - consciousness of repertoire*	*Much repertoire is created for alignment purposes. Yet, mechanisms of production do not automatically contribute to knowledge perceived by the receiver as 'useful' or 'relevant'. Therefore, a form of professional reflexivity is a valuable concept for the COP to be self-conscious of the repertoire produced. It helps to create and validate the quality of the produced repertoire. Doing so, it contributes to effective knowledge sharing.*
7	*Organisational*	*COP & IPC*	*Coordination*	*The importance of coordination of knowledge between local practices is indicated by Wenger (2002), but also refers to concept of centrality (D'Amour 2008 in Chung et al., 2012, p.2) as it refers "to the existence of a clear and explicit direction towards collaboration between professions." 'Strategic and political' tools help to materialize the implementation of collaborative developed knowledge.*
8	*Team*	*IPC*	*Leadership*	*Leadership is an acknowledged enabler of interprofessional collaboration (e.g. Pfaff et al. 2013; Chung et al. 2012; Mulvale et al. 2016). 'Shared leadership' reduces the power differential between partners (Supper et al. 2014) in favour of knowledge sharing (meaning; opinions are heard and all members participate in decision-making) (Chung et al., 2012).*
9	*Organisational, Team*	*COP*	*Support for innovation*	*COP's designed for innovation purposes, (Pattinson et al. 2016) both top-down and bottom-up initiated require support for innovation. Support can be delivered in form of allocated time and resources (external support) and intrinsic factors of members (internal support).* *Both interprofessional learning as well as expert support is essential for implementing these innovations (Chung et al., 2012)*
10	*Organisational, Team*	*IPC*	*Connectedness*	*The level of connectedness is both on community level as well as organisational level a crucial component for the community engagement.* *Strong connectivity allows for rapid and continuous adjustments to problems arising from coordination (Chung et al., 2012). Therefore, organisations should facilitate support-programmes for COPs to facilitate belonging in a larger network (Jeon, Kim & Koh, 2011).*

Table 3: Factors (origin, perspective and interpretation) influencing interprofessional collaboration revealed in literature study

#	Perspective	Theory	Factor	Interpretation of factor
11	*Organisational*	*IPC*	*Dialogue*	*"Dialogue" deals with the information exchange between local entities. The existence of information infrastructures and the appropriate use of it allow professionals to exchange information properly and fast. (D'Amour 2008 in Chung et al. 2012).*
12	*Organisational, Individual*	*COP*	*Partnerships (retrieved from information exchange)*	*Individuals are members of multiple communities. This is what Wenger (2002) describes as a nexus of membership. To share the knowledge from one domain to the other (in another community), professional partnerships should be in place. Such partnerships take place in- and outside the organisational boundaries (e.g. start-ups, consultants, alliances) and should be promoted and mutually educated (Jeon, Kim & Koh, 2011).*
13	*Team*	*IPC*	*Transparency*	*For professionals, "it is important to know what is expected from them and what they can expect from others" (Chung et al., 2012, p. 2). Therefore, it is assumed that transparency helps to establish trustworthy and open ethical codes for the collaboration. Referring to advocacy (which encompasses a broad range of activities which influence decision-making); transparency creates openness and might help to overcome conflicts.*
14	*Individual*	*Social Learning*	*Identity*	*The community is shaped by multiple individuals who shape their personal identity and the community's identity by experiencing the world around them. (Wenger, 1991; Wenger, 2002) A person's identity influences the community and vice versa. The level of engagement therefore is closely related to the level of community engagement.*
15	*Organisational*	*COP, IPC*	*Commitment*	*Support for the COP arises from the organisations' commitment. "Lack of formal support from institutional leaders was an organizational barrier to IPC" (Pfaff et al. 2013, p. 13), in which 'formal support' refers to prescribed and recognized organisational structures.*
16	*Individual*	*Social learning*	*Participation*	*Wenger stated (2002) that engagement links to activities that create meaning, e.g. conversations, reflections and interaction. Clearly, in this social context, others are involved. The level of participation can be marginal, peripheral or fully committed.*
17	*Individual*	*Knowledge Management (KM)*	*Creativity*	*Bartol & Srivastava (2002) argue that creativity focusses on the generation of ideas, which contribute to knowledge creation. (A valuable factor for innovation (Pattinson, 2016). The discussion of creative solutions then, is relevant to the extent that those ideas are shared and adopted as valuable knowledge. If not, the innovation will not be constructed.*
18	*Team*	*COP*	*Negotiability*	*In cross-disciplinary projects, professionals are confronted with "problems that are outside the realm of their competence" (Wenger, 2000, p. 238). Negotiation is their means to grasp the competence of one another and use both competences in the project. Hence, negotiation is therefore a central aspect of practicing (Mørk et al. 2010, p. 576).*
19	*Team*	*KM, COP*	*Shared understanding*	*Knowledge sharing is effective when both participants consider the shared information useful for their own purposes. Yet, the understanding often lacks due to interpretation differences. This often occurs when knowledge that is accumulated over time, e.g. to some, it becomes 'common' knowledge within the community and is held in the minds of long-term members. This can cause barriers, in particular to new members.*

#	Perspective	Theory	Factor	Interpretation of factor
20	*Organisational, Team*	***Practice***	*Mandate*	*Found in the case analysis, is the factor mandate. This factor corresponds with the fourth layer of power (Hardy, 1996), 'the decision embedded in the organisational system that everyone takes for granted' (Mørk et al., 2010, p.579). If the community or its members do not have a form of mandate, there are no possibilities to implement the shared knowledge. In other words; getting the job done.*
21	*Individual*	***Practice***	*Adaptability*	*The factor 'adaptability' is added to the list based on the strategy pillar of the MOD. Adaptability refers to the intertwining mode of being robust and able to proactively change. Adaptation can be either passive (shaped by the environment) or dynamic (one shapes their environment). Dynamic adaptation can be viewed as innovation. Flexibility comes with passive adaptability and is a desired behavioural factor for community members (Mulvale et al, 2016).*
22	*Individual*	*Social learning*	*Learning energy*	*Learning energy is understood as the willingness to actively participate in activities which help to bridge boundaries with other COPs.* *In the sensitizing booklets some participants acknowledged their willingness to spend time and effort on intervention moment or other forms of learning activities voluntarily. As learning happens on boundaries (Wenger, 2002), the willingness to learn extends the boundary and creates room for knowledge development in the community itself.*
23	*Individual, Team*	*Social learning*	*Comprehension*	*Knowledge sharing should be adapted to the comprehension of the receiver (according to interview participant A). When receiver is expected to execute a task of which he/she cannot estimate and asses the cause and effect-relationship of the task, it can harm not only the individuals' reputation but also the community's reputation.*
24	*Organisational, Team*	*COP*	*Acknowledgement*	*Reward systems are commonly used to acknowledge one's contribution. Jeon, Kim & Koh (2011, p. 253) distinguish reward systems for informal (bottom-up) and formal COPs (top - down). Reward systems for informal COPs mostly depends on internal reward, such as 'enjoy ability' and mutual trust, whereas rewards for formal COPs are external rewards (e.g. incentives from executives).*
25	*Individual*	*IPC*	*Involvement*	*The responsibility for the community's development depends on two requirements, i.e. the members' involvement and organizational commitment. A Community shares knowledge and supports the effectiveness of the learning process only if it can benefit from the members' involvement. Individuals need to prioritize time and resources to the community (organisational constrains) and their feeling of belonging towards the community (individual constrain).*

theory, factor and the interpretation of the factor. There are two factors that were derived from literature. This will be discussed in paragraph *5.5.3 Added factors by practice.*

- **'Perspective'** refers to the level of which this factor is of influence. For example, the factor 'coordination' is linked to the organisational level of influence.
- **'Theory'** refers to theoretical foundation in which the factor was found.

- **'Factor'** refers to the enabler or barrier of collaborations in the discussed circumstances. Note: For some factors literature clarifies it connotation (negative or positive or both). However, for most factors this is not the case.
- '**Interpretation of factor'** refers to the interpretation or definitions of the factor given by the researchers are explained.

The table contains 25 factors found, of which 23 were revealed in literature. Two factors were found in practice which will be discussed in the next section.

5.5.3 Added factors found in practice

The factors 'mandate' and 'adaptability' were not explicitly mentioned in the literature, but derived from practice. The researcher considered the factors as valid for addition based on a small pilot test with a Defensity College participant.

Based on the interviews and the critical node, the factors were required for the subordinate in the professional collaboration. The factors that were found in practice where validated with a Defensity College participant. The pilot test aimed to see if the participant recognized and acknowledged the factors as present. The participant was asked the following questions:

- Do you recognize the importance of the factors?
- If answered 'yes': Can you provide examples that indicate a form of acknowledgement of the factors?

Two quotes are highlighted that provide evidence for the factors found in practice:

- *"Als student moet je het gewoon zelf regelen als je eenmaal op je plek zit, je moet gewoon een beetje assertief zijn."* – Adaptability
- *"Je hebt niet altijd de bevoegdheid, dus dan moet je naar je begeleider toe. Dat is geen probleem als hij bereikbaar is en het direct kan regelen, maar als dat niet zo is, is het enorm inefficiënt"* - Mandate / Adaptability

5.6 Conclusion

Knowing the critical node in the Defensity College program and the factors that derived from literature, the SQ2 can be answered. **Which factors influence knowledge sharing in and between communities of practice on micro level?**

There are 25 factors identified that have an influence on knowledge sharing in and between Communities of Practice. The factors are based on five articles in the field of knowledge management, interprofessional collaboration, social learning and communities of practice and practical insights from the discover phase.

All factors have an influence on micro level, meaning the collaboration between professionals. Some of the twenty five factors can be changed by the individual, some factors by the team and a few by the organization. Yet, this is an ambiguous area.

Some factors are identified as enabler or barriers. However, most are considered as 'having an influence'. Also, "these models capture many factors that have been suggested as having a relationship to collaboration, the statistical evidence for these associations is unclear" (Mulvale et al., 2016, p. 2)

The twenty five factors are: reciprocity, expertise, cognitive authority, practice, recognition, self - consciousness of repertoire, coordination, leadership, support for innovation, connectedness, dialogue, partnerships, transparency, identity, (organisational) commitment, participation, creativity, negotiability, shared understanding, mandate, adaptability, learning energy, comprehension, acknowledgement and (member) involvement.

By answering the second sub question, the model for scientific purposes can be proposed. Based on the factors, the scientific model can be created. The construction and design of the model will be discussed in chapter 6: Model development.

"Als student moet je het gewoon zelf regelen als je eenmaal op je plek zit, je moet gewoon een beetje assertief zijn." – ***Adaptability***

"Je hebt niet altijd de bevoegdheid, dus dan moet je naar je begeleider toe. Dat is geen probleem als hij bereikbaar is en het direct kan regelen, maar als dat niet zo is, is het enorm inefficiënt" - ***Mandate / Adaptability***

Participant E

Figure 20: Quotes from practice that identify the factors 'Mandate' and 'Adaptability'

Figure 21: Photo of 'Lean management' being implemented at the DMO. Employees can write ideas on a post-it and stick them on the wall so that colleagues can read it. (A form of knowledge sharing)

6

Model development

Translating the concepts of communities of practice & interprofessional collaboration into a conceptual model: 'Collaboration Analyser'.In chapter six, the model will be designed base on van der Sanden (2016)'s initial draft and the results of SQ2. Chapter six therefore comprises a discussion of the purpose of the conceptual model (6.1), the development of the framework (6.2), the concepts of the model (6.3) and the relation of the variables to the concepts (6.4). Since the variables are quite interpretable, the explanations of the variables are developed in light of Defensity College (context) (6.5). At last, the use of the model in form of a guideline is discussed (6.6). The define phase concludes with a summary of the define phase (6.7).

In the previous chapter, the factors that influence knowledge sharing in and between communities of practice on micro level (SQ2) identified. This chapter describes how a conceptual model of these concepts and factors has been designed. First, the purpose of the model will be discussed (6.1), followed by the development of the framework (6.2). In sequence, the concepts (6.3), variables (6.4) and the explanation of the variables (6.5) will be discussed. Then, the use of the model will be discussed based on a guideline (6.6).

The model is based on van der Sanden (2016)'s initial idea. The initial idea is depicted in Figure 22. The figure shows the draft model of social learning adapted for the purposes of this research at the beginning of this project. The draft, which is based on the social learning theory and the concepts of the COP theory (Wenger, 1991) was suggested as prototype of a model for the Ministry of Education to support teachers and researchers in scenario building for the social learning to collaborate more effectively. Its unfinished state provided room for thought to develop a model along with the case of Defensity College.

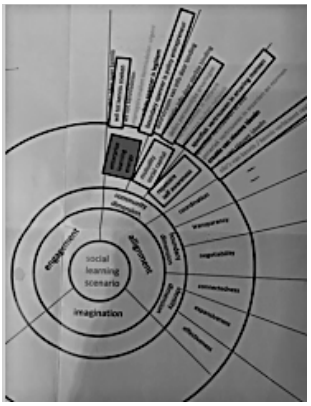


Figure 22: Initial draft 'COC' by van der Sanden (2016)

6.1 Purpose of the conceptual model

The purpose of the conceptual tool is to facilitate COP - managers in their process to establish, maintain and improve their COPs in line with the innovation strategies of the organisation.

The purpose of the conceptual model derives from the need for facilitating (guiding and supporting) social innovation implementation mechanisms. Those mechanisms, of which the COP-approach is one, are required to have executive professionals / employers to implement the innovations in the same direction along the path of the innovation strategy.

Many COPs established for innovation implementation start off pretty well, but over time fail to retain member involvement. One of the consequences, is that it results in lack of knowledge sharing between the members and other professionals that are not part of the community. There are various reasons that can lead to little effectiveness of the COP of which lack of organisational commitment is one (Pfaff et al. 2013). Not surprisingly, there are various models that support in cultivation or evaluation of COPs. Yet, little

attention is paid to the establishment COPs for innovation purposes.

Even more concrete, no models have been found that focus on the innovation strategies of organisations in relation to the establishment of COPs, although the need for innovation implementation is considered high and substantive. This means that no models (yet) facilitate COP-managers in COP development, maintenance or improvement of COPs that are designed as mechanisms to enhance innovation capabilities in organisations.

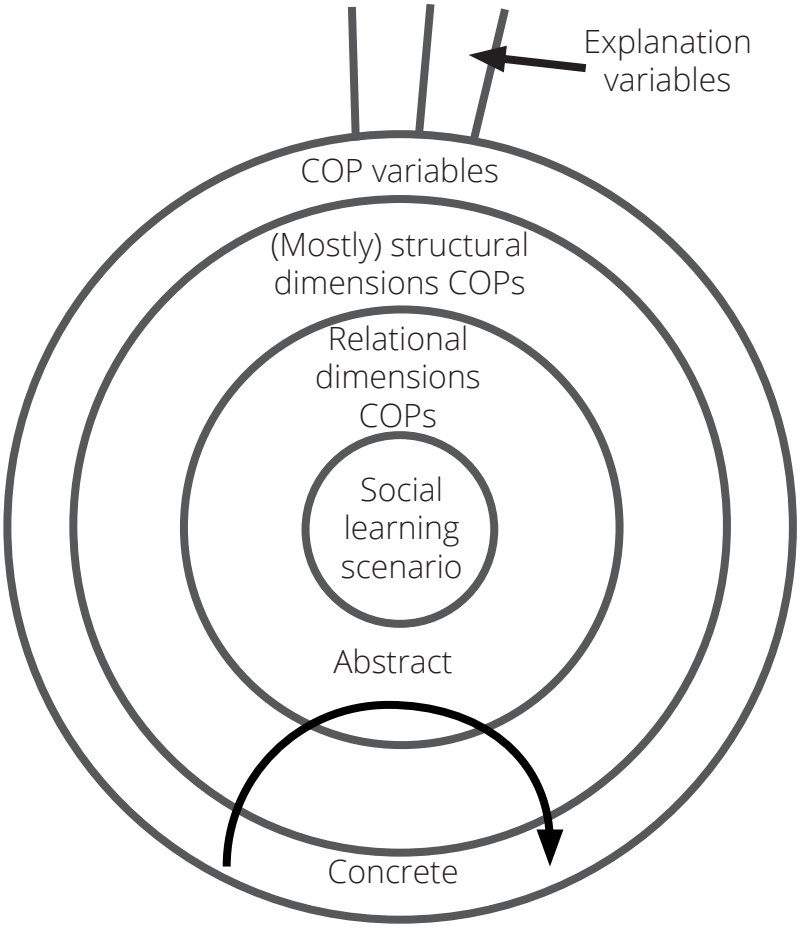
The draft has a slightly different focus, as it no longer focusses on scenario building for social learning only. Instead, it takes the building blocks of social learning (e.g. COPs) and relates that to the aim of organisations to gain competitive advantage. This corresponds with the design goal presented in Figure 18.

Thus, the aim of the ptual model is to facilitate COP-managers to establish, maintain or improve their COPs in line with the innovation strategies of the organisation. And, as a beneficial side effect, the COP-managers can in return help innovation managers identify what can't or won't be implemented on the work floor. Using the goal of the conceptual model, the framework of the model can developed.

6.2 Framework development

The draft, called 'the Circle of Collaboration' (CoC) provided by van der Sanden (2016) has been first 'stripped down' to its framework and an analysis how the framework could be useful was conducted. This resulted in a guideline that can be used to modify the model to a given situation and build a scenario. The scenario builder guideline and draft framework as proposed by van der Sanden (2016) is depicted in Figure 23.

In Figure 23 can be seen that the draft makes an attempt to relate concrete steps to an abstract level of thinking, revising thoughts and bring the revised thoughts back to concrete steps, using the scenario builder guideline. The draft is built up as follows; The basis is formed by the social learning and COP theory (1). The relational dimensions of the COP are presented to conceptualize relationships of members in the community (2). The 'mostly' structural dimensions (3) define the community relative to other communities. The word 'mostly' is added, since



Scenario Builder: How does this work?
(Retrieved from van der Sanden, 2016)
The purpose is scenario development for social learning.

- Where can / should I pay attention?
- What is manageable?
- Am I satisfied with my choice?
- What can I measure?
-

Step 1: tick the different KPIs that you find interesting.
Step 2: consider which of these KPIs you can easily measure.
Step 3: draw lines from those KPIs inside
Step 4: Which specific dimensions did you miss? And do you think that's important?
Step 5: Which fashion of belonging have you not yet completed?
Step 6: What is the scenario now?

Figure 23: Interpretation of framework and guidelines as proposed by van der Sanden (2016)

the draft proposed 'identity', but identity is considered a variable of both the structural and relational dimension. In the next ring (4), the variables identified with the concepts in ring two and three are presented. These variables are interrelated with the dimensions. The last ring (5) comprises the suggestive statements that provide support regarding what concrete steps can be taken. The statements can be answered by yes or no and suppose to work as a 'tick box'.

Although the idea seemed promising, it did not provide a one-on-one model applicable for Defensity College as it does not contains factors that working floor professionals can influence.

Nevertheless, the draft offered potential in its translation from abstract thinking to concrete steps, which is considered highly valuable for organisations. Therefore, it was used as a base for the proposed framework. The proposed framework by the researcher is presented in Figure 24.

The framework, based on the 'COC', contains 3 layers; the dimensions of a COP (1), the variables related to the COP and interprofessional collaboration with a focus on innovation (2) and the explanation of the variables (3).

The relational and structural dimensions are combined in one ring (1), as they are constantly influencing one another. To illustrate; to maintain a COP, the members have to feel related in some way and aiming for knowledge sharing. The community requires the relational dimensions. Yet, the group itself (e.g. the community) and its boundaries are required to define themselves and be able to be defined by others. Making a distinction between these dimensions on conceptual level would therefore only create confusions. And so, the dimensions are collected in the same circle.

The variables of the COP are collected from: a) the factors that influence interprofessional collaboration, retrieved from the literature study, b) the variables linked to social learning and communities of practice. In particular those for the concept boundaries, are they are left out of scope in

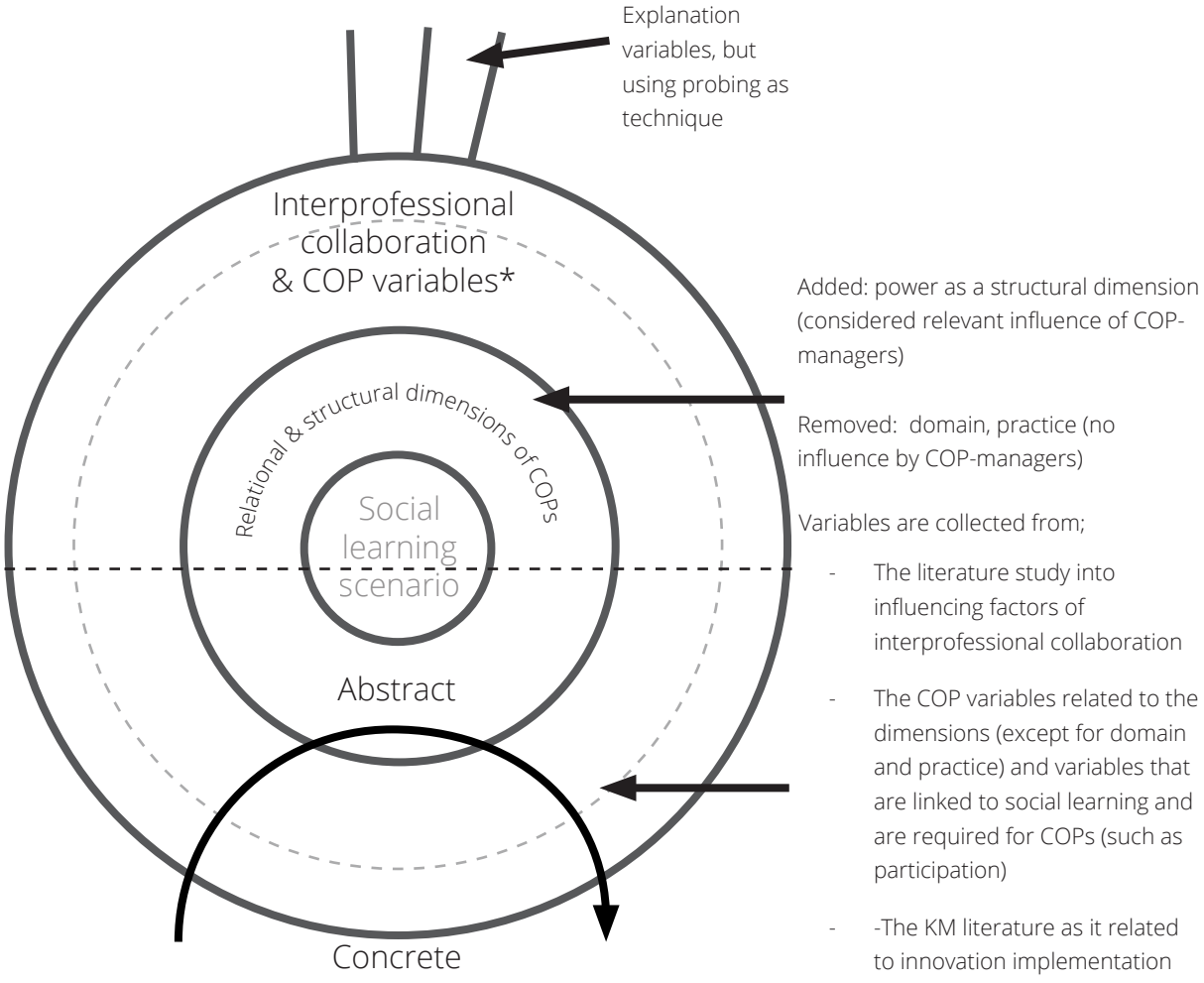


Figure 24: The (new) framework of the conceptual model

the literature study and c) the collected variables found in the introduction literature of knowledge management and innovation.

The last layer (3), contains the explanations of the variables provided using the probing technique which will be elaborated on later in this chapter. Having the framework of the model designed and the variables found in the previous section, the next paragraphs will be dedicated to explain the six chosen concepts and their relation to the variables.

6.3 Concepts of the model

There are six concepts identified that are shown in ring 1 of the model. These concepts are divided into structural and relational dimensions. In this paragraph, the concepts (community, engagement, alignment, imagination, boundary and power) are explained to understand the relationship between these concepts. The following list provides the definitions of the six concepts as a foundation for the model:

- ***Community:*** Communities are the building blocks of social learning. Being part of a community allows us to define ourselves by the constitution of competence in a given context: reliable doctor, a gifted dancer, a leading researcher. (Wenger, 2000)
- ***Boundaries:*** Boundaries are the dividing lines between the community and its environment. In contrast with organisational boundaries, COP-boundaries are fluid and often unspoken. Those arise from different histories, repertoires, ways of communicating and capabilities. (Wenger, 2000)
- ***Power:*** The first layer is decision-making power, the second layer about processes (what is restricted and extended to access to decision-making), the third layer how interests group may shape the perceptions, cognitions and preferences by managing meaning and the fourth layer that the decision is embed in the organizational system that everyone takes for granted." (Mørk et al., 2010, p. 579)
- ***Alignment:*** The process of adapting knowledge to other local activities, so it can be (re-)used. (Wenger, 2000, p. 227 - p.228)
- ***Imagination:*** The construction of ourselves, the community and the world to understand ourselves and reflect on our situations to ultimately explore future possibilities. (Wenger, 2000, p. 227 - p.228)
- ***Engagement:*** The way we engage with each other and with the world shapes our experience of who we are. We learn what we can do and how the world responds to our actions. (Wenger, 2000, p. 227 - p.228)

Having the defined the concepts, the following paragraph explains the relation between different concepts in a narrative form.

Community building

The community building starts by the required element to create knowledge sharing between professionals; the community. To prepare the community for knowledge sharing, three relational dimensions are required. A form of engagement needs to be in place to keep professionals 'on board'. Second, there has to be some form of imagination (people have to be able to draw a picture of the knowledge shared). Third, alignment; the insights have to be translatable from one daily practice to another.

Once the community is established, the knowledge can be dispersed by sharing it. A community-member interacts with another member in or outside the community. In both cases, the community-member bridges a boundary towards another person or group. Therefore, boundary is an important concept at the start of community knowledge sharing.

Yet, to actually share the knowledge, there is a need for a form of power. Over the years, power has been both a limitation as well as an enabler for COPs, e.g. it is a limiting factor when a self-steering communities does not have its own mandate, but if the organisation established the community to exchange innovative capabilities, the COP uses the organisations' power 'over' and power to 'access' to share knowledge (and get the job done).

For those who noticed, the concepts 'domain' and 'practice' are left out of the model. As described in chapter 3, the people that are bounded together share knowledge about a specific domain, using different forms of practice. The domain is the field in which the community-member collaborate to share knowledge and practice refers to the tools and the repertoire that community members created to share knowledge. The argument to put forth to leave the domain and practice out of the model is that the development process of a COP deals with the interface of the COP and does not seem not to be directly related to the content of the COP, e.g. the domain and practice. To conclude, the foundation of the model derives from the social learning and COP theory. In this section, the first ring of the model including its concepts are discussed. An overview of the concepts in the model can be found in Figure 25. In next paragraphs the variables depicted in the second ring will be explained in relation to the concepts.

6.4 Variables of the model

The variables are presented in the second ring of the model. The variables are related to the concepts based on the researchers' initial assumptions. The researcher has designed a first draft, the draft is based on the researchers' understanding of the concepts and the variables. The links between the variables and concepts were validated by scientific articles. In addition various relationships were suggest by an expert (researchers' supervisor). These relationships were validated as well.

In Table 4 (presented on the next page), the variables are linked to the concepts. The relations are substantiated with citations from the literature using 'illustrative quotes'.

Figure 25: The overview of the concepts related in the model

Remarks to the illustrative quotes

Community: All variables related to the concepts community derive from Wenger (2000, p. 230)'s vision on Communities of Practice.

Boundary: All variables related to the concepts boundary derive from Wenger (2000, p.234)'s vision on Communities of Practice.

Alignment: Wenger (2000, p. 227 – p.228)'s definition of alignment focuses on the process of adapting knowledge from one local entity to another. In order to relate the given IPC factors to alignment, the three dimensional alignment model proposed by Ocker and Mudambi (2003) is used. They studied the readiness of firms for CRM (Customer Relationship Management) and proposed an assessment model. Their model can be seen in Figure 26.

This model shows how CRM focus areas relate to alignment areas, which offers a taxonomy of factors that can be related to the factors found in this study.
The model is developed to assess the readiness of organisations for CRM, based upon the premise that business value is enhanced through the alignment of complementary factors occurring along three dimensions, intellectual, social, and technological (Ocker and Mudambi, 2003, p.1).

The dimensions are divided into intellectual, technological and social alignment. In particular, the social dimension of alignment in the context of this study is assumed to have overlap with the definition of alignment used in the context of social learning and communities of practice.

Ocker and Mudambi (2003)'s social dimension of the model contains the three factors (culture, domain knowledge and stakeholder interaction) which appear to have an overlap with the factors 'shared understanding', 'dialogue',

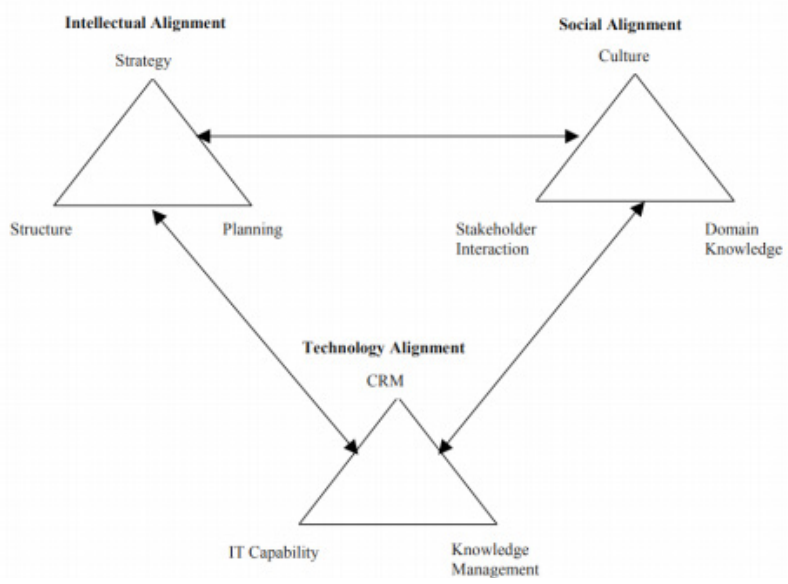


Figure 26: Three dimensional alignment model of CRM readiness factors retrieved from Ocker and Mudambi (2003)

'partnerships' and 'practice' derived from the literature study in interprofessional collaboration.

Imagination: Imagination is investigated in psychological, sociological and educational sciences (e.g. Osborn, 1953;Mills, 2000; Egan, 1992). Therefore, recently written literature is used from integrative psychological and behavioral science to support the variables chosen in relation to the concept imagination.

Concept	Variable	Illustrative quote
Power	*Leadership*	*"Power is not the same as leadership, but often is seen as a feature of it (Maccoby; McClelland; Zaleznik & Kets deVries; in Hollander & Offermann, 1990). Power in organizations has three identifiable forms, which often exist together as a result of an individual's position in a time and place, as well as his or her personal qualities. Power over, power to and power from." (p.179)*
	Expertise	*In a study that researched the role of power and expertise in professionals organisations, "managers apparently are willing to share power with staff if they have the knowledge and experience in esoteric fields* that enable them to cope with complex uncertainties" (Blau, 1979, p. 119). Besides, Blau (1979) argues that "competence in tasks outside their field of expertise gives a person control over uncertainty and thereby enhanced power, but this is only for lower-ranking staff" (p.120).* *(*Esoteric fields: Highly specialized knowledge or interests fields that are likely to be understood by only a small number of people.)*
	Cognitive authority	*"What transforms power into cognitive authority? First of all, there is the specification that change is allowed to alter ego's behavior with regard to cognitions, but not necessarily with regard to other spheres (such as ordering ego to change jobs). The cognitive authority may have authority in other spheres, but this is not necessarily the case. Second, ego must accept the rightness of alters influence; changing power is thus seen as legitimate by the less powerful party. Thus, while power (following Weber's definition) is objective and interpersonal in nature (about the actual relation in a dyad), authority is subjective and, one might say without distortion, "personal," for the transmutation of "raw" power (power that is not necessarily legitimated) into authority occurs "inside the head" of the less powerful person." (Berger and Luckmann; Berger et al; in Martin, p. 873)*
	Mandate	*Mandate: "Usually, the conferral of a power of representation is accompanied by a mandate, which obliges the representative to exercise the power of representation in certain ways. For example, besides giving his agent the power of representing him in buying musical recordings, a user may command the agent to buy a specific recording, from a retailer included in a list of agreed retailers, below a certain maximum price, and so on" (Gelati et al., 2002, p. 50).*
Community	*Learning energy*	*"Learning energy is a part of any community, as without the willingness and ability to learn, the community becomes stagnant." (Wenger, 2000, p. 230)*
	Reciprocity	*Reciprocity: Reciprocity is a requirement for mutuality and building of trust (Pattinson et al, 2016). "People must trust each other, not just personally, but also in their ability to contribute to the enterprise of the community, so they feel comfortable addressing real problems together and speaking truthfully. Through receiving and giving help, they must gain enough awareness of the richness of the community to expect that their contribution will be reciprocated in some way. " (Wenger, 2000, p.230)*
	Self-consciousness of repertoire	*Self-consciousness of repertoire: "Being reflective on its repertoire enables a community to understand its own state of development from multiple perspectives, reconsider assumptions and patterns, uncover hidden possibilities and use this self-awareness to move forward. " (Wenger, 2000, p.230)*
Boundary	*Coordination*	*"Can boundary processes and objects be interpreted in different practices in a way that enables coordinated action? For instance, an elegant design may delight designers but say little to those concerned with manufacturability. Across boundaries, effective actions and use of objects require new levels of coordination. Boundary processes and objects must accommodate the practices involved without burdening others with the details of one practice and provide enough standardisation for people to know how to deal with them locally" (Wenger, 2000, p.234).*
	Transparency	*"Coordination does not imply that boundary processes provide an understanding of the practices involved. Therefore the question should be: 'do boundary processes give access to the meanings they have in various practices?" (Wenger, 2000, p.234).*
	Negotiability	*"Boundary processes can merely reflect relations of power among practices, in which case they are likely to reinforce the boundary then bridge it. For instance, a business process reengineering plan may be very detailed about the implementation (coordination) and explicit about its intentions (transparency), but reflect or allow little negotiation between the perspectives involved" (Wenger, 2000, p.234).*

Table 4: Relationship between concepts and variables defined based on literature (presented as illustrative quotes).

Concept	Variable	Illustrative quote
Alignment	*Shared understanding*	*Ocker and Mudambi (2003)'s first factor 'culture' seems to overlap with the variable 'shared understanding' found in the literature study regarding interprofessional collaboration. Culture in the studied context, is understood as the perspective on shared values and behaviours, cooperativeness and the extent to which people cooperate on trust-based relationships. Shared understanding helps to overcome cultural differences (Higgs, 1996) and creates a new culture on itself that focusses on shared values and behaviours. Therefore, the variable shared understanding is related to the concept alignment.*
	Dialogue	*The second factor of social alignment is 'stakeholder interaction'. The level of CRM readiness is defined by "the identification and awareness of stakeholder dynamics, the inclusion of stakeholder in planning efforts and the technology savviness of stakeholders" (Ocker and Mudambi, 2003, p. 10). In any case, stakeholder interaction requires a form of dialogue in which different parties can exchange information and a form of partnership to include the stakeholder in the planning efforts. Therefore, the concept alignment also comprises the factors dialogue and partnerships.*
	Partnerships	
	Practice	*The third factor of social alignment is 'domain knowledge', which refers to enhanced depth of knowledge within business units and the breadth of knowledge across business units and its translation from one to another. As this refers directly to Chandler (2012)'s definition of 'practice', this variable is also related to the concept of alignment. In addition, other researcher found that shared domain knowledge is a long term influential antecedent to alignment (Reich and Benbasat , 2000).*
	Adaptability	*There is one more variable related to alignment, which has been derived from the model pilot test; adaptability. As Birkinshaw & Gibson (2004) define the relationship between alignment and adaptability under the umbrella of ambidexterity. They view alignment and adaptability as complementary capabilities that an organisation should master to create long term success. Alignment, according to them, is the "clear sense of how value is being create in short term and how activities should be coordinated and streamlined to deliver that value" and adaptability "the ability to move quickly towards new opportunities, to adjust to volatile markets and to avoid complacency" (Birkinshaw & Gibson, 2004, p. 47).* *In other words, the level of adaptability is both an enabler and a limitation for alignment in a way that adaptability is the enabling capacity to adapt a process to maintain the alignment in changing environments. It is limiting in a sense that adaptability seems to be the contact adjustment towards new trends, which limits a structural alignment over a longer period of time. Both ways, it has been made clear that adaptability is an important variable to alignment and thus adopted in the proposed conceptual model.*
Imagination	*Creativity*	*According to Pelaprat & Cole (2011, p. 399), "Vygotsky characterizes creativity as a process that is based on the products of imagination". In their study Pelaprat & Cole (2011) investigate the relation between the concepts creativity and imagination and conclude: "creativity and imagination to be a cyclical, mutually-dependent nature of the interpenetration" (p. 418).*
	Comprehension	*In the book 'The imaginary: A phenomenological psychology of the imagination', Sartre (2010) explains us the relation between comprehension and imagination by constructing images to create a substantive thought. The citation aims to provide an understanding of this relationship. "Thought, although we could express ourselves about it without keeping account of the images in which it reveals itself is never directly accessible to us, if we have once taken the imaging attitude in forming it. We will always go from image to image. Comprehension is a movement which is never ending. It is the reaction of the mind to an image by anther image, to this one by another image and so on, in principle to infinity." (Sartre, 2010, p. 116)*
	Recognition	*Bolls (2006, p. 205) defines recognition as an indicator of how well information was encoded into memory. Robinson and Rundell (2016, p. 92) recite Kant (1970)'s view on the relationship between recognition and imagination: Kant, a profound philosopher "argues that there are three moments within the synthetic formation of knowledge: the synthesis of apprehension in intuition, its reproduction in the imagination and its recognition in the concept".*

Concept	Variable	Illustrative quote
Engagement	*Participation*	*Wenger, Trayner & de Laat (2011, p. 18)'s view on participation of professionals in and between communities has multiple levels that corresponds with their level of engagement. "Typical categories of membership and participation include: the core group, the active participants, the occasional participants, the peripheral participants and the transactional participants." For an explanation of those memberships, see chapter 3, figure 8.*
	Aknowledgement	*According to Littefield (2016), consultant and founder of AcknowledgmentWorks, "Study after global study shows that recognition is fundamental to the engagement and retention of top talent and the profitability of our organizations." In his TEDx talk given in 2012 in Beirut, he later argues that acknowledging members by what they would like to be acknowledged for, increases their level of engagement.*
	Support for innovation	*The study done by Bhatnagar (2012) reveals that psychological empowerment of employees positively affected work engagement and led to high innovation and lower turnover intention. It is suggested that professionals feel more engaged to and with the community, if the management support innovation initiatives by allocating time and resources (Chung et al. 2012).*
	Connectedness	*In a study into international students' connectedness with their peers, institutions and the broader community, Tran & Pham (2016) found that, students' engagement is affected by the connectedness to the larger network of the communities, the connectedness with his peers and the institution. However, the student's personal identity should be in sync to a certain level with the communities identity. This is illustrated by the Tran & Pham (2016, p.17): "[students] their status seems to be found in the solid building of that Australian world of which they seek to be a member, but their sense of personal identity resides in the periphery of that same world."*
	Identity	
	(organisational) Commitment	*In understanding the contribution of member involvement and organisational commitment in relation to engagement, Wolf-Wendel, Ward & Kinzie (2009, p. 426) concluding words of their research are used as explanation. "Involvement is the responsibility of the individual student, though the environment plays a role. The unit of analysis for involvement is the student and his or her energy; it is the student who becomes involved. Integration (or what Tinto might now call "sense of belonging") involves a reciprocal relationship between the student and the campus. To become integrated, to feel like you belong, a student must learn and adopt the norms of the campus culture, but the institution is also transformed by that merger. The focus on engagement is on creating campus environments that are ripe with opportunities for students to be engaged."*
	(member) Involvement	

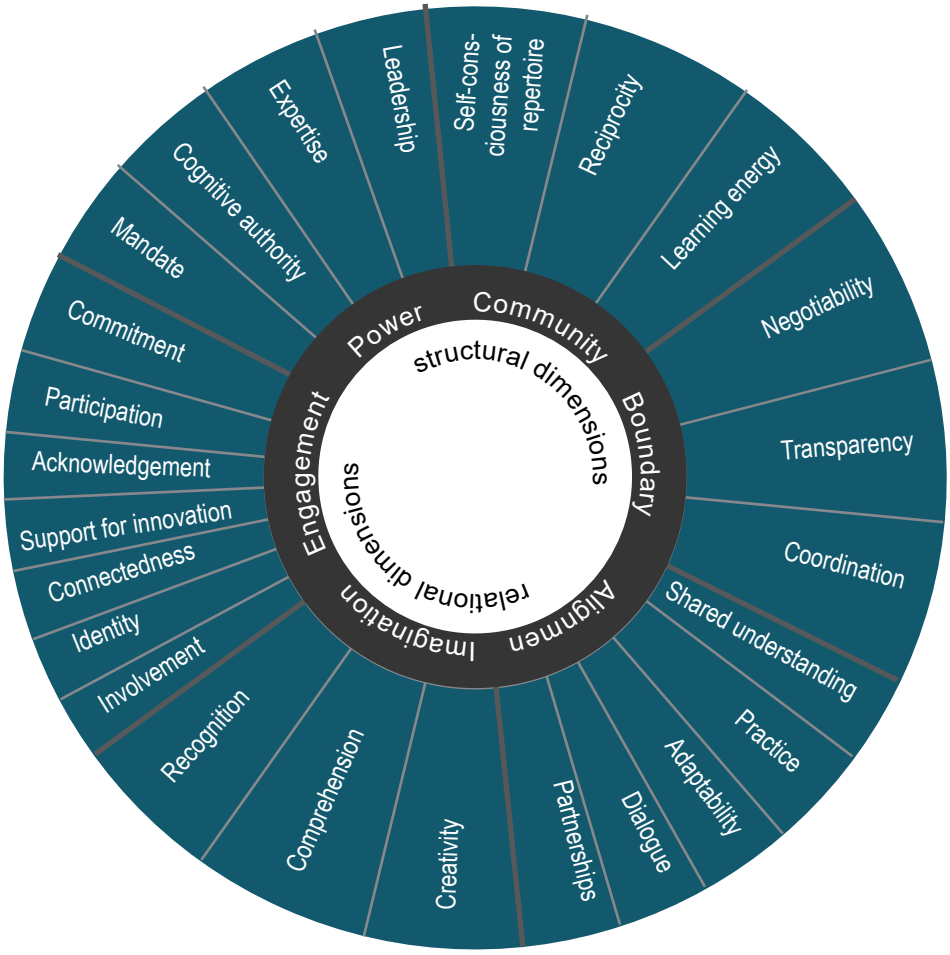


Figure 27: The visual presentation of the concepts and variables of the conceptual model

Having all variables related to one of the six concepts, the model is depicted in Figure 27.

Figure 27 shows the two rings of the model. The next step of the design process of the models is to create a meaning of the variables in context of the case study.

6.5 Development of the explanation of variables

Development of the third layer, the "variables' explanation" is based on the Cultural Probes technique (Gaver et al., 1999), which belongs to the domain of sensitizing tools used in the field of strategic and interaction design. The list of variables and their explanation can be seen in appendix E. The applied Cultural Probes technique is based on probes, which "are collections of evocative tasks meant to elicit inspiration responses form people – not so much comprehensive about them but fragmentary clues about their lives and thoughts" (Gaver, Boucher, Pennington and Walker, 2004, p. 53). Probes are established on a 'playful and subjective' form (Sleeswijk Visser, Stappers, van der Lugt, Sanders, 2005). In light of the research field, communication design for innovation, this method uses probes or statements in relation to the variables in the context of Defensity college. The explanation of the variables are therefore established in cooperation with DC-managers, students, mentors (employees) during the pilot and test sessions. The following questions were asked to develop the variable explanations:

- Question 1: "Can you tell me in summary what you are working on?" (This was a mind-teaser to prepare the answer in the specific direction of the variable in light of the context of the participant. The answer itself was not of importance).
- Question 2: "Do you think you understand the variable? If not you can look it up on internet. If yes, then think a moment about how you would formulate it." (Provide the participant a moment to prepare for formulation.)
- Question 3: "If you think about concept X and you should explain it to your five year old niece/ daughter/son/nephew, how would you explain it in one sentence?" (The outcome of these statements are used to collect explanations of variables. The overlapping variables are chosen by the researcher and validated by research colleagues.) The full model (later called the Collaboration Analyser) can is presented on Figure 28. Note: The variables' explanations are in Dutch, as further tests within the Ministry of Defence were fully in Dutch.

6.6 Use of the model & guideline

The model can be used once the goal of the community is defined (establish, maintain or improve) in light of the innovation strategy of the organisation. The goals of the innovation strategy have be clear. Therefore, a having a meeting with the innovation strategy managers is recommended.

Guideline

The presentation of the framework and the model can be seen in Figure 28. Community of Practice managers can use the model as follows; Start at layer 1 and discuss which of the concepts are considered underdeveloped or could be improved. Then, go to layer 2 and define within the management team more concrete which variables require attention. Layer 3 contains the explanation of the variables in context of Defensity College. This layer is an addition to decrease misinterpretation of the variables.

Once variables 5 – 8 are defined, discuss a) if the variables are critical for knowledge sharing and implementation in your COP and b) if focussing on these variables contributes to the innovation strategy as a whole. Both questions have to be answered with 'yes', if not, remove the variables from the list.

Choose from the remaining variables, the 3 variables that are considered most influential; these three variables are your strategy variables. The last step is to write your strategy around these variables.

6.7 Summary of the define phase

In this phase, the research was further defined and a conceptual model was designed. The research was defined in chapter 5 by the critical node of the case study and by scoping the COP-approach to an innovation capability of an organisation and relating the approach to the concept of power. After scoping, it became clear that little could be found in literature about how COP-managers could be facilitated to design their COP. Therefore, a literature study into factors that influence interprofessional collaboration was conducted as a means to answer the second sub question: **Which factors influence knowledge sharing in and between communities of practice on micro level?** The answer contains a list of 25 factors; 23 derived from the literature study and two were added from practice.

In chapter 6, the conceptual model was created based on van der Sanden (2016)'s draft to facilitate COP-managers in design of their community in light of the innovation goals of the organisation. The model comprises three layers. The factors influencing interprofessional collaboration, found in the literature study in chapter 5 form the basis for the variables (layer 2) and are related to the key concepts of Communities of Practice (layer 1). Based on the probing technique by Sleeswijk Visser, Stappers, van der Lugt, Sanders (2005), the variables are explained in simple phrases, which can be found in the model as 'explanation of variables' (layer 3).

By providing a step-by-step approach, the COP-managers can discuss the purpose of the COP (establish, maintain or improve) and its focus (3 variables), to define a structured COP strategy. By answering the second sub question and propose the model for scientific purposes, the define phase has served its goal. In the develop phase, the scientific model is used as a starting point for the development of the tool. The insights of both the discover and define phase are used to develop the knowledge sharing support tool for collaborations.

Model: Collaboration Analyser

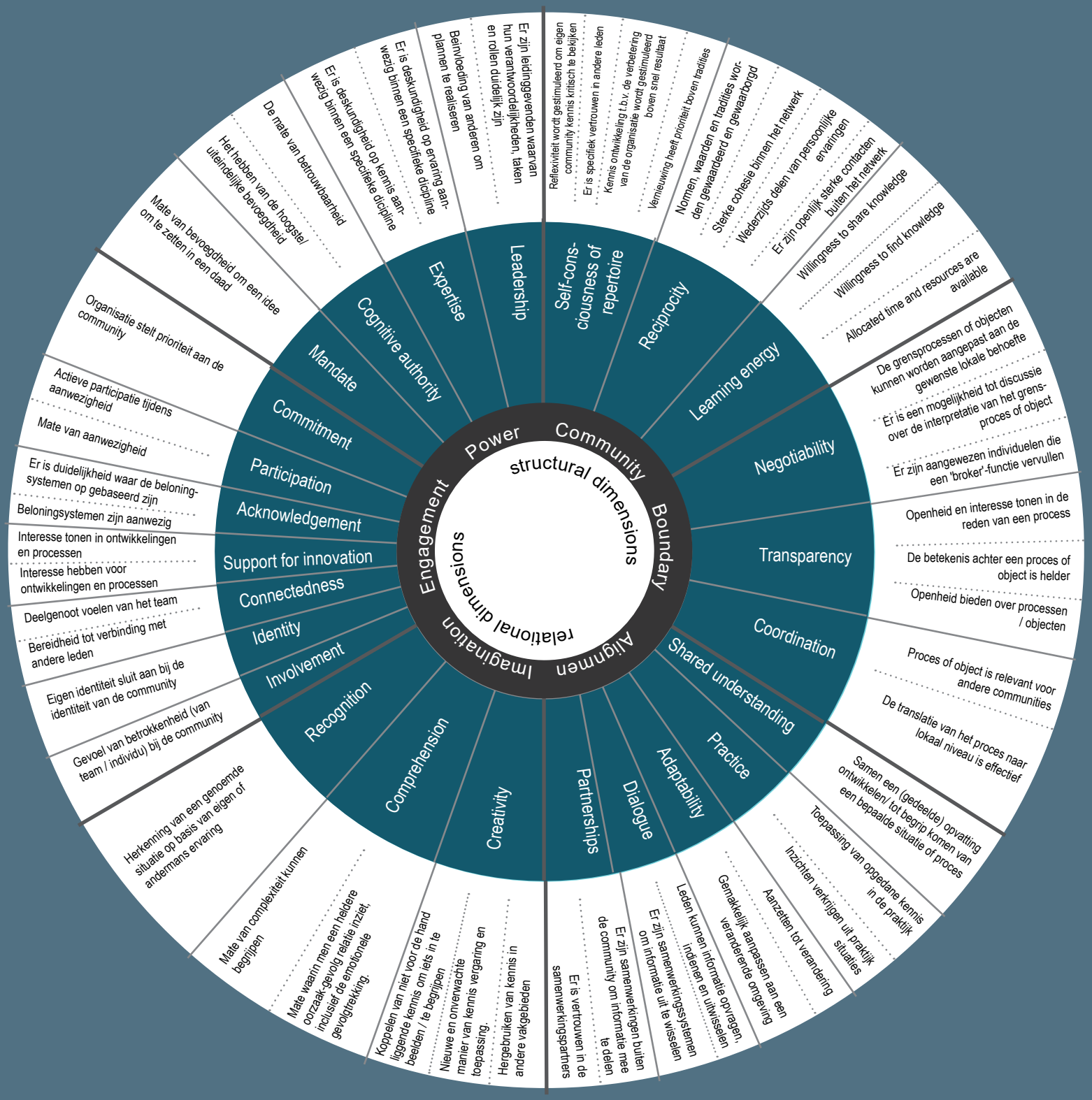
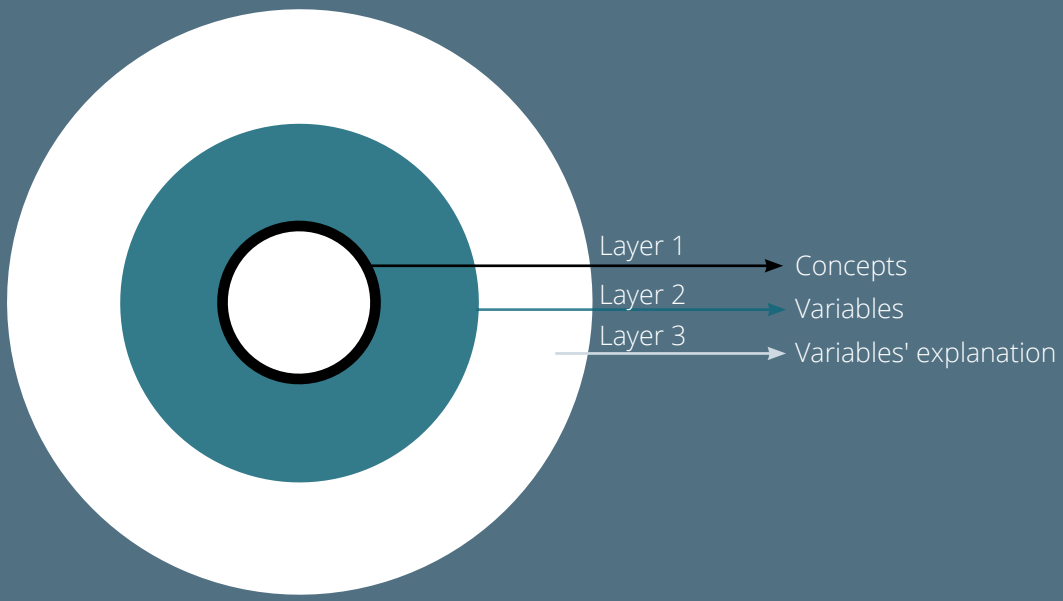


Figure 28: Model 'Collaboration Analyser'

The model framework



Develop

Design, build, test, learn and improve

The develop phase uses the model to design and develop a tool for the micro level collaborations. In other words, the professionals that collaborate on projects aiming to support the organisation's innovation goals. Therefore, the third sub question will be answered in this phase; **What are the preconditions the tool must meet?** This question will be answered by means of a set of design criteria. The list of design criteria provides a base for the tool development. The development includes an ideation phase (using brain sketching and a game designer expert consult) and a short investigation into communication theories and game design.

The tool development is finished in a minimal viable product, a prototype ready for testing. The tool is tested by means of five iterative cycles. After five loops, the develop phase concludes by answering the fourth sub question **How is the usability and applicability of the prototypes perceived by the employer and employee?**

Chapter 7: Design Criteria
Chapter 8: Defining the knowledge sharing support tool
Chapter 9: Testing

7

Design Criteria

The previous phase concluded with a conceptual model that aims to analyse communities of practice designed for innovation by looking at micro level factors that influence interprofessional collaborations. In chapter phase of the develop phase, the design criteria for the development of the tool are listed. Therefore, a new design goal specified to the tool should be described.

The practical list of design criteria derives from the interviews, the critical node. The theoretical list of design criteria derives from a framework that captures communication theories from which design criteria can be drawn. This chapter first discusses the new design challenge and design goal (7.1), followed by the framework of how the list of design criteria is established (7.2).

Subsequently, the design criteria derived from practice are listed (7.3). The next paragraph describes theoretical background which serves as input for the additional design criteria (7.4). The chapter finalises with a conclusion to sub question three: **What are the preconditions the tool must meet?** (7.5).

7.1 Design challenge and design goal for the tool development

The method by Plattner (2015) is also used to establish the design goal of the tool. Therefore, first the design challenge has to be formulated. The challenge is focussed on the micro level interprofessional collaborations and the insights from the model. The design challenge served as input for the design goal.

Design challenge

The design goal is developed using the same method as during the model development. The design goal is presented in Figure 29 and based on the design challenge. The design challenge was formulated as:

In order to make use of the potential of the innovation strategy, it is of importance that (newly) obtained knowledge is implemented on the work floor. As students function as boundary spanners to share knowledge and thereby implementing the innovation strategy, students should be supported in open collaboration communication with his/her employer in the 'fuzzy front design stage' of the collaboration.

7.2 Design criteria framework

Having the design challenge and the design goal, the list of design criteria can be created to set the boundaries for the tool development.

A framework is created for development of the design criteria. This framework is build up as follows: First the design criteria from practice are listed. Then, the four different communication perspectives are discussed which all capture one or more questions. Those questions will be answered by means of design criteria that derive from theories and concepts. Figure 30 represents the framework and illustrates how these perspectives are translated into

Design Goal

Design a **tool** that supports **COP members** to **openly discuss** how to **create effective collaborations** with their employer at the working floor during the **'fuzzy front design stage'** of their cooperation. By developing a **collaborative physical game** that focusses on **conceptual thinking about the collaboration into clear mutual agreements and concrete next steps.**

Figure 29: Design Goal formulated for the tool development

design criteria.

7.3 Practice-based design criteria

Several design criteria have been mentioned during the discover phase during the interviews. The design criteria are:

- The tool has to incorporate a game element
- The tool has to focus on professional development
- The tool cannot take more than more than 25 minutes to play (lunch time / long coffee break)
- The tool should be used at the start of a (new) collaboration
- The tool should support the student as well as the employer in the design of the collaboration so that "manager" or employer provides the student with a suitable job.

Therefore, this collaboration tool aims to create open communication in the collaboration (for innovation) between two professionals where (organisational) power inequality is in place. The development of this tool requires specific knowledge into the focus areas (social learning, group dynamics and decision making, communication behaviour in interprofessional collaboration and organisational communication). Therefore, theory in those focus areas are investigated as input for other design criteria.

7.4 Theory-based list of design criteria

The design criteria for the tool found in theories are based on the four perspectives and serve as answers to the questions. It is argued that the collaboration tool should aim to facilitate knowledge sharing in the interprofessional collaboration (for innovation) between two professionals in hierarchical organisations. Therefore, the perspectives are based on the aim of the tool.

To create such a collaboration tool, four different perspectives are used to cover different aspects of the problem. The four chosen perspectives are:

- Social learning: The fundamental theory for learning in social context as a mean for innovation implementation is viewed to know what stimulates social learning.
- Group dynamics and creative decision-making tools: Various theories of group dynamics provide insights to understand how groups in communities behave. Creative decision-making tools are investigated to get inspired by different decision-making models that can circumvent the perceived hierarchy between professionals.
- The communication behaviour in interprofessional collaboration: This perspective is investigate to understand what behaviour two professionals show in their communication and what we can learn from this.

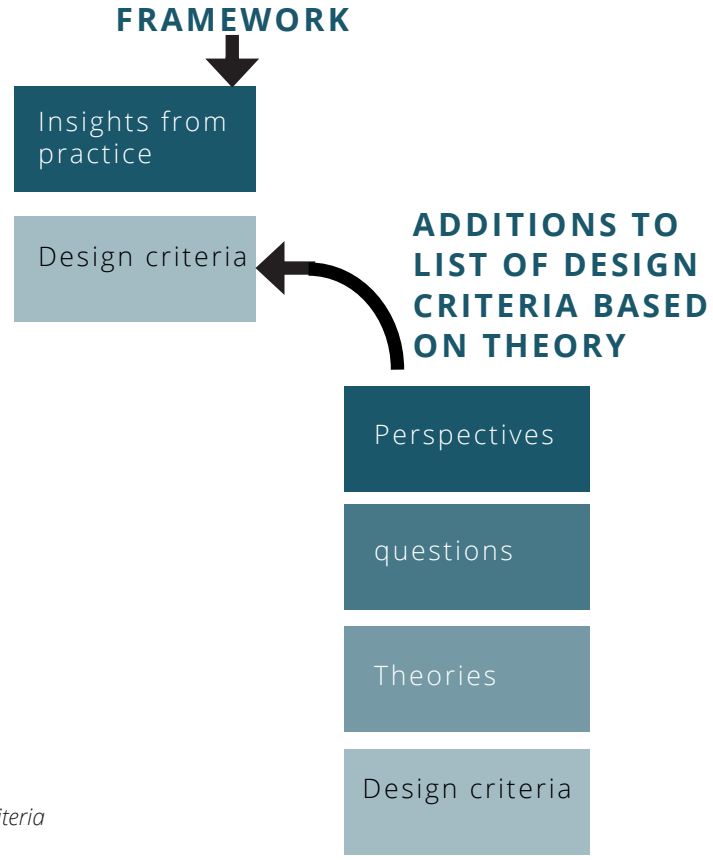


Figure 30: Framework design criteria

- Organisational communication: Designing for boundary spanners of community within a large organisation, insights of organisational communication are required to understand what the organisational restrictions are.

Within those perspectives questions are developed to find theories and answer the questions by means of the design criteria. All theories are based on 'Theories of human communication' 10th edition by Littlejohn & Foss, except for the social learning theory (Wenger, 1991) and the creative decision making tools (desk research). A summary of all theories can be found in appendix D. The four perspectives contain in total twelve theories that are used to answer the questions and create the list the design criteria, these can be found in Table 5, presented on the next page.

7.5 Conclusion

The aim of this chapter was to answer the third sub question: **What are the preconditions the tool must meet?**. The answer to this question is given by the design goal and the list of design criteria for the development of the tool. The design goal can be found in section 7.1. The list of design criteria is based upon practical insights and a theoretical background and is published in Table 5 as part of section 7.4

Perspective	Question(s)	Theory	Design criteria
Social learning	***What are requirements to stimulate social learning?***	*Social learning*	- *Participation needs to be intensive and interactive while using the tool.* - *Stimulate moral development about decisions and actions made in the collaboration.* - *The tool should support the process of knowledge management and should not be a KPI-system for organisational purposes (meaning, focus on the process instead of results).* - *The tool should stimulate both the professional development of the employer/manager and the employee.*
Communication behaviour in interprofessional collaboration	***What behaviour do two professionals show in their communication and what can we learn from this?***	*Interaction Adaptation Theory (IAT)*	- *This perspective shows us the importance of understanding of each other's RED factors. As those are different for every individual, the tool should incorporate a possibility to make those factors explicit so all parties may adapt to one another (based on reciprocity). RED: requirements, expectations and desires. Requirements are things you really need in the interaction, expectations are patterns you predict will happen (based on e.g. social norms of politeness) and desires are those things you want to accomplish.*
		Uncertainty Reduction Theory (URT)	- *The tool should incorporate questions that aim to reduce uncertainty about the other person during the collaboration.* - *The environment in which the people gain information about each other should be equal (no virtual sessions).*
		Communication Accommodation Theory (CAT)	- The *tool should not be an evaluation method, but a design method.* - *Reduce the amount of 'desired' answers.*
		Communication Privacy Management (CPM)	- *Make roles, tasks and responsibilities clear in the decision-making, using the SMART method.* - *Do not make personal behaviour explicit* - *Make sure that people are not force to answer personal questions*
Group dynamics and creative decision-making	***How does a decision between two people affect the group and are creative ways possible?***	*Groupthink theory*	- The t*ool should have its focus on the investment in openness between members and individuals potential.* - *Watch out for insulation. People tend to choose familiar options to keep the group cohesiveness.*
		Structuration theory	- *Be aware that unintended consequences of actions can occur, incorporate time (delay) to solve those consequences.* - *Incorporate decision-moments about objective task-, group task- and group structural characteristics*

Table 5: List of Design criteria for the development of the tool (prototype)

Perspective	Question(s)	Theory	Design criteria
Group dynamics and creative decision-making	***How does a decision between two people affect the group and are creative ways possible?***	*Participatory values of group decision-making*	- *Stimulate mutual understanding by using the Diamond model in the tool: divergence, groan zone and convergence.* - *People need to create their own tasks.* - *Be critical on disapproving behaviour.*
		Creative decision-making: the 'Six Hats' method	- *Define/divide the problems' state on the pillars fact, interpretation, and value of policy.* - *Use the perspective of 'six hats': Define different thinking styles to create distance from people's personal thinking style.*
Organisational communication	***What are the restrictions of the organisation, what are the preconditions of the tool?***	*Co-Orientation*	- *The tool should provide room to establish a coherent meaning: Design agreements about jointly faced facts, responsibilities and ongoing interaction.*
		Managerialism & Weber's Theory of Bureaucracy	- *Collaboratively define the bureaucratic requirements for the organisation. Within this framework, search for innovative collaboration methods*
		Organisational control theory	- *The tool should focus on 'concertive control': meaning the use of interpersonal relationships as form of control.*
Design criteria based on practice	***What are requirements / restrictions that are found in the analysis of the case study?***		- *The tool has to incorporate a game element* - *The tool has to focus on professional development* - *The tool cannot take more than more than 25 minutes to play (lunch time / long coffee break)* - *The tool should be used at the start of a (new) collaboration* - *The tool should support the student as well as the employer in the design of the collaboration so that "manager" or employer provides the student with a suitable job.*

8

Defining the knowledge sharing support tool

This chapter outlined the development of the tool using the design goal and the list of design criteria described in the previous chapter as means for the idea generation. Furthermore, two game experts were consulted and a short literature investigation into the topic of board game theories was conducted to understand what tips for game development are.

In this chapter, first the suggestions provided by the wargame experts are discussed as they provide a substantial introduction in game design. In addition, suggested literature was reviewed for tips and tricks (8.1), followed by the idea generation (8.2). At last, the prototype was introduced by means of its interface and guideline ready for testing (8.3).

8.1 (War) gaming design and development

To understand how to design a game for collaborative and creative knowledge sharing can be created in context of Defensity College and the Ministry of Defence, two game experts were consulted who are specialised in war gaming.

"Effective games have to be fun and provide learning in some way to be played more than one time" was the first comment directly after their introduction. Goldsworthy and Stolk, wargame experts and founders of *Goldsworthy, Stolk & Associates* gave an explanation about war gaming and including recommendations for development for this tool. Their recommendations are collected in following sub paragraph.

8.1.1 (War) gaming requirements

There are four steps that every war game must contain in order to be successful. These four steps consist of:

- A) Creating a point of urgency,
- B) Analysis based on specialism,
- C) Provide room for intervention moments during the game
- D) Provide players with a moment of reflexivity and finally, provide an evaluation for the learning process.

"After each intervention, participants get to work, one of the most important things being that the mediator draws the conclusions so that the participants can jointly reflect on choices made." (D. Stolk, game expert, personal communication, October 2017)

A) Determine the point of urgency and make sure all participants are familiar with the point of urgency. Use the following questions: "What should be the outcome of the game? Why is it important for each participant / party separately?"

B) Benchmark determination. During the first step, no participant really knows what he / she should do. This is why the objectives, resources and tasks must be determined in the most effective way possible. Provide slightly different information to all parties. They will find out during the game that they have to work together to solve

the problem. Provide a strategic perspective and let the players design a course of action.

C) The intervention moments. During these moments, the mediator presents the results of the steps so far in a (interim) presentation. The participants must be able to correct their mistakes. This does not mean that they can turn things back, but they must be able to learn from the mistakes. Finally, during this moment new information can be provided to the participants (to increase the complexity of the game).

D) Present the results and conclusions. Afterwards: Provide evaluation time to correct mistakes that have been made and let the parties collaboratively search for alternatives for the choices made. Ask the questions: "How do we deal with this? What could be better? How are we going to do that concretely?"

8.1.2 Other resources on (board) game development

Next to Goldsworthy and Stolk's view, other resources are consulted as additional insights specified to board games. Mostly recognized for their contribution to explaining the science behind collaborative board games are Zagal, Rick & His, (2006). Therefore, their work is used to collect do and don'ts for game development.

Games are roughly categorised into three areas: Competitive, cooperative and collaborative games (Zagal et al., 2006). Clearly, competitive games where out of scope. However, the differences between cooperative and collaborative required an explanation: "Cooperative games model a situation where the purposes of two or more individuals are not fully aligned, neither completely the opposite. Collaborative games are games in which all participants work together as a team and therefore share the payoffs and outcomes, winning or losing" (Zagal, Rick & His, 2006, p. 25 – 26).

Since the design goal is to create effective collaborations, the tool is categorised in the 'collaborative games'. A collaborative game is considered effective if the "players are tempted to behave competitively but winning the game requires them to behave collaboratively" (Knizia in Zagal et al., 2006, p. 29). To get players interested and creating an urge to play, Zagal et al. (2006) provided four lessons that should be incorporated in the design of the game **to create successful and repeatedly played games**:

- To highlight problems of competitiveness, a collaborative game should introduce a tension between perceived individual utility and team utility.
- Further highlight problems of competitiveness, individual players should be allowed to make decisions and take actions without the consent of the team.
- Players must be able to trace payoffs back to their decisions, meaning experience expectation failure. They expect their decision to be a good one but later discover it to be problematic.
- To encourage team members to make selfless decisions, a collaborative game should bestow different abilities or responsibilities upon the players. That means that every character should have other abilities that can be useful to be put into the collaboration, so once they cooperate the can win as a team.

Zagal et al. (2006) also provided three **pitfalls for game design:**

- To avoid the game degenerating into one player making the decisions for the team, collaborative games have to provide a sufficient rationale for collaboration.
- For a game to be engaging, players need to care about the outcome and that outcome should have a satisfying result.
- For a collaborative game to be enjoyable multiple times the experience needs to be different each time and the presented challenge needs to evolve.

The recommendations and insights were required to understand the complexity of designing games. Having a general understanding of the do's and don'ts in game design the idea generation phase can start.

8.2 Idea generation

In designing, the first step in the development of a new concept is the ideation phase or the idea generation. In this phase, ideas are developed to incorporate many ideas into possibilities for a new concept based on the design challenge, design goal, design criteria and output from the game experts consult. Some of these concepts make it to a prototype. In this research, only one prototype will be built and directly tested with users.

For the ideation phase, the book 'Game Architecture and Design: A New Edition' written by Rollings & Morris (2004) was consulted. The book helps to design games and provide practical steps how to understand and build the guidelines of a game. The questions (that deal with the game development) that are suggested in the book are leading for the ideation phase. The questions and answers can be found in appendix H.

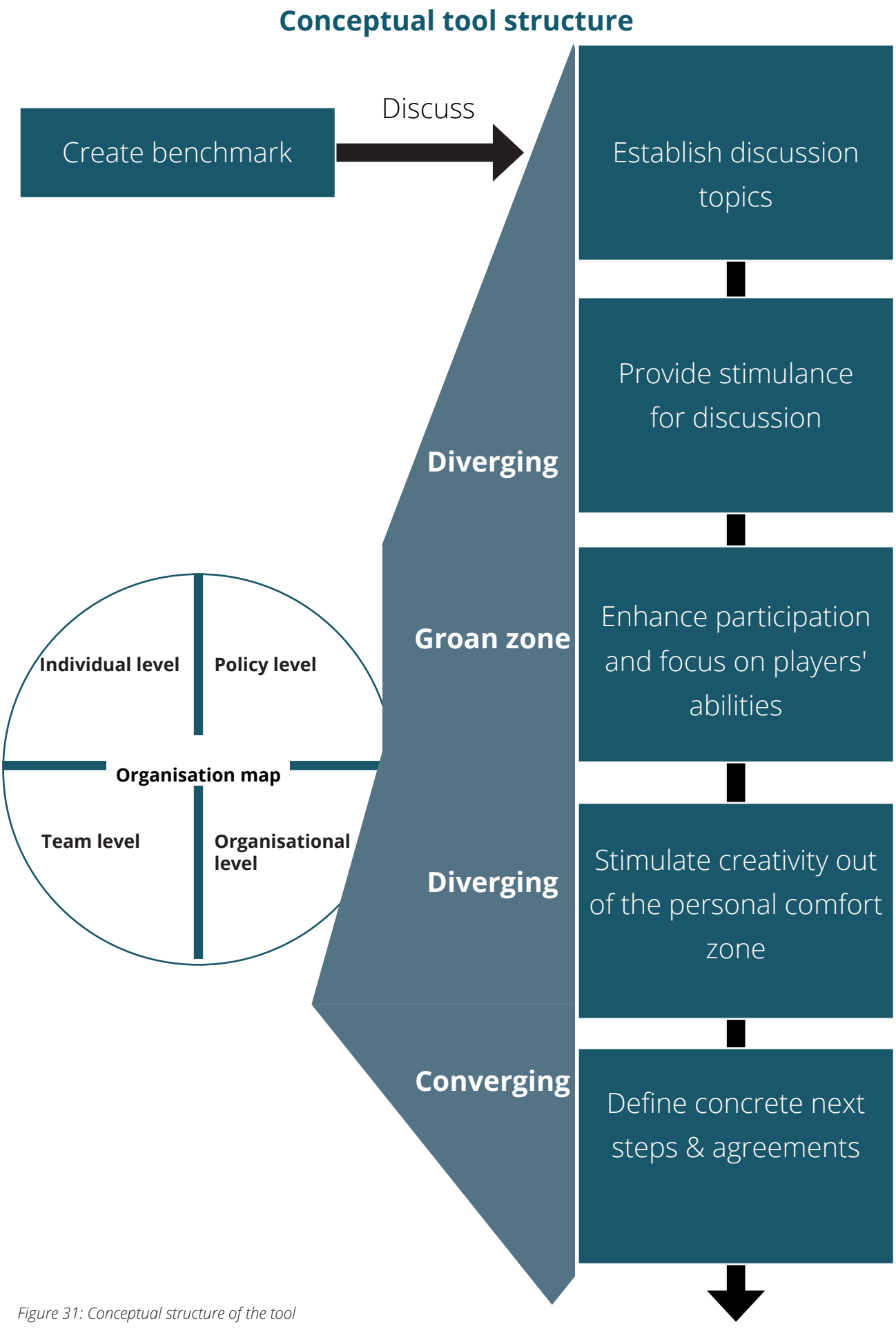


Figure 31: Conceptual structure of the tool

Game structure

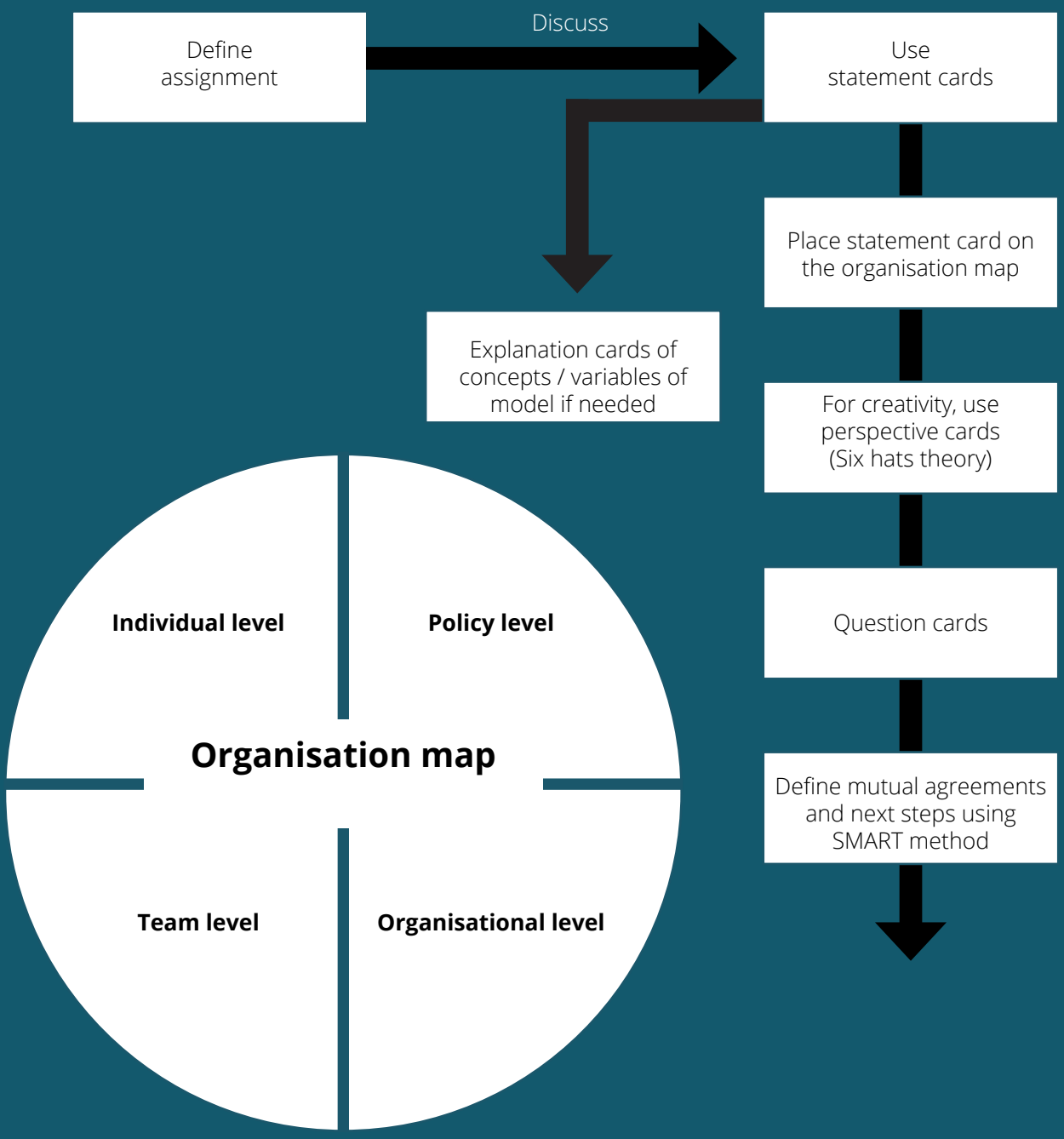


Figure 32: Implementation of conceptual structure of the tool. In this game structure, the conceptual structure is applied by means of steps to be taken in the game.

The insights are used and translated into a concept. The concept is presented in appendix H. The appendix also shows how the design criteria are adopted in the concept. Having proposed the concept, games cannot become successful without testing according to literature and the game consultants. Therefore, this concept was directly converted to a prototype. In the next section, the prototype will be presented.

8.3 Prototype tool design

Based on the concept, the next step was to create a Minimal Viable Product (MVP). A MVP is an early, 'stripped down' version of a product (an early state of a prototype), which determines whether that product is profitable.

In this section, the prototype is presented based on the content, the interface and the guideline. The content discusses the structure of the conceptual tool. The interface discusses how the conceptual structure is translated into a practical game structure and how it is presented to users during the tests.

The content

The prototype comprises a board game (which also functions as text board) and a set of cards. The information on the cards is based on the model defined in chapter 6. The conceptual tool structure is based on the design criteria. The game structure is based on the conceptual tool structure. The *conceptual tool structure* is presented in Figure 31. The *game structure* is presented in Figure 32. The figures are related to each other, therefore the figures are explained simultaneously.

Figure 31 and Figure 32 present the steps taken in the process to establish an effective collaboration between two professionals. First, the benchmark needs to be created by agreeing on the definition of the assignment. Then, the discussion starts by establishing discussion topics (statement cards). To stimulate the discussion, statement cards are created based on the outer circle of the model (ring based on probing). Subsequently, the statements have to be placed on the organisation map to enhance participant and focus on player's abilities. This is an interactive discussion and can be seen as the groan zone. In the next step, the perspective cards can be used to stimulate creativity within the collaboration. Then, the question cards are used to get the conceptual level of the discussion less abstract and more in the context of operation. The last step opens the discussion by defining mutual agreements and next steps using the SMART method.

The interface and guideline

The prototype comprises a board game (which also functions as text board) and a set of cards. The set of cards consist of the perspective cards, the question cards, the statement cards and the explanation cards (cards to explain the concepts and variables of the model). The design of the cards can be found Figure 33 on the next page. The game board is presented in Figure 34. (Turn the page). The last part of appendix H represents how the design criteria are translated in the game board.

The colours and lay out are not yet related to the corporate identity of DC in this stage to avoid miscommunication between users and DC (participants might perceive the tool as part of DC instead of as part of a research project).

At last, the prototype was established using a guideline. Using a rewarding system of points, the players have to collaborate to earn as much points as possible. The guideline can be seen in Figure 35. The full guideline can be read in appendix I: Guideline of prototype.

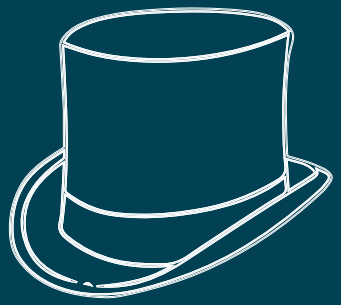
To conclude, the aim of this chapter was to develop a prototype ready for testing. The design criteria established in the previous chapter were used as boundaries for the design of the prototype. Based on different theories related to gaming and a consult with game experts and an ideation phase, the prototype was designed and developed. By proposing the prototype including instructions for use, the prototype can be tested in the next chapter.

Figure 33: First version (prototype) of game cards. (Top - down: concept cards (explanation), perspective cards (six hats theory), statement cards and question cards

Concepten

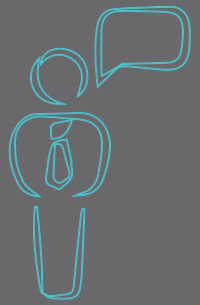
Collaboration start - up

Perspectief



Collaboration start - up

Statements

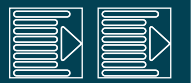


Collaboration start - up

Vragen

Collaboration start - up

Alignment



The process of adapting knowledge to other local activities, so it can be (re-) used.

Wederzijds begrip, Praktische focus, Aanpassingsvermogen, Dialoog, Samenwerkingsverbanden

Rode hoed

Bekijk het probleem vanuit het onderbuik'-gevoel, intuitie en emotie. Bedenk ook hoe anderen emotioneel kunnen reageren. Probeer de reacties te begrijpen van mensen die uw redenering niet volledig kennen.

Hoe zullen klanten/belanghebbenden/ collega's zich voelen? Welke emotie zal dit besluit te weeg brengen?

Creativiteit

1. Kennis van andere vakgebieden wordt effectief hergebruikt.
2. Koppelen van niet voor de hand liggende kennis om iets in te beelden of te begrijpen.
3. Nieuwe en onverwachte manier van kennis vergaring en toepassing.

"Creativitieit is een overgewaardeerd process: het is belangrijker om op onze afdelingen te focussen op resultaten."

Imagination

Betrokkenheid

Gevoel van betrokkenheid (van team/individu) bij de gehele organisatie.

Welke maatregelen worden er genomen om de betrokkenheid van het team te creëren?

Hoe kan een nieuwe collega uiting geven aan diens betrokkenheid?

Engagement

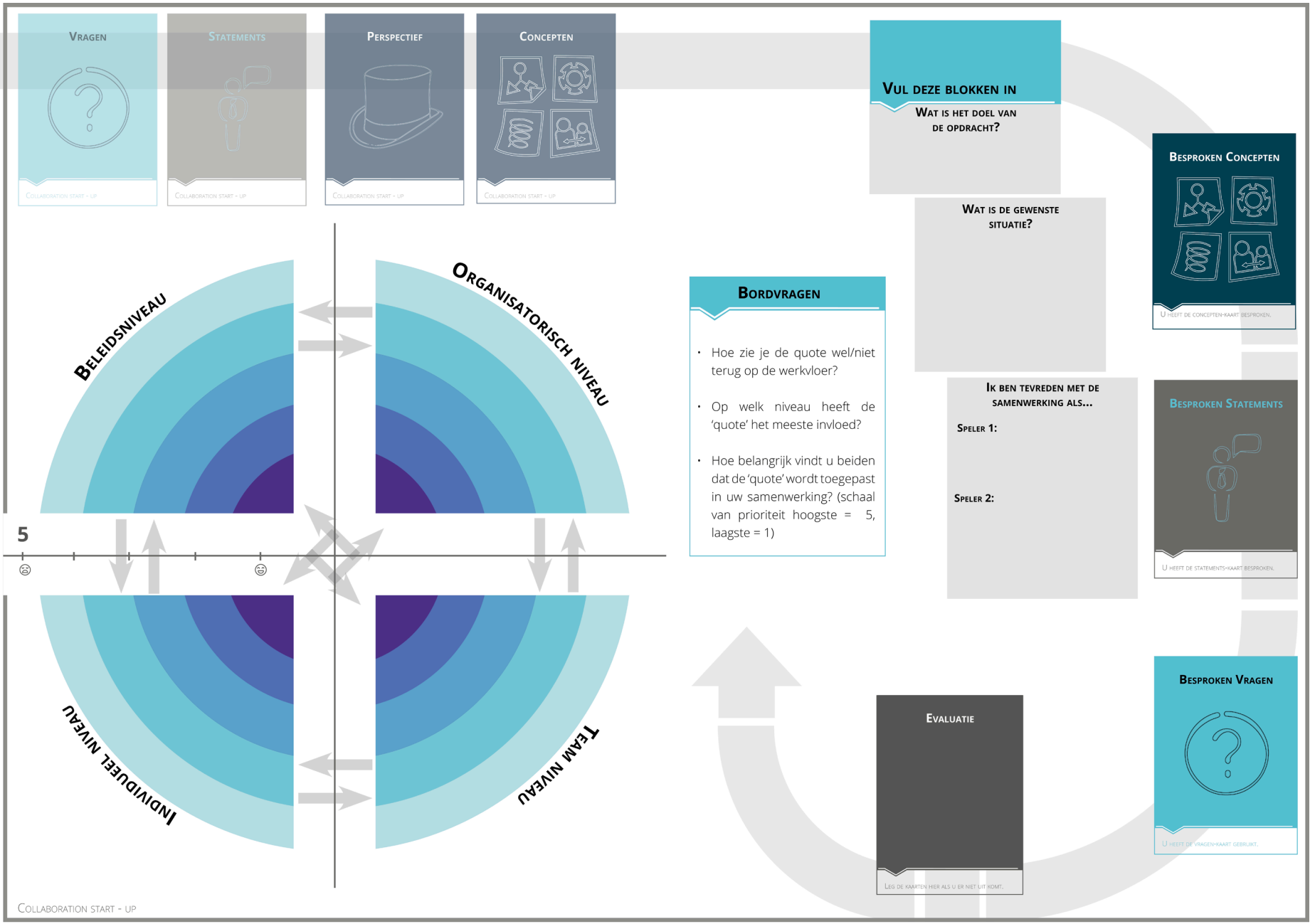
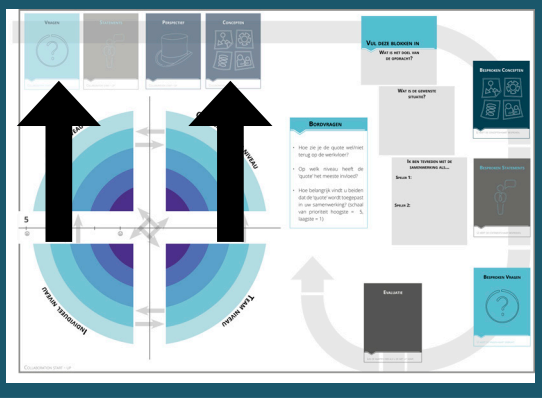
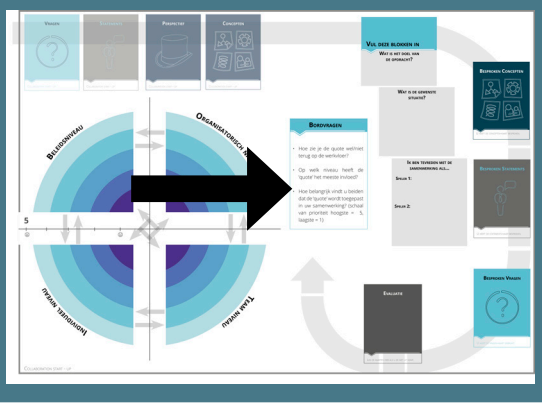


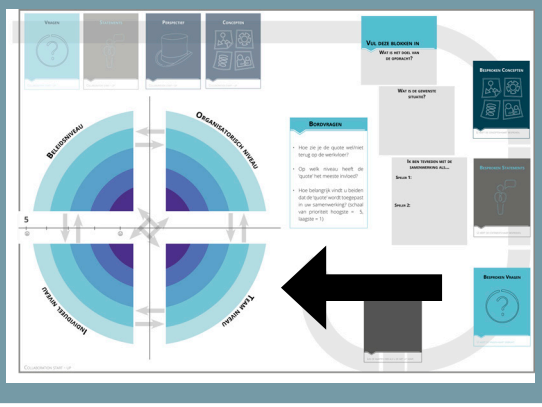
Figure 34: First version (prototype) of the game board.



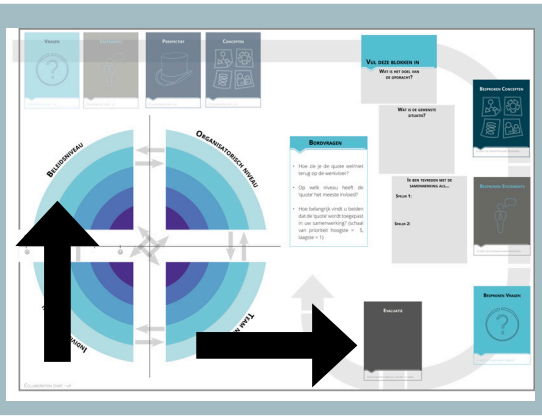
First the tool will be introduced by the facilitator. When the manual iswritten by both players, they have to prepare the game by placing all cards on the right spots on the boad.
Henceforth, they view the perspective cards. They have to consider (individually) what cards corresponds with their most natural way of reacting and write that down as their number one. Followed by the numbers two to six, being six the least natural way.



During the first round, the participants have to complete the assignment together on the game board by answering the questions in light of their collaboration. They have to answer in two sentences. The questions are: What is the assignment that your collaboration is needed for? What is the goal, the desired and current situation? They write the answers on the game board and complement each other where necessary.



In the second round, players take a 'statement' card in turn. They place these on the organization map and discuss why they think it should be there. If the other player thinks differently, he has to place the statement elsewhere on the map. The different is puts them into minus points. BUT.. the players can earn points by formulating a suitable position with which they both agree on within 30 seconds (to ensure that they do not go completely out of time). They receive the amount of points they lost "doubled" back. (Exanple: - 4 + 8 = 4)



In the third round, the abstract discussion will become more tangible using the question cards. Those cards put the new made statements into the operational context. To come up with innovative answers and ideas for the mutual agreements and the next steps, the perspective cards can be used. By using these cards the players also recieve extra points (within a time frame of 60 seconds).
The players can evaluate statements / agreements if requested (by one of the players).

The game finishes if all statements and questions cards have been answered and translated into mutual agreements and next steps. The point system:
- x to 0 = Consensus has not been formed well enough. Unfortunately, try to listen to each other better next time and make sure that concrete plans are made. / 0 - 50 = Big chance that you had many differences in the beginning and discussed a lot, then you have played the best game. Did you have few differences and little perspective maps? Chances are you are much in line. That is easy, but be careful that choices are not made too quickly. / 50 - 75 = You are strong in concreting assignments 'in time' and have taken many perspectives (and therefore out-of-the-comfort zone) cards to earn points. Well done!

Figure 35: Guideline of the prototype (game board)

9

Testing

In this chapter, the development from prototype to tool is described according to the iterative cycle of design, test, evaluate, redesign and test again. The chapter comprises respectively the usability tests as test method (9.1), the main test results per identified area (9.2) and the adaptations in the tool throughout the process (9.3). All sections contribute to providing an answer to the fourth sub question: How is the usability and applicability of the prototype perceived by employer and employee? This will be answered in the final section (9.4).

9.1 Method: Usability test

For the development from a minimal viable product (MVP) to the final design, five usability tests were conducted. A usability test is used to understand how users perceive the usability and the applicability of the product that is being tested. The objective of the test is to detect features that are not clear, not used or not applicable so they can be improved in a newer version of the prototype eventually leading to the final design.

The methodology comprises the principle of building a Minimal Viable Product (MVP) which is designed so it works but requires much iteration to be recognized as a tool. In this project five iterations are conducted by testing, evaluating, improving with and for the user. Although five tests seems a small amount, 80% of the usability problems are detected within four of five tests. More tests reveal less new information (Virzi, 1992). Therefore five tests are conducted.

9.1.1 Usability test design

To test the prototype, five interactive sessions including a feedback discussion at the end were conducted. Each test session lasted approximately sixty minutes. The test started by an introduction of the tool by means of the researcher reading the guideline, followed by the couples interacting with the tool (playing the game). The researcher only answered questions and only gave suggestions when the participant tried two times or did not know what to do for a period longer than two minutes.

After fifty minutes, the researcher started the discussion about the positive and negative features of the tool. The researcher encouraged both participants to provide constructive feedback, using probes like 'why should you not implement the tool?', 'what are three benefits of the tool you can think of?'

Each test was recorded on speaker to gather insights from the participants. The insights are not validated by the participants. After every test, the feedback is included in the next version of the prototype.

9.1.2 Participants

The five tests were conducted with four couples of two participants, and one group of three participants. Two couples consists of (potential) end-users (e.g. a Defensity College student and a super visor within the MOD), two couples consist of an intern and the employer both of the Ministry of Defence and one test was conducted with research colleagues from the master program Science Communication. Specific data about the participants can be found in appendix J.

9.1.3 Analysis of usability test

The usability tests were audio recorded and observed by the researcher. In addition, notes were taken. The information is summarized based on the researcher's observation, the recordings and the discussion sessions afterwards. This method is chosen, so the researcher could focus on facilitating during the session if participants had troubles understanding the purpose of the game or got stuck in the conversation. Afterwards, the discussion session was used to validate observations made by the researcher and to gain additional feedback about possible improvements the participants were willing to share. The recordings were a means to validate the observations and used to identify quotes. The test sessions were summarized and together with the quotes, they serve as validation material to identify the main errors in the tool. The errors which the participants mentioned as most critical have been adapted first in the next design. The test results were analysed by four main areas:

- (1) Complexity in playing the game
- (2) Openness between players in discussions
- (3) Encouragement of creativity and collaboration using the game
- (4) Execution of diverging, groan zone to converging: From abstract collaboration design to mutual agreements and concrete next steps

9.2 Results of the usability tests

The tool is improved along with the test period based on the users with the aim to improve the user-friendliness and the applicability of the prototypes in the context of Defensity College on operational level. As guidance, the fourth sub question how is the usability and applicability of the prototypes perceived by the employer and employee? was used.

The sub question will be answered (summarized in 9.4) by means of a discussion of the test results based on the four main areas. Per area, the test session results will be discussed. In these sections the main conclusions are drawn. For all test results see appendix K.

9.2.1 Complexity in playing the game

The overall conclusion is that the game prototypes were too complex and required guidance of a facilitator. Mainly, because the different rounds were not easily interlinked and it was not easy to go 'back' to a previous step (test 1, 4, 5). Voluntarily using the perspectives cards or providing points as a rewarding system was not considered useful (test 2, 3). It was recommended to incorporate the perspective cards as a mandatory step so to avoid the question when the cards should be used. Also the statement cards were either too 'vague' or too 'tricky' for the context of the MOD (test 3, 4).
Furthermore, two couples indicated that the full version guideline was long (test 1) and sometimes hard to understand (test 5).

9.2.2 Openness between players in discussions

The openness between players in discussions was highly appreciated (test 1, 3, 4, 5), mainly the discussion during the first round. The aim of that round was to define the assignment within two sentences resulted in effective and open communication. Also the overall experiences contributed to the openness between players. This is illustrated by quotes from participants: "I valued the conversation we had" (test 1), "I found it very useful to think differently" (test 4) and "I find it was a fun game. It forces you to think/reflect" (test 5).

9.2.3 Encouragement of creativity and collaboration using the game

In general, the extent to which creativity and collaboration are encouraged during playing the game was considered positive in the last iteration of the prototype. In previous tests, it was argued that when question cards were 'too obvious', it was not necessary to use the perspective cards. In this test, the encouragement of creativity was appreciated at moments the perspective cards where properly used. Although facilitation was required, the overall view was that the creativity was fuelled by the use of the cards.
Next to creativity encouragement, collaboration was encouraged (and valued) mostly by the innovation and strategy departments (test 1, 4, 5). In particular, the interactive part of the game (together designing statements and mutual agreements) was conducive to the cooperation in the game.

9.2.4 Execution of diverging, groan zone to converging: From abstract collaboration design to mutual agreements and concrete next steps

The concept of 'design thinking' (Plattner, 2009) was applied in the development of the game. The design thinking was applied by means of the conceptual structure of the tool (discussed in chapter 8). The test results indicate that going from diverging to the groan zone, to converging was considered very hard. In particular the converging step seemed to be complex. This was illustrated by a participant "I found it very useful to think differently and super interactive. Yet, it was pretty complex to change from abstract to our concrete assignment" (test 4). This statement was acknowledged (test 1, 5).
However, it has been argued that having a facilitator that could guide players through the game was perceived as

positive and helps to overcome the complex step from abstract to concrete. This was illustrated by two examples: "You [as a facilitator] did make various attempts to make it very concrete by saying: 'how could this affect the assignment? How can you improve it?'" (Test 4) and "It remains difficult to take that step from abstract to concrete, but I just think it's wise if you [as facilitator], which you did by the way, that you just give the explanations of the game again. What is the intention? And then it just runs. I'm sure it will not happen automatically, such a game." (Test 5).

The last question that was suggested was how to ensure implementations of the mutual agreements and concrete next steps (test 1, 5). As this was not part of the usability test, this note was not directly implemented but was listed as an improvement for the final design.

9.3 Main adaptations throughout the process

The aim of analysing the usability tests results was to detect problems that occur in playing the game and improve the game for applicability and usability purposes. In appendix J, all suggestions for improvements and adaptations are explained per step. In this section, the suggestions for improvement after the last test are discussed. Although no tests have been conducted within the Ministry of Defence after the fifth prototype test, much iteration have discussed with research colleagues. After the last session, all information was collected and used for input for the development of the final design. The most crucial notes were divided into points for 'change', points to 'remove' and points to 'add'. The notes are listed as follows;

Change:

- The interphase of the tool has to incorporate the corporate identity of Defensity College. As a result, the corporate identity is used as the colour palette for the tool.
- More structure should be added to the interface of the tool to minimize guiding texts in a manual. The board should indicate the different steps taken in the process. Therefore lines, numbers and colours which correspond with the numbers are added as guideline.
- All questions were discussed with the case owner to evaluate to what extent the questions were between too concrete and too abstract.
- The perspective cards were incorporated in a mandatory manner.

Remove:

- The statements were considered not creating the desired behaviour (knowledge sharing) for MOD's purposes and are left out. The statements were considered too tricky.
- The focus on gaining points became the prior focus, therefore the game element 'gaining points' was deleted. Mainly because the discussion between players was the intention of the game and it was acknowledged as valuable without the points.
- Leaving out the 'defining a new statement'. It was replaced by the mix&match game (which will be explained in chapter 10).

Add:

- Focus on the knowledge sharing by using the question cards, rather than concrete solutions.
- A text board is designed separately from the text board to make the game even more interactive, including hexagon pieces (chapter 10).
- The results of the mutual agreements and concrete next steps are collected using an app.

9.4 Conclusion

In this chapter, the first prototype was tested, evaluated and redesigned for improvement. Conducting five usability tests, the answer to the fourth sub question can be provided. **The question was formulated as; How is the usability and applicability of the prototypes perceived by the employer and employee?**

The answer as given by means of the complexity of the game (the interface and the execution of diverging, groan zone to converging), the openness between players in discussions, the encouragement of creativity and collaboration using the game and

The overall conclusion is that the steps in the prototypes were too complex, except for the step in which the players have to define the assignment in two sentences. Due to the complexity, the game cannot be played by the players without any guidance. However, the contribution of a facilitator guides players through the game and also helps to overcome the complexity from abstract thinking to concretize plans and agreements.

The openness between players was encouraged during the game, as well as the creativity and collaborative thinking, which was aimed. Therefore, the conceptual structure of the game and the first step has been retained. The perspective cards served its purpose of encouraging creativity and collaborative thinking, but it was unclear when

they were supposed to be used. Therefore, in the final design, the perspective cards are mandatory incorporated.

To conclude, the structure of the interface and especially the transition between the game steps should be more obvious. A facilitator must have a supporting role. Also, to ensure that the agreements are also implemented, an app will be developed that provides reminders.

Quotes from participants during tests

"It is too complex. Before I understand the first part, I have to move on and do something else. Build up your phases; First one part, then a little piece of information and then the second part etc."

– Student (Test 1)

"It definitely need some work, but I think it might be useful for introduction meetings with new military employees from different Operational Commands (Armed Forces) might benefit from such a tool."

– Employer (Test 1)

"The questions do not fit with the quotes. Make the questions more process-oriented."

– Fictive employee, research colleague (Test 2)

"The only differences with the statements is our idea of interpretation. I would prefer to first answer the questions myself and define a reason to the extend I agree with a certain statement before I discuss together our differences."

– Student (Test 3)

"The first round is a useful method to see if the employee understand the assignment [....] We are never going to use it, it just doesn't work in our organisation" "

– Employer (Test 3)

"I found it very useful to think differently and super interactive, but it was pretty complex to change from abstract to our concrete assignment"

- Student (Test 4)

"I like the interactive part, but I kind of miss the link between abstract and practice. On the otherhand, you did make various attempts to make it very concrete by saying: 'How could this affect the assignment? How can you improve it?"

- Employer (Test 4)

"I had the most difficulties to apply the statements to our specific assignments. I had that especially with mandate .. I mean, of course, if [employee] wants to do his job, he should be able to access everything. But in this case that simply doesn't work. Therefore, it is difficult to understand such a statement in view of the assignment. But that does not matter, because it's all about being able to talk about it. "

– Employer and acknowledged by Student (Test 5)

"I thought it was a fun game and the examples (the statements) are fun. It forces you to think. I think it would work in our department. This department is open to it. However, I do not think it works at very structured departments, such as the legal departments or at security authority... they are too much interested in the processes, I think. But it could certainly happen within the HDBV. "

– Employer at the strategic level of the Ministry (Test 5)

Figure 36: Photo's of test sessions

Deliver

Final design and implemenation plan

In the deliver phase, the final design including a roadmap to prepare the design ready to launch are presented, based on the iterative redesign cycles of the prototype conducted in the develop phase. In the deliver phase, the final design is described by answering the fifth sub question **How does the final design work?** and the roadmap for implementation is proposed based on the sixth sub question **What are the implementation requirements for DC?**. Having presented the final design including a plan for launch, the deliver phase has served its task. In the last phase, called 'the road', the research project will be discussed and an answer to the main research will be given, including recommendations for all parties and further research.

Chapter 10: Final design "Community Builder Program"
Chapter 11: Final design implementation

10

Final Design
"Community Builder Program"

In this chapter, the final design is presented and an answer to the fifth sub question, formulated as: How does the final design work? is provided.

The final design is called the "Community Builder Program" and contains the "Collaboration Analyser", the "C-Booster" and a design brief for an App.

First, this chapter introduces the final design and the integration of the Collaboration Analyser and the C-Booster (10.1). Subsequently, the next section explains the problem context and why this final design would be of value for Defensity College and the Ministry of Defence (10.2). Then the final design, the Community Builder Program, will be presented and explained by means of an extensive guideline (10.3). In following sections, the Collaboration Analyser for user purposes will be discussed (10.4), the C-Booster in its final state will be explained (10.5) and the design brief for the app will be described (10.6). The chapter concludes with an answer to the fifth sub question (10.7).

10.1 Introduction to the final design

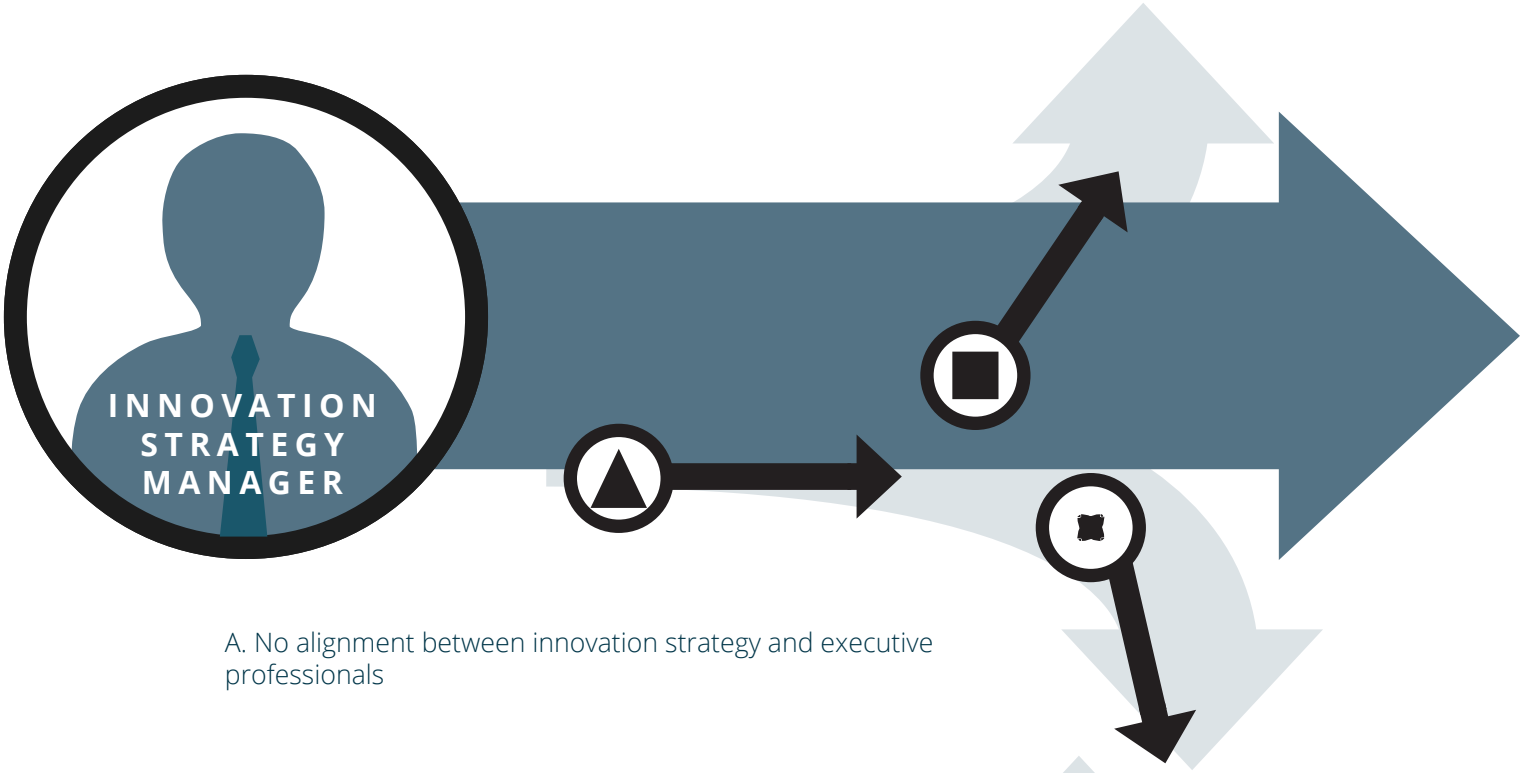
The final design, called the Community Builder Program, comprises the Collaboration-Analyser (and guideline) and the C-Booster (and guideline) and should be accompanied with a mobile application. The app functions as the connection throughout all steps in the program. The deliverables of the Community Builder Program are presented in Figure 38.

The full program is designed for Community Managers (tactical level) but connects between the top level innovations strategists and the community members on the work floor (and the professionals they collaborate with). The CBP uses the COP approach and focusses on interprofessional collaboration to establish a link between the innovation strategy (strategic level) and the implementation and execution of the innovation strategy at in the work floor (operational level), using the community-of-practice theory.

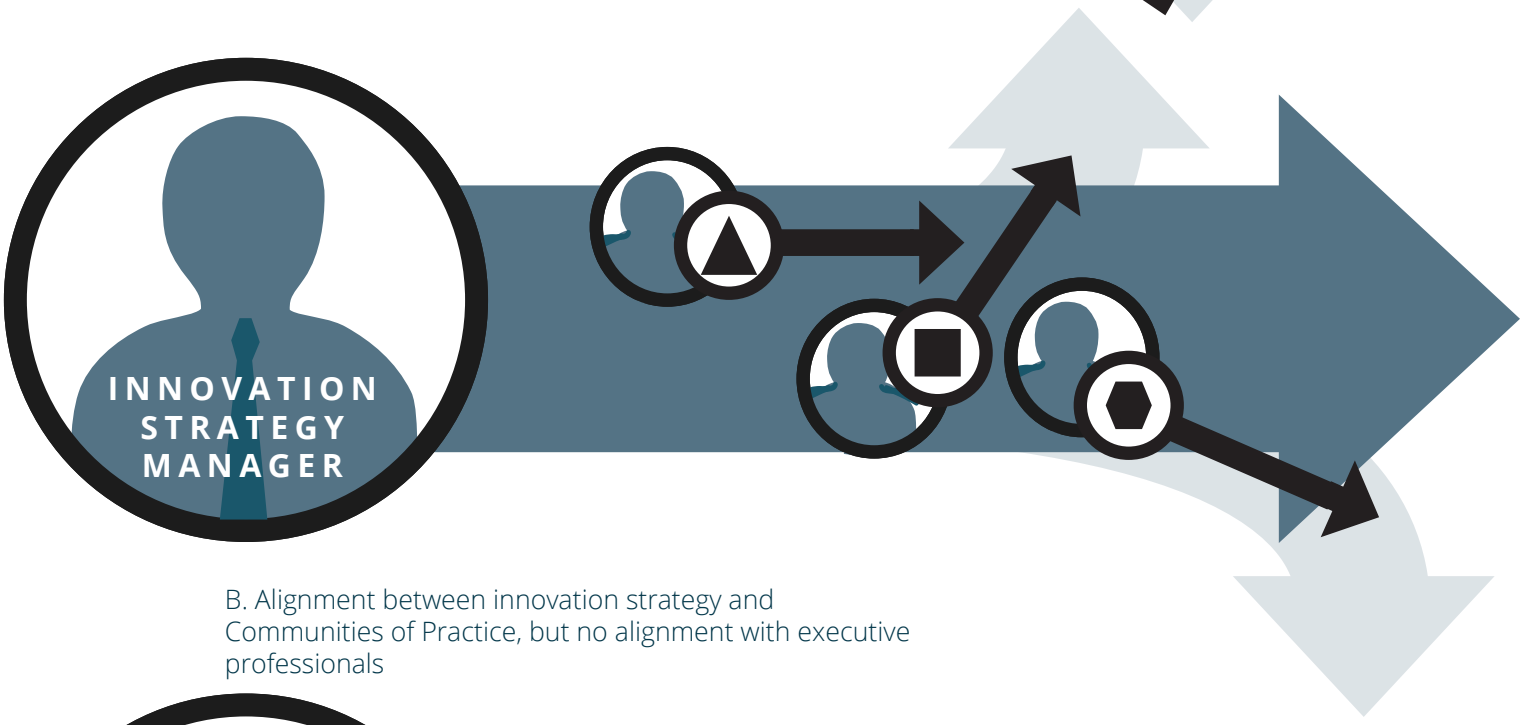
10.2 Problem context

When a large hierarchical organization aims to implement an innovation strategy on a large scale, multiple innovation initiatives are needed to implement this strategy. Innovative initiatives arise at different organizational levels and often in different departments.

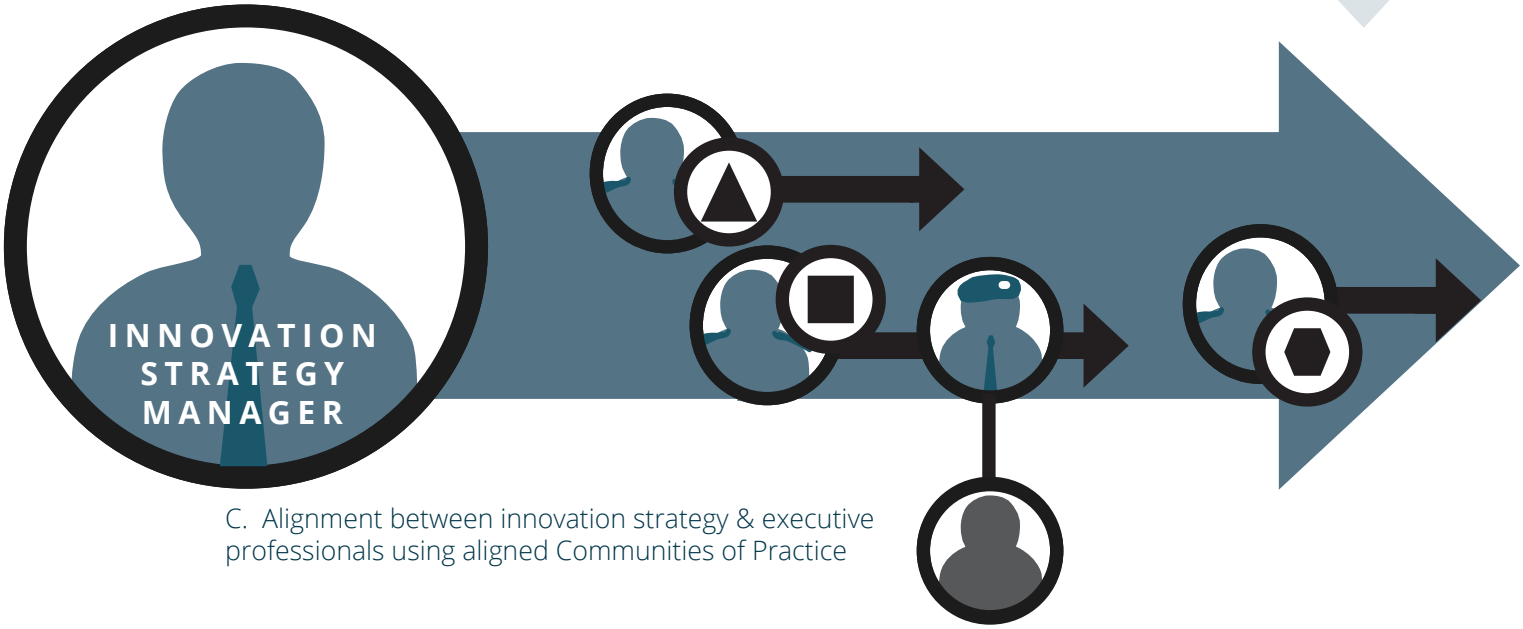
However, if these initiatives interpret the organization innovation's strategy slightly different (silo thinking), these initiatives will innovate in a 'different direction'. This means that many new processes are developed side by side, especially in bureaucratic organizations. Instead of innovation, process delays will occur. This scenario is depicted in Figure 37A. The blue line is the innovation strategy 'the Adaptieve Krijgsmacht', the black boxes represent communities and the black lines, the community members executing the strategy in collaboration with the work floor employees.



A. No alignment between innovation strategy and executive professionals



B. Alignment between innovation strategy and Communities of Practice, but no alignment with executive professionals



C. Alignment between innovation strategy & executive professionals using aligned Communities of Practice

Figure 37: Consistency of innovation strategy implementation at operational level, using Communities of Practice at tactical level.

Figure 37B represents the situation in which the alignment between innovation strategists and COP managers is created but the work floor executives are not involved in the innovation strategy implementation, which eventually leads to deviant behaviour.

To tackle this problem on a large scale, this research investigated how the link can be established between the innovation strategy (strategic level) and the implementation and execution of the innovation strategy at in the work floor (operational level), using the community of practice managers on tactical level (see also Figure 37C).

10.3 Final design presentation: Community Builder Program

One solution is to use communities of practices (COP), where COP managers have three main tasks. This is integrated into a program called Community Builder Program. How this Community Builder Program relates to the alignment between innovation strategies and interprofessional collaboration on operational level can be seen in Figure 47.

First, COP managers have the role to establish the connection between the innovation strategists and the implementation on the working floor, by developing their COP strategy within the preconditions of the innovation strategy and the restrictions that occur at operational level. In this way, COP managers can make the abstract innovation strategy applicable for practice. Secondly, COP management teams have to offer support to the COP members who will work together with other professionals outside the community to share the knowledge. COP managers can facilitate the formation of the collaboration between these two professionals during their first introduction meeting in which they determine the assignment they will be working on and shape their collaboration. Thirdly, community managers must gather feedback from the knowledge sharing and innovation implementation from the workplace and communicate this back to the innovation strategists.

The innovation strategists will receive feedback from multiple management teams of COP feedback with which they can adapt their strategy in strategic steps and communication. Logically, COP management can also adjust the COP strategy to the feedback from the COP members. This solution has been developed in the form of a program, the Community Builder Program.

10.3.1 Guideline: How does the Community Builder Program work?

The Community Builder Program is an integrated program that connects the innovation strategists and COP-managers

Community-Analyser:
- booklet
- model

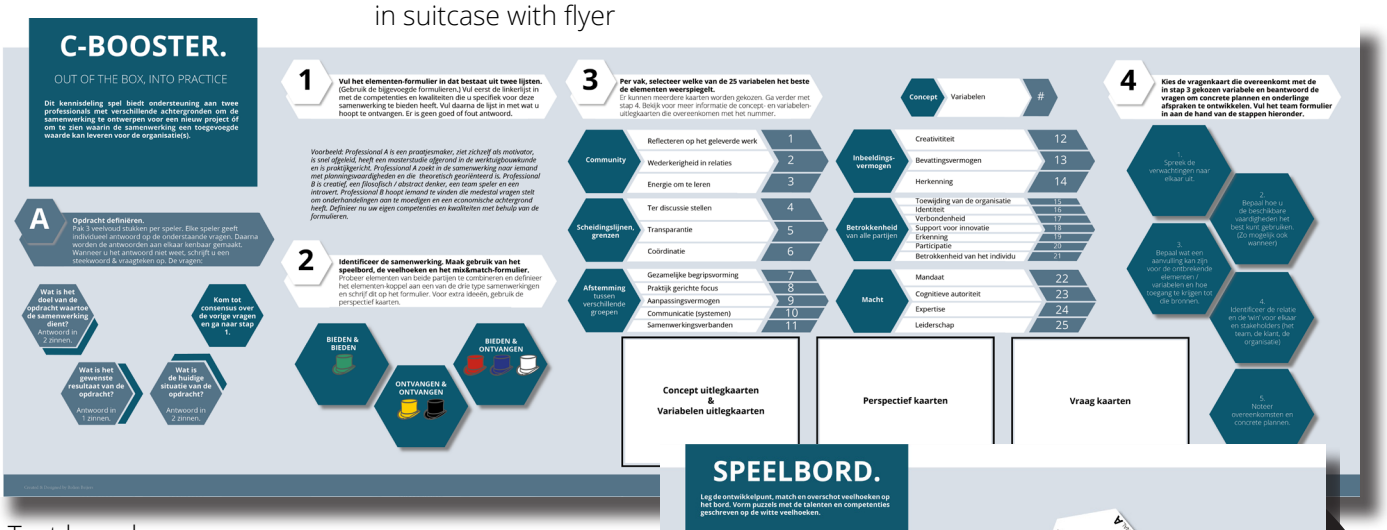
on strategy development with the executive professionals that work as 'boundary spanners' on the working floor. The program's aims are twofold:

- Facilitate innovation strategy managers and COP-managers in the implementation of innovation strategies by using Communities of Practice (as a mechanism to enhance innovation capabilities) in the organization, and;
- Support executive professionals (boundary spanners) with other employees to design their collaborations for knowledge sharing at the work floor to encourage effective collaborations.

By working together, they can provide feedback on the realisation of the innovation implementation strategy via the COP-managers. This (Community Builder Program)

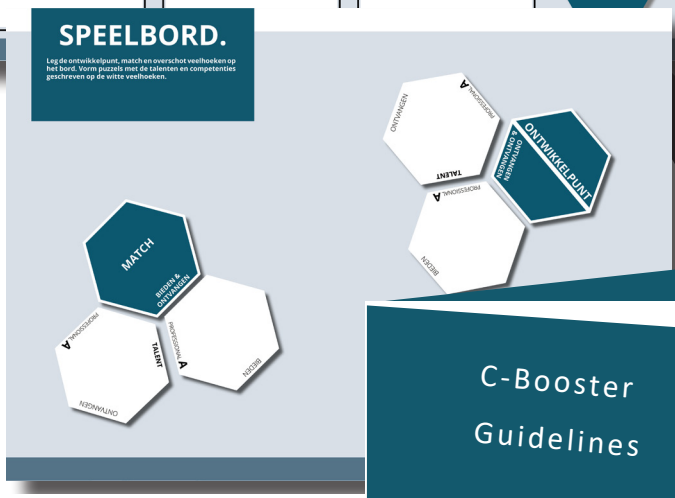
COMMUNITY BUILDER.

Community Builder Progam (contains Community Analyser & C-Booster) delivered in suitcase with flyer

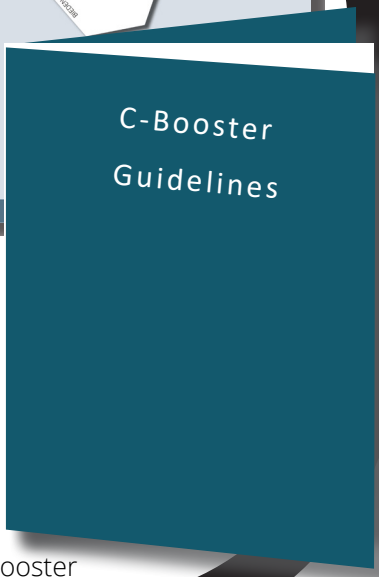


Text board

Cards

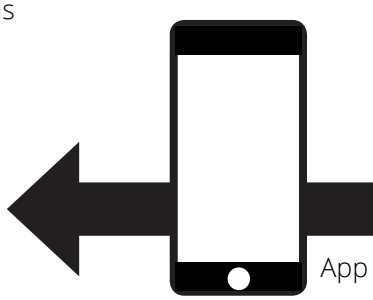


Game board & game hexacons



Booklet C-Booster

C-Booster:
- Text - & game board
- Booklet
- Cards & game hexacons
- App

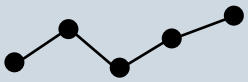


App

Figure 38: Final design deliverables

1 DESIGN INNOVATION STRATEGY

Innovation strategy



Solution: Community of Practice!

INNOVATION STRATEGY MANAGER

Innovation strategy managers use feedback to adapt their innovation strategy to working floor insights.

COMMUNITY

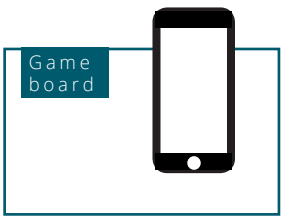
X is not realistic because of ... Y is working fine, we suggest continuing with step Z.

How does the COP function as an innovation mechanism? What should changed in the strategy?

4 COLLABORATIVE FEEDBACK SESSION

COP-managers provide feedback gathered from professionals and present to the innovation strategy managers.

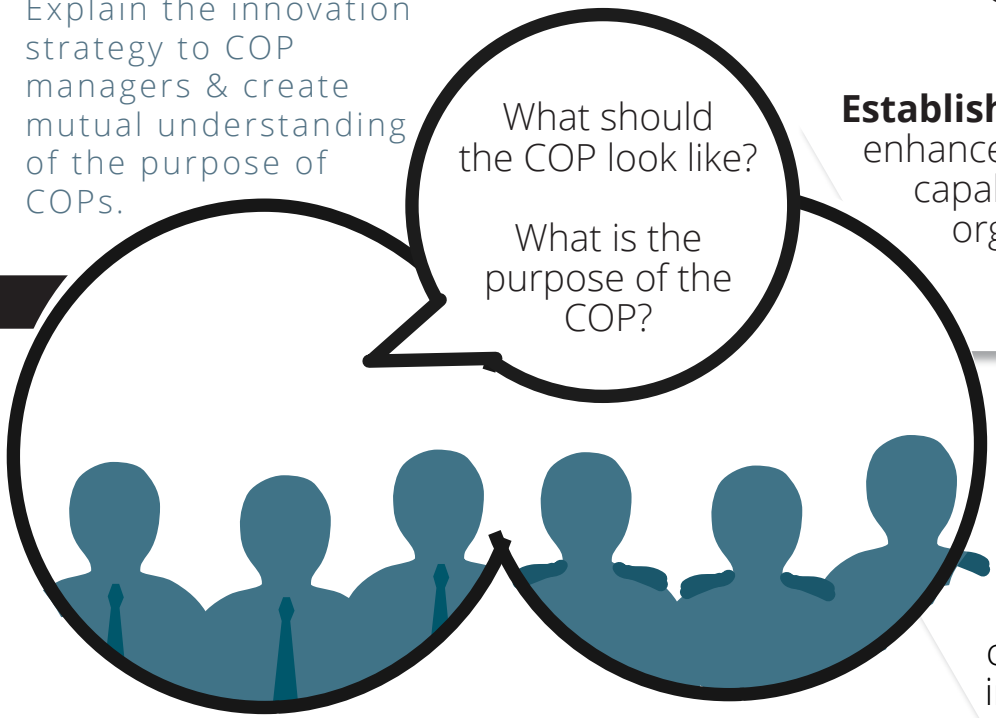
INNOVATION STRATEGY MANAGERS & COP MANAGERS



BUILDER PROGRAM

2 COLLABORATIVE WORKSHOP

Explain the innovation strategy to COP managers & create mutual understanding of the purpose of COPs.



Option A

Establish a community to enhance the innovation capabilities of the organisation.

Option B

Improve the community when members are not engaged or not effectively contributing to the innovation goals of the organisation.

Option C

Maintain the community, but provide more autonomy to the individual professionals.

3 DESIGN COP STRATEGY

Use the Collaboration Analyser form to identify three focus variables of attention which serve the focus areas for strategy development or adaptation.

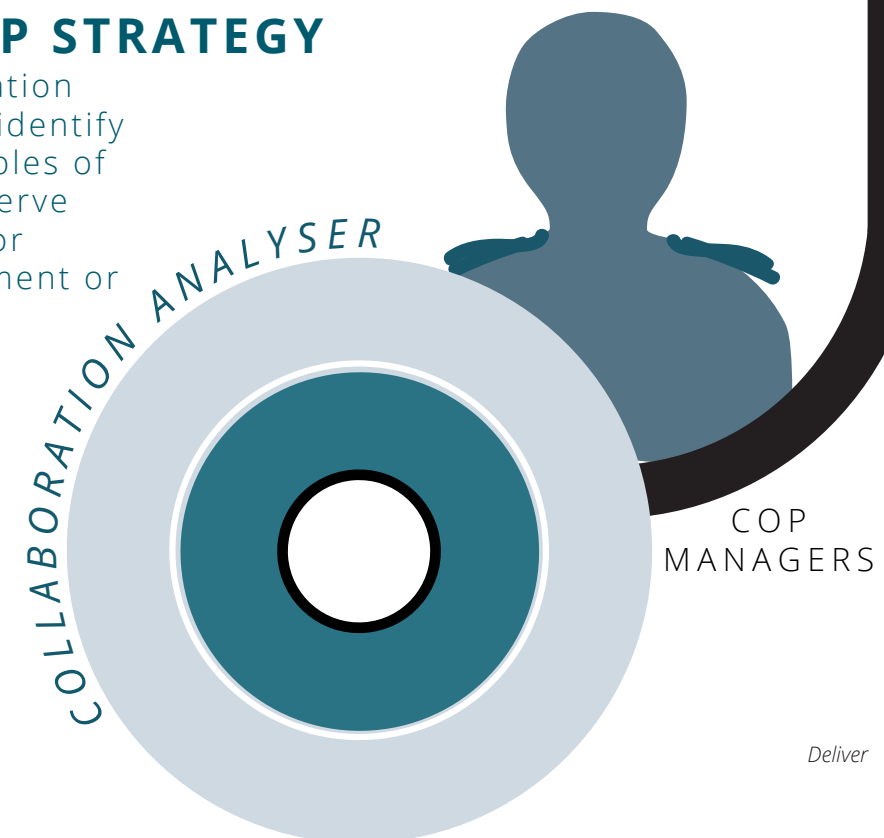


Figure 39: Community Builder Program process steps

process is presented in Figure 39.

The steps that are shown in the Community Builder Program are similar to the steps taken in the OODA-loop model (Boyd, 1987), which is a common model used for decision-making in the MOD (according to pilot interview with participant B). The OODA-loop is deliberately chosen to function as the base for the Community Builder Program to enhance acceptation of the program by current MOD personnel. Figure 40 is depicted to indicate the OODA-loop integrated in the Community Builder Program.

Figure 40 presents how the innovation strategy development corresponds with the "Orient"-step. In this step, the strategy developers orient on internal and external analysis and translate the information in a potential strategy. They will "Observe" when presenting the strategy to the COP managers. The actual translation from the innovation strategy in the purpose of the COP could be compared with the decision-making step with in the OODA-loop. Last, the working floor professionals execute the devised strategy which corresponds with the step of "Acting" in the loop. The insights from the working floor community members will be translated back via the app to the COP managers. When the COP managers have collected reliable and valuable data, they can use this knowledge for their own purposes, as well as for the innovation strategists, whereby the innovation strategists can verify to what extent the strategy proves to be applicable in practice.

In this way the major innovation strategy 'Adaptieve Krijgsmacht' is developed through various initiatives based on community building (such as Defensity College) and put into practice by community members (such as students).

In this way, the interpretation differences of the strategy are likely to be reduced by employees. Eventually, the organisation will innovate as a whole 'in the same direction'. Having the big picture of the Community Builder Program in mind, the next sections will explain every step of the program in depth. During these steps will also be discussed which user is involved. To create an overview of this, Figure 41 is depicted. In the following paragraphs, the steps will be discussed:

Step 1: Designing the innovation strategy
The aim of this step is for the (potential) community of practice managers to become aware of innovation strategy. COP managers should go to information events and get familiar with the network of innovation strategists. Therefore, it is encouraged to keep up to date through network meetings, conferences or subscribe to newsletters. In case of the Ministry of Defence, FRONT is responsible for the connection between the MOD and 'the outside world at large'.

Once / If innovation strategists decide to use communities of practice as innovation mechanisms, (potential) COP managers should initiate to plan a collaborative workshop with both parties involved.

Step 2: Collaborative workshop
The aim of the collaborative workshop is to fully understand the purpose of the innovation strategy and align the goal of the (to be established) community with the strategy of the organisation. At the end of the workshop the following subjects should at least have been discussed:

- (1) Get familiar with the innovation goals of the organisation, the current state of the strategy

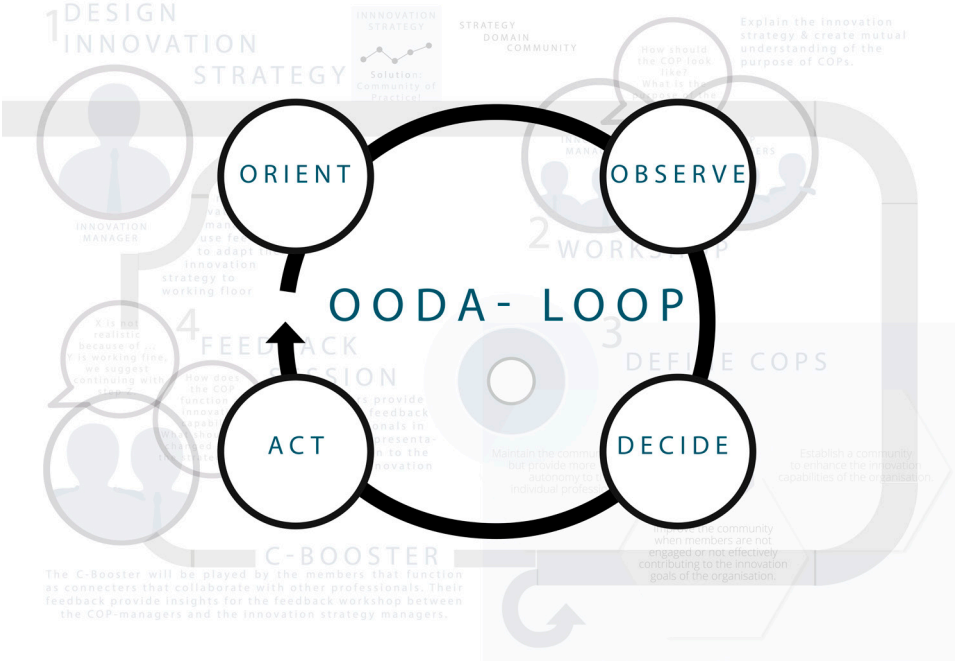


Figure 40: Relation between the OODA-loop (Boyd, 1987) and the Community Builder Program

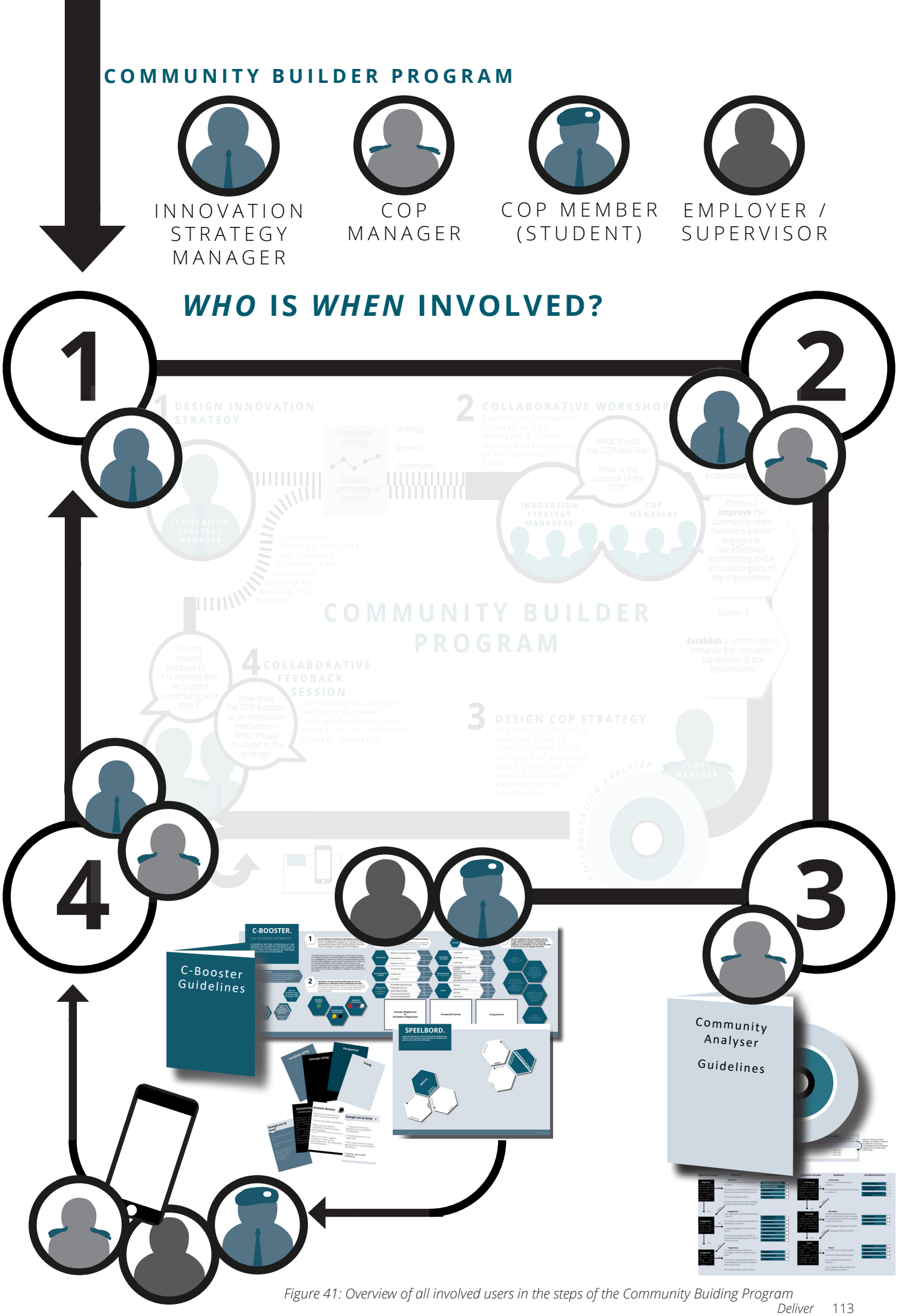


Figure 41: Overview of all involved users in the steps of the Community Buiding Program

execution and potential other communities that are important for your Community of Practice.

- (2) Define, in collaboration with the innovation implementation strategists, which goal the community would serve by answering the following question based on the COP's purpose:
  a) *This COP needs to be established, to serve the following purpose:*
  b) *This COP should be maintained to create stability within the COP over a longer period of time / provide more autonomy to executive professionals / (fill in the reason):*
  c) *The COP should be improved before falling apart as it still serves the purpose of innovation mechanism / the community does not work effectively / the COP works effective but does not provides its contribution to the innovation strategy at large.*

This step is completed when the community's raison d'être is clear for the COP management and it is aligned with the innovation goals of the organisation at large.

Step 3: Design COP strategy
During the third step, the COP-management develops their strategy for their COP based on the Community Analyser. The COP strategy development is the first step to align (all) communities to the larger innovation picture.

The COP management have to start by defining the desired state of the COP and analyse its current state. Then, the Community Analyser form will be used to design the three variables of attention, which functions as the core variables to build their (COP) strategy on. Once the variables are chosen, the managers have to discuss the potential effect of applying the variable into practice and its effect on the bigger picture of the organisations' innovation strategy. (This purpose of this last step is to stimulate managers' comprehension capabilities, e.g. overseeing the cause-effect relationship.)

The last part exists of the COP managers developing the strategy. As there are many tools, such as the GE McKinsey Matrix (portfolio analysis matrix for business units, REF) and the Business Model Canvas, further exploration in tools is considered out of scope.

Given the initial thoughts of a COP (e.g. where people work as professionals who are interested in problem-solving within a specific domain), the strategy can also be developed during an interactive session with community members, but this depends on the COP members' field of expertise.

After the COP strategy is developed, the COP members have to do their 'job'. They start working for employers somewhere in the organisation. For this, they will use the C-Booster, the knowledge sharing game which will be elaborated on, later in this chapter.

Step 4: Collaborative feedback session
The fourth step contains a recap and feedback moment between the COP managers and the innovation strategy managers. During this second collaborative workshop, the different COP management teams present the feedback they retrieved from the executive professionals. After that they should discuss to what extent the COP management adapted their strategy to the insights of the professionals and to what extend the adapted COP strategy is still in line with the larger innovation strategy.

The feedback of the COP managers can be used to adapt their roadmap for implementing their strategy.
To illustrate, if it turns out that multiple COP management teams struggle to apply the innovation strategy into practice, the innovation managers can postpone the next step of the strategy or adjust the communication so that it becomes clearer what is expected of the COP managers. That brings us back to the first step of the loop where the innovation managers design their strategy.

Having explained all steps, in the following sections the Collaboration Analyser required for step 3 "Design COP strategy" will be discussed, followed by the C-Booster. This C-Booster should be used between steps three and four by the executive professionals to gather feedback for the COP management teams. Finally, the mobile application (App) will be explained. The app is used to integrate the feedback from the COP members and can be used as input for the COP management, as well as for their own professional development to become adaptive experts.

10.4 Community - Analyser (model)

The Community-Analyser is the form, based on the model (defined in chapter 6) to help COP-managers to build, maintain and improve communities of practice by facilitating them to define the variables of attention required for the strategy development. The Community Analyser will be explained based on its final appearance: Figure 42.

The depicted form guides COP managers through the process of defining variables that require attention that influence interprofessional collaboration. The model will be explained based on the content and the interface (based on the design criteria).

10.4.1 Content

COLLABORATION ANALYSER

1. Community name:

2. Focus on: establishment / maintainance / improvement

3. Define the community's variable of attention.
Use the flowchart. Start at the black boxes. If the answer is no, discuss the questions. If the answer to the question is no, move to the blue box and tick the box: this is your variable of attention.
The questions are formulated as 'closed questions' to encourage discussions between opponents and proponents.

4. Choose the 5 - 8 most important focus areas for the community. Discuss the following questions:
a) Do we consider variable X as critical for knowledge sharing and knowledge implementation?
b) Does focussing on this variable contribute to the innovation strategy?

5. Write down your strategy variables.
Look at the 5 -8 variables and specify by discussing the 3 most important variables that will form the basis of your strategy. To which concept are they related?

1) Concept:
2) Concept:
3) Concept:

Make sure that your chosen variables are related to maximum two different concepts (e.g. acknowlegdement & participation [engagement], learning energy [community])

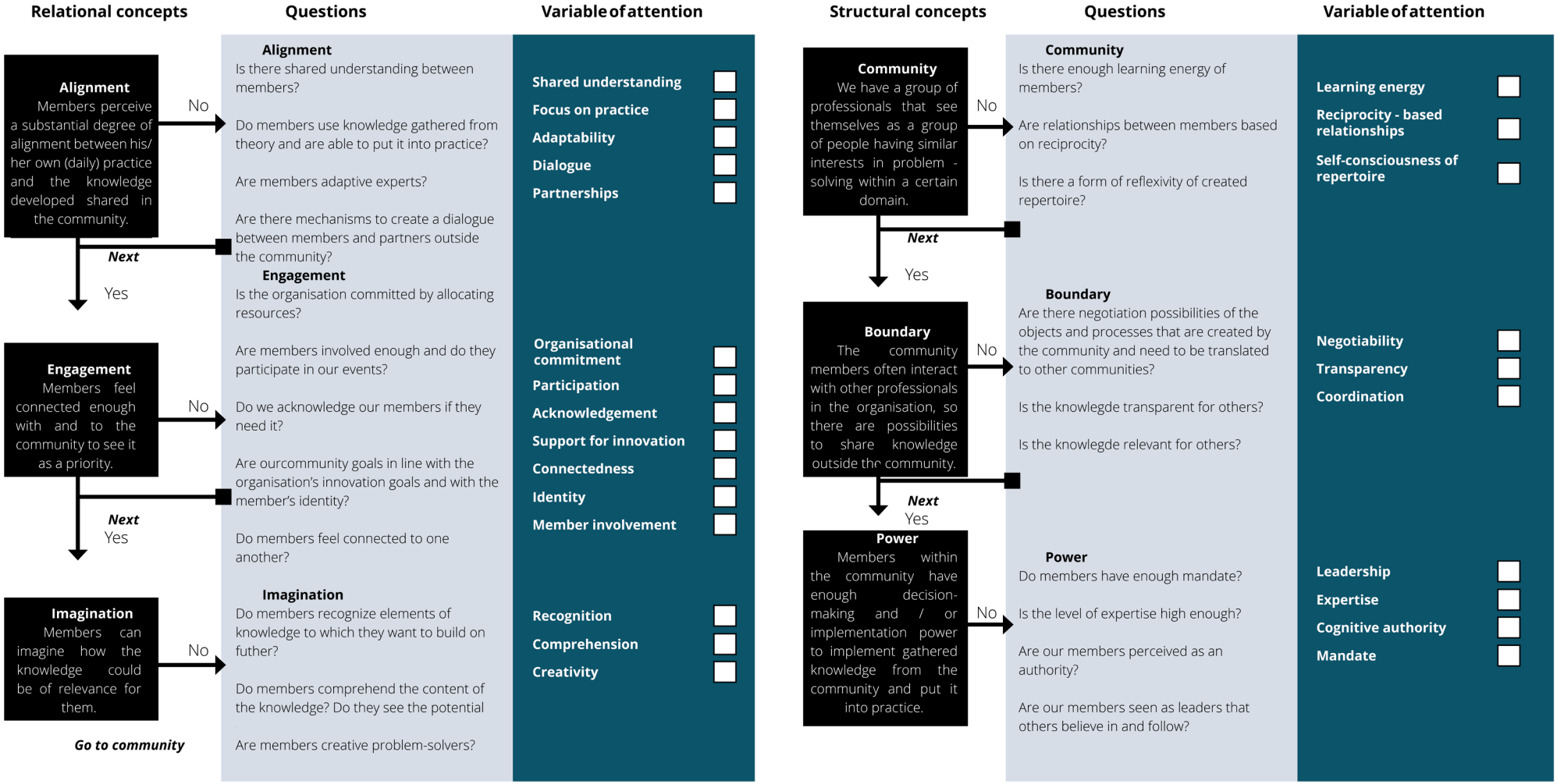


Figure 42: The Collaboration Analyser translated in a form to be used by COP-management teams

The form is based on the model discussed in chapter 6 and captures the six concepts of the COP theory (community, alignment, engagement, imagination, boundary and power) and the 25 factors that influence interprofessional collaboration found in the literature study. Furthermore, it explains the variables retrieved from conversations with participants and managers of Defensity College's program, using the probing technique.

With regards to the model, the additional questions are developed to guide COP management teams through the discussion and decision-making process to define three variables they have to build their strategy on.

10.4.2 Design criteria

The design criteria were listed to find a suitable presentation of the model so it serves the goal of facilitating COP management teams with a model that can indicate which factors influence interprofessional collaborations in COPs. It also should support the management in their discussion which of those variables require most attention in their COP strategy to establish, maintain or improve their COP so it contributes to the innovation goals of the organisation. Thus, has to stimulate the discussion about all concepts and variables. Hence, the interface should do the following:

- The Collaboration Analyser must be used during team meetings
- It should provide a way to guide teams through a structured discussion
- It should not require a facilitator, meaning it has to be easily understood
- It must facilitate the discussion which variables require attention in such a way that all concepts and variables of the model will be passed

Therefore, it was decided to keep the interface as simple as possible, so it could be shared easily and could be used as a support tool.

10.4.3 Interface

The model is presented as a one pager form that contains five questions / short assignments and a flow chart with 'closed questions'.

As depicted in Figure 42, five questions/ short assignments have to be filled in using the flowchart. The flowchart starts at the left upper corner with the black boxes, corresponding with the first ring of the model (six concepts; community, engagement, imagination, alignment, boundary and power) and a statement that can be answered with yes or no. If no is chosen, the team have to answer every question in the second column with yes or no. When considered 'no', the box with the variable should be ticked. Then the second black box will be discussed. The steps will be repeated until the last box is discussed.

The next step is to consider assignments that are relevant for domain development and establish collaborations between COP members and other professionals. The C-Booster will facilitate the process of collaboration design between two professionals on micro level.

To conclude, with to use the Collaboration Analyser the COP management team should follow the five steps on the form to indicate the three variables for their COP strategy. Once they have discussed the form and found a consensus about the three core variables of attention, they can design their strategy around it.

10.5 C-Booster (tool)

Between the third and fourth phase of the Community Builder Program, the COP members have to work on assignments with other professionals within the organisation. To support the COP members in the 'design phase' of their collaboration with other professionals (especially with their employers, higher in rank), the C-Booster is developed. First the final design of the tool is presented in Figure 43. Thi includes a game board, text board, hexagon pieces and cards.

The *text board* is presented in Figure 52, Figure 53, Figure 54, Figure 55 and Figure 56. (Note: As the presentation of the game requires 5 pages, the the figures are presented at the end of this chapter). Subsequently, the working principle of the game will be explained. Next, the C-Boosters' integration in the Community Builder Program is explained.

The C-Booster is a knowledge sharing game designed to facilitate the discussion between two professionals during the design phase of a n ew collaboration for a (new) assignment. One of those professionals is the COP member (student, employee). He or she is subordinate to the organisational hierarchy with respect to the other professional (employer).

The C-Booster is comprised by the cards (which can be seen in Figure 51 and all cards can be found in appendix C), text board, game board, hexagon pieces and whiteboard markers and exists of five steps which can be viewed as designing the 'course of action' for the collaborators.

10.5.1 Conceptual background of tool

The concept of the "Course Of Action" is a commonly used method in the MOD. In military terms, the course of action follows (amongst other things) from the consequences of

the analysis of the assignment. These consequences can include restrictions and possibilities imposed, the aims of the of the two next-highest commanders (1up and 2UP); and the self-determined choice criteria, in which use is made of own knowledge and experience and that of the unit.

10.5.2 Using the C-Booster

On a more conceptual level, this 'course of action' is applied in the five steps (step A followed by respectively step 1 - 4) that can be depicted on the text board.

Step A: Defining the assignment.

During the first step (A) the assignment (Figure 52) will be established and/or there has to be agreed upon (consensus) by both professionals. This will be done by understanding the 'purpose of the assignment' and by defining the 'desired state' (e.g. when would the assignment successfully completed?) and the current state (e.g. what is the current situation in which the professionals are located?).

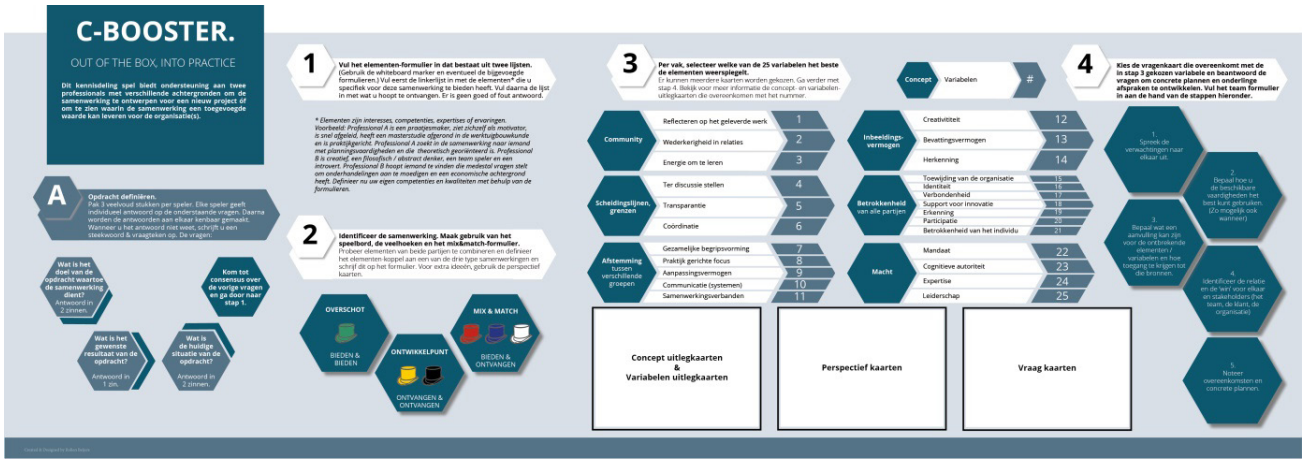
Step 1: List your own competences, interests, expertise and experiences (these together form a list of 'elements').

In this step, (Figure 53) both the professionals write down what they offer and what they aim to receive during the collaboration. All competences have to be written down on the two 'elements forms'. (Students can use their conducted psychological test as a base, employers are considered to have more experience and know their own elements.)

Step 2: Identify the most effective collaboration (while building trust).

During this step (Figure 53), the professionals are supposed to use the perspective cards as a means to help them defining the most effective collaboration while building trust. The process is presented in Figure 44 (on the next page).

There are three options; mix&match (one offers, the other receives), surplus (both offer) or development point (both aim to receive). Use the game board, the hexagon pieces to mix and match the elements from the previous step and the perspective cards. In this step, the professionals have to discuss to what extent they see matches, surpluses



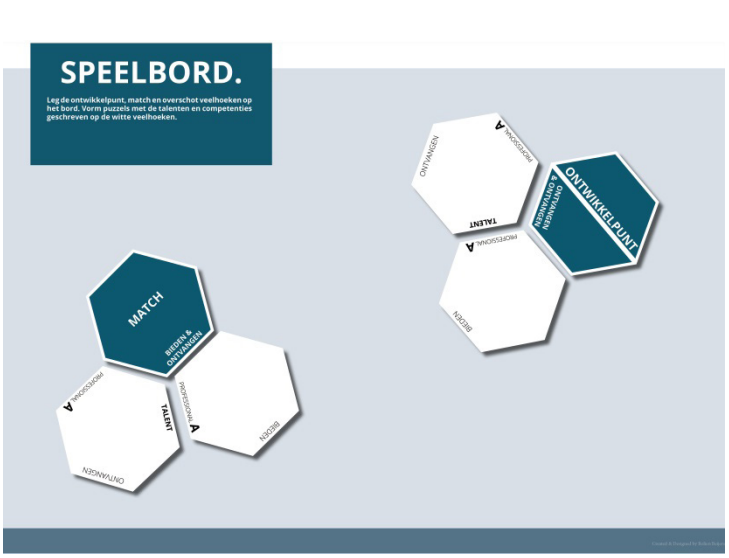
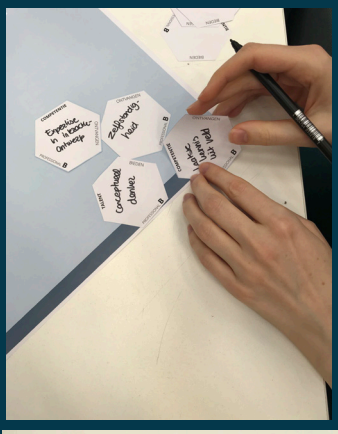
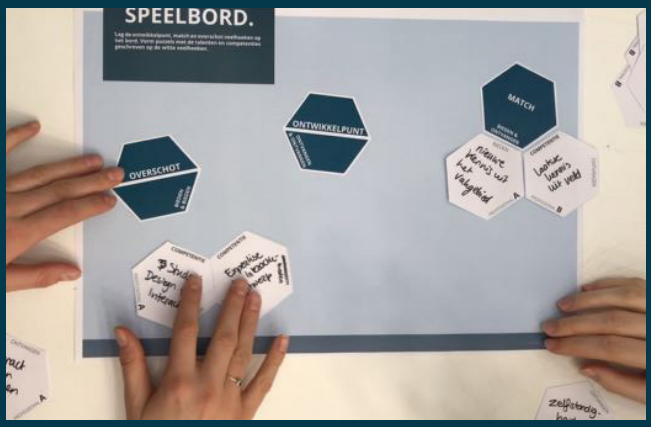


Figure 43: The C-Booster (text board, game board, hexagon pieces and cards)

The C-Booster in use





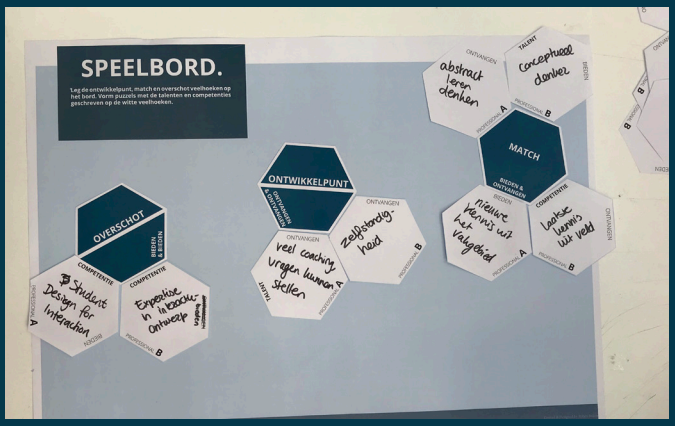


Figure 44: Execution of the game, step 1 and 2

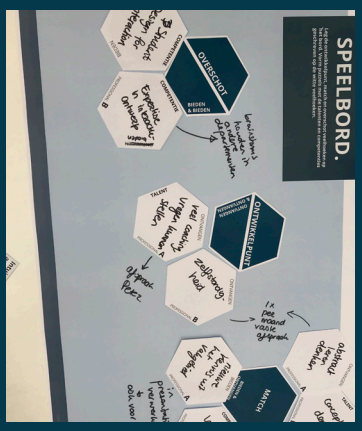


Figure 45: Execution of the game, step 3 and 4

or development points while using the game board, the hexagons, the perspective cards and the whiteboard markers. In this interactive step, the assignment is build up in such a way that the professionals are already creating an experience in which they have to cooperate in a creative, innovative way (Figure 44). This contributes to building trust.

Through the interactive shifting of the hexagons on the board, the professionals can create various possibilities. The sub-step ends when three blue hexagons with 'mix & match', 'surplus' or 'development point' are surrounded with white (completed) hexagons with elements (both offer and receive) filled in by the professionals. If the professionals are satisfied with the result, they have to look for the most effective collaboration in a collaborative and creative way. They do this by using the perspective cards and writing the outcomes of the ideas on the board (write clearly for readability!). The use of the perspective cards will be explained:

- For 'mix & match', use the blue card (process control), white cards (facts and data) and the red (intuition) card. The aim is to see what the 'unique selling combination' is of the collaboration between these two professionals for others, such as partners, stakeholders and the community (using the red card). The white card helps to remember the professionals of previous collaborations based on facts and data and how these insights could be used in this collaboration. The blue card helps to think about the entire process (the assignment in the larger picture) and in which part the collaboration would be most effective.
- For the 'surplus' the green (creative) card is supposed to be used. This card helps in the search for alternative options or scenarios in which the elements could be applicable. Think of a surplus of creative people. They do not help at a department where process optimization has to be achieved but can they might be of use if they will be divided over other departments where new ideas have to be devised.
- Finally, for the 'development points', the yellow (positive) and black (negative) cards can be used. For elements that both parties hope to find in the collaboration, but which are not available, it can be questioned to what extent that would cause problems by putting the development point in a brighter light. An example of this is: "our lack of these elements will not cause a problem, as these elements where not required in a comparable assignment in department X". On the other hand, a completely negative scenario can be outlined by asking to what extent the lack of elements delivers issues later in the collaboration (black card). An example is "without this expertise or competence we will get stuck immensely or cannot solve the problem at all".

To conclude, take a photo of board which should include the writings outcome of the discussions and the three sets of options and convert the photo directly into the app if possible.

Step 3: Relate the defined collaboration to all required facets of interprofessional collaboration
In this step, the professionals link their insights to various facets of interprofessional collaboration by selecting one of the 25 variables that best reflects the element couple. As this is considered a difficult step, multiple variables can be chosen for each element couple.

Step 4: Define mutual agreements and next steps for the effective collaboration
In this step, the questions cards corresponding with the chosen variables in step three will be discussed and answered in form of mutual agreements and concrete next steps (see Figure 45).

The mutual agreement and concrete next steps can be developed by:

- (1) Express expectations to each other.
- (2) Determine how to best use the available elements-couples in the collaboration and if possible, when.
- (3) Determine what can be an addition to the missing elements / variables and how to gain access to those required resources.
- (4) Identify the relationship and the 'win' for each other, the stakeholders (the team the customer and the organization).
- (5) write down the agreements and concrete plans on the form or link directly to the app if possible.

Understanding the purpose of the C-Booster and knowing how it should be used in practice, the next section explains how the C-Booster is integrated within the program.

10.5.3 C-Booster in program

The C-Booster is incorporated in the Community Builder Program during the introduction meeting between two professionals in which they establish their collaboration and their assignment. In Figure 46 can be found which steps have to be taken to incorporate the C-Booster in the Community Builder Program.

HOW THE C-BOOSTER FITS IN THE PROGRAM

COP MEMBER

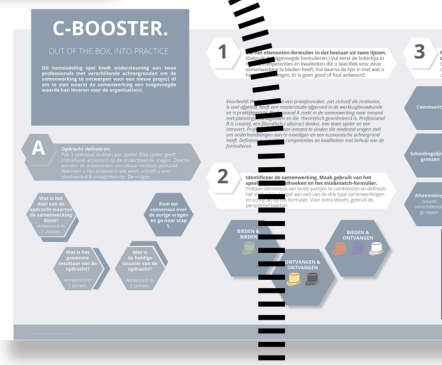
Resume and letter of motivation

LinkedIn ENDORSEMENT

END OF COLLABORATION

Write in app:

1) feedback for COP
2) endorsement for the other professional
3) suggestions for future professional development of student / nominate supervisor for rewards



EMPLOYER / SUPERVISOR

Figure 46: The C-Booster process

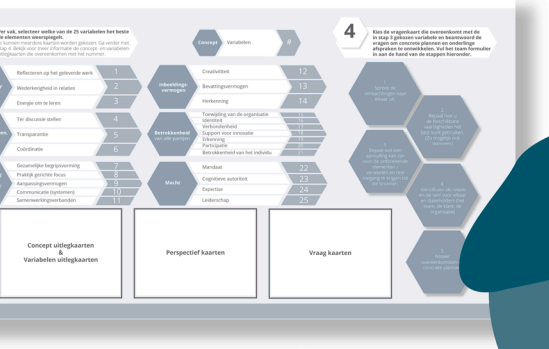
Students take psychological test indicating interests, competences, expertise and experience

COP MANAGERS (HR / PSYCHOLOGISTS)

COP MEMBER

The mutual agreements and concrete next steps collected are to be found in the App

INTRODUCTION MEETING (MIX&MATCH)



COP MEMBER

DURING THE COLLABORATION

The COP member already sent its resume and letter of motivation during to application for the DC program. If the student is hired, the student has to do a psychological test to identify his or her interests, competences, experiences and expertise, download the app and create a profile. The test results will be discussed during a meeting with the COP management, a HR manager or psychologist within the COP. Thereafter, the information will be added to the app. If there will be a match between the student and an assignment created by an employer, the HR manager will invite both parties to the introduction meeting. During the introduction meeting, the employer and student will use the C-Booster. The results will be collected in the app, after which the student starts to work at his assignment. Over the period of the collaboration, both professionals receive periodic app updates to verify how the mutual agreements and concrete steps are put into practice. After the collaboration, both parties receive an app request to fill in three points for development.

- The *student* is asked to fill in: 1) feedback for the COP (Defensity College), 2) an endorsement for the employer and 3) a nomination for his / her supervisor for rewarding moments (such as the yearly prom evening of Defensity College).
- The *employer* is asked to fill in: 1) feedback for the COP, 2) endorsement for the student and 3) suggestions for the students' further professional development.

To conclude, the benefits for using the C-Booster are three-fold:

- (1) the student continually works on its professional development and collect feedback from those he/ she directly works for.
- (2) the supervisor will be endorsed by its employees.
- (3) Defensity College collects feedback on how the innovation strategy is implemented in practice by those who actually do the work.
- *In addition,* the endorsements can be shared on their LinkedIn page to create personal awareness and build on their credibility as professionals.

In the next paragraph the design brief for the app is presented as a support system for the Community Builder Program.

10.6 App (mobile application)

In this section, the design brief for the App is described using Figure 49 and Figure 50. The app provides the connection between the COP members, COP managers and the employers from the organisation. In Figure 50 and Figure 50 can be seen which steps the app should contain per user per phase (prior to the meeting, during the introduction meeting, during the collaboration and at the end of the collaboration).

However, for the app development, a User Interface (UI) designer (external), User Experience (UX) designer, an app developer (from JIVC), a jurist and a scrum master (could also be JIVC) should be hired. The UI and UX designer have to do a user research how the app should be working in detail. The app developer designs the back end of the app in collaboration with the jurist's insights on data confidentiality. The scrum master facilitates sprints to design the app using all the capacities of the other team members.

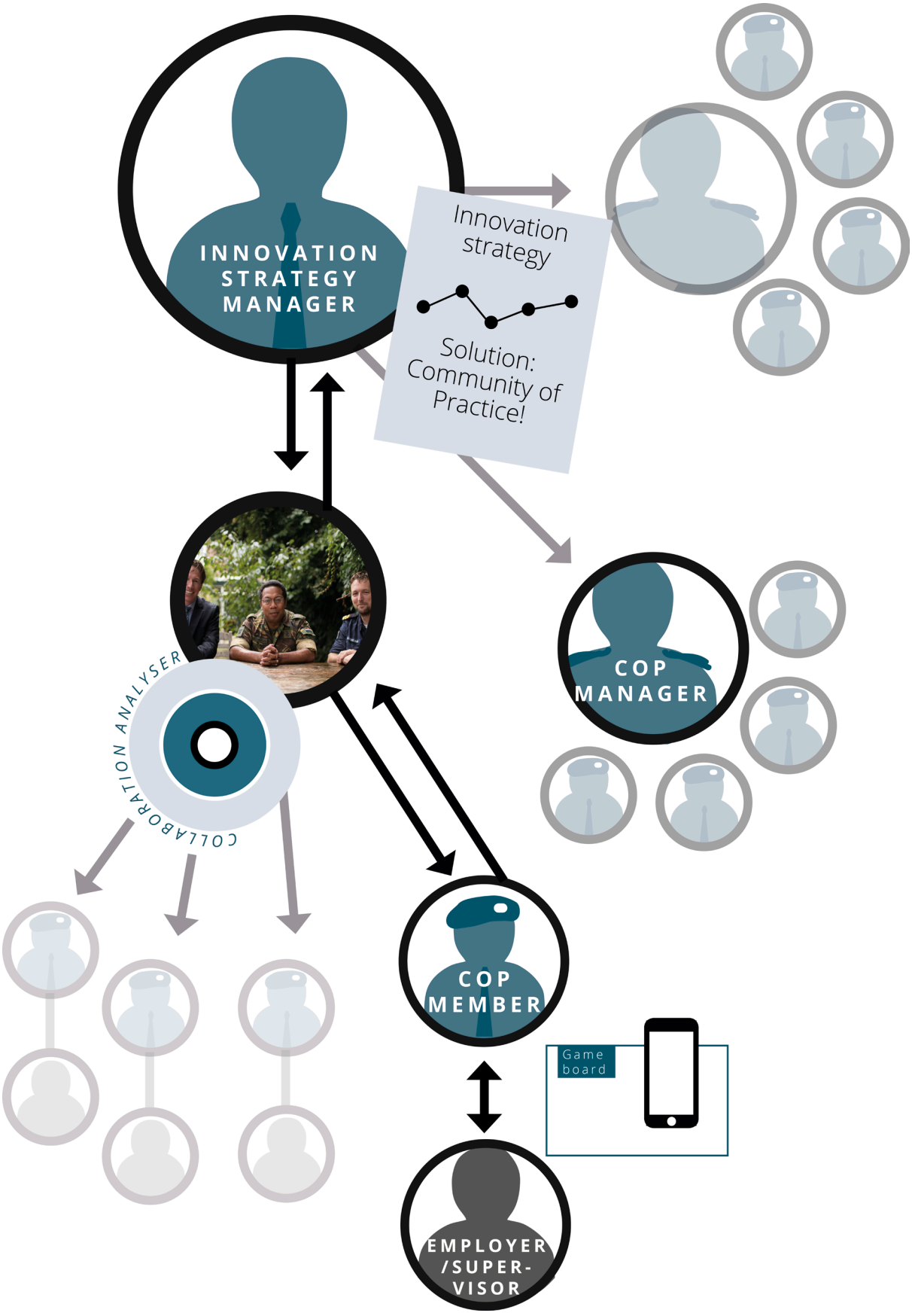


Figure 47: Usage of the Collaboration Analyser, C-Booster and App in relation between the innovation stategy designed on strategic level, Communities of Practices (management teams) at tactical level and the Community members on operational level.

10.7 Conclusion

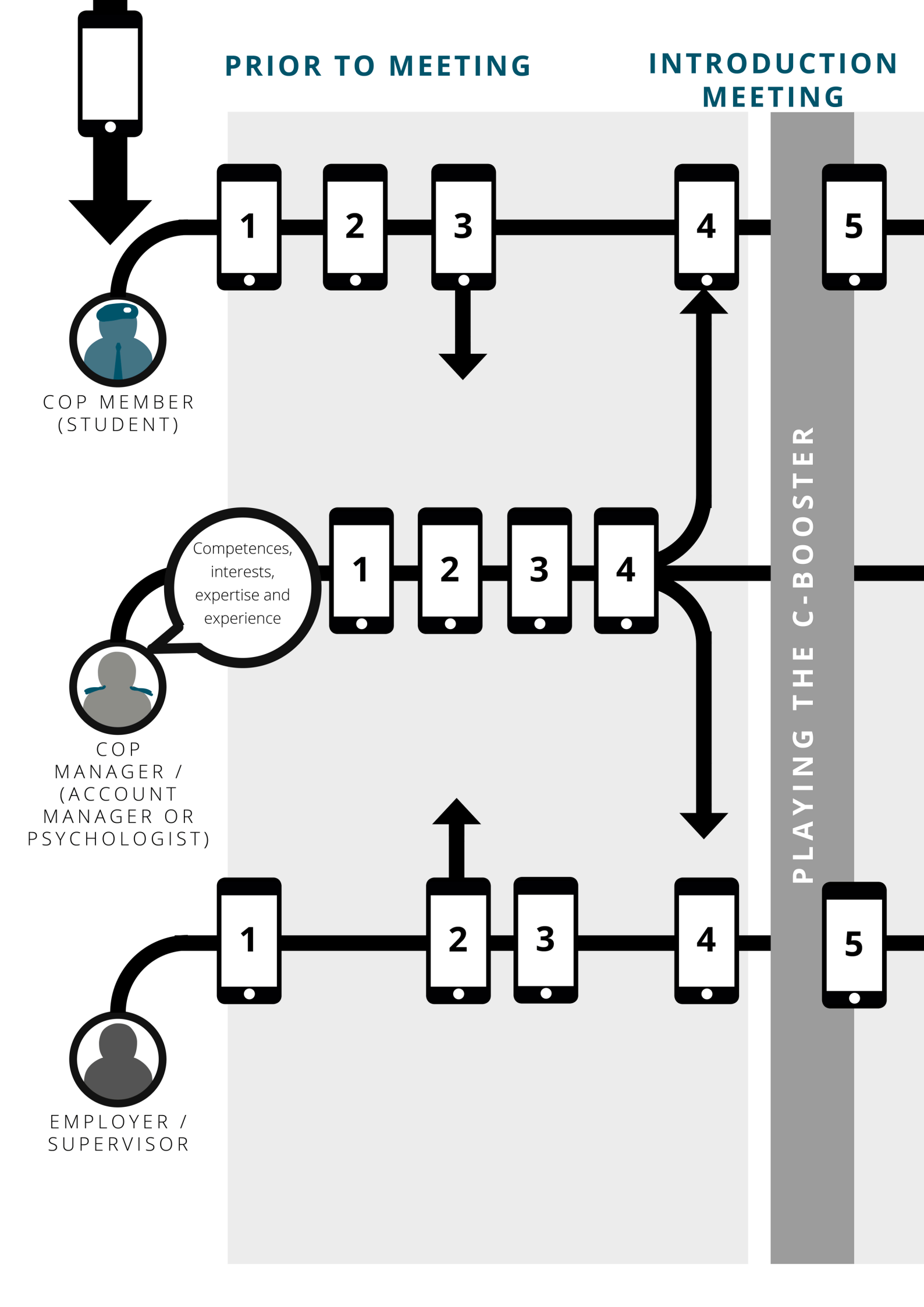
In this chapter, the final design that will be presented to Defensity College is shown. This lead to answering the fifth sub questions: **How does the final design work?**

The final design is called the Community Builder Program (Figure 38) consists of the Collaboration Analyser (Figure 42), the C-Booster (Figure 43) and a design brief for a mobile application (Figure 49 and Figure 50) that should be developed in the near future. The app is supposed to be designed as a tool to provide a connection to the game and the CRM system of Defensity College so their account-managers can keep track of the collaboration and the students (boundary spanners). Obviously with approval of both professionals. The Community Builder Program (CBP) consists of four steps for COP-managers, see Figure 39. The steps are as follows;

- Keep up to date with design innovation strategy. Once the strategists decide to use COPS as innovation mechanism
- Plan a collaborative workshop, in which the COP managers align the goal of the community with the innovation (implementation) strategy of the organisation.
- Based on the COP's purpose, the management should C) design the COP strategy (C1), based on the 'Collaboration Analyser', then the collaboration within and between the COP should be built on micro level, using the 'C-Booster' (C2). The mutual agreements and concrete steps will be recorded in the application (C2), which sends a periodic reminder to the professionals to validate their actual cooperation (C3). The generated data can be translated into a visual data presentation (C4).
- The COP-managers can present the data to the innovation strategy managers, who, at their turn, can adapt their innovation strategy (which should contribute to the 'Adaptieve Krijgsmacht') to working floor feedback.

By succesful execution of the Community Builder Program (CBP), the innovation strategy should be implemented correctly. Proper use of the CBP' tools can be in Figure 47. Having presented the final design, the next chapter describes the implementation plan including a roadmap.

Figure 48: Foto of final design in use (with prototype of cards)


PRIOR TO MEETING
INTRODUCTION MEETING
1
2
3
4
5
COP MEMBER (STUDENT)
Competences, interests, expertise and experience
1
2
3
4
COP MANAGER / (ACCOUNT MANAGER OR PSYCHOLOGIST)
1
2
3
4
5
EMPLOYER / SUPERVISOR
PLAYING THE C-BOOSTER

EXPLANATION STEPS

1 Create profile

2 Accept data & competences retrieved from DC

3 Search for database assignments

4 Accept 'match' with employer and accept data option for a 'mix&match' introduction meeting

5 Fill in mutual agreements and concrete made steps

5

1 Accept profile and have conversation with student based on phsychological test

2 Fill in data and competences based on discussion with COP member

3 Accept assignment provided by employer

4 Accept match and plan meeting for the introduction meeting

5 Accept list of mutual agreements & next steps and send to CRM system.

1 Create profile and add assignment

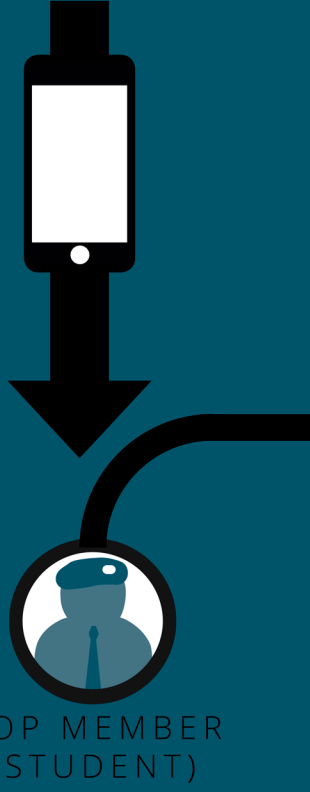
2 Search student profile

3 Accept 'match with student'

4 Accept data option for a introduction meeting

5 Accept mutual agreements & concrete made steps

EXPLANATION STEPS



COP MEMBER (STUDENT)

6 *To what extent is mutual agreement X complied with? When would you have been satisfied? What rating do you give now? Do you want to request a meeting with DC? Do you want to change the mutual agreement?*

7 Fill in:
1. Endorsement for supervisor
2. Feedback DC
3.Optional: Nominate supervisor

8 Accept endorsement and accept endorsement being shared on LinkedIn

COP MANAGER / (ACCOUNT MANAGER OR PSYCHOLOGIST)

6 Send reminder questions. Exponential decrease of reminders being sent

7 Send endorsement list

8 Gather feedback for COP strategy and innovation strategies

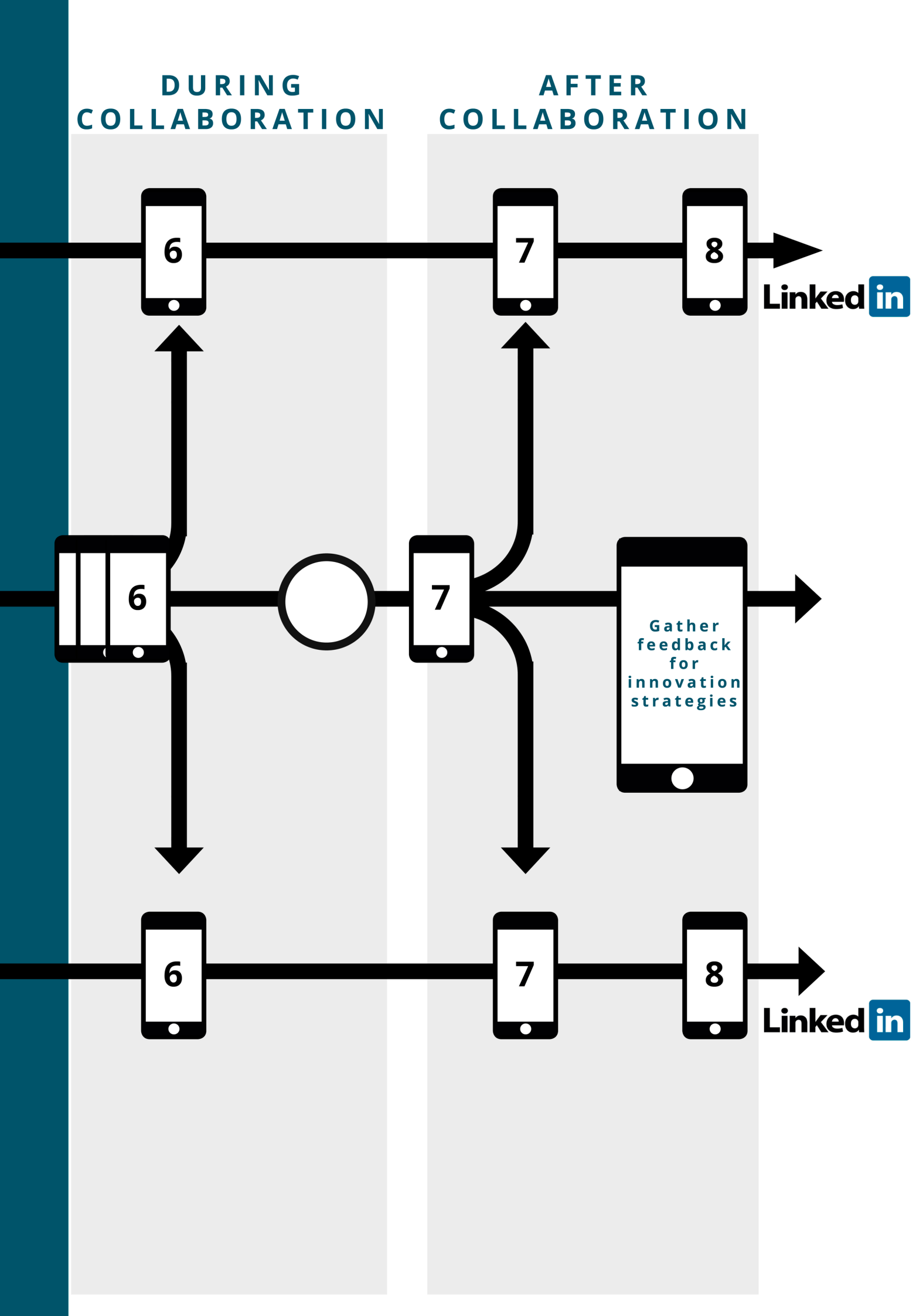
EMPLOYER / SUPERVISOR

6 *To what extent is mutual agreement X complied with? When would you have been satisfied? What rating do you give now? Do you want to request a meeting with DC? To what extend is student performing according competence X?*

7 Fill in:
1. Endorsement for student
2. Feedback DC
3. Suggestions for students' future professional development

8 Accept endorsement and (being shared on LinkedIn)

Figure 50: Design brief of app (2/2)


DURING COLLABORATION
AFTER COLLABORATION
6
7
8
LinkedIn
6
7
Gather feedback for innovation strategies
6
7
8
LinkedIn

Concept uitleg

Variabele uitleg

Perspectief

Vraag

Community
Community

Communities zijn bouwstenen van het 'sociaal leren'. Deel uitmaken van een community stelt ons instaat om onszelf te definiëren door de samenstelling van bepaalde competenties in een bepaalde context: Een betrouwbare

Energie om te leren 3

1. Bereidheid om kennis te delen.

2. Bereidheid om kennis te zoeken.

3. Er zijn specifiek tijd en middelen toegewezen aan persoonlijke en professionele ontwikkeling.

Kritisch denken

Wat kunnen hindernissen zijn tijdens onze samenwerking?

Hoe zou dat anderen beïnvloeden?

Welke soorten projecten / opdrachten moeten we buiten scope houden?

Energie om te leren 3

1. Hoeveel tijd moeten wij besteden aan 'vak-specifieke ontwikkeling'?*

2. Hoeveel tijd wordt er voor vrijgemaakt?

3. Hoe houden we onze mensen gemotiveerd om zichzelf te blijven ontwikkelen?

** Expertise / persoonlijke ontwikkeling*

Figure 51: Example set of cards

C-BOOSTER.

OUT OF THE BOX, INTO PRACTICE

Dit kennisdeling spel biedt ondersteuning aan twee professionals met verschillende achtergronden om de samenwerking te ontwerpen voor een nieuw project óf om te zien waarin de samenwerking een toegevoegde waarde kan leveren voor de organisatie(s).

A

Opdracht definiëren.
Pak 3 veelvoud stukken per speler. Elke speler geeft individueel antwoord op de onderstaande vragen. Daarna worden de antwoorden aan elkaar kenbaar gemaakt. Wanneer u het antwoord niet weet, schrijft u een steekwoord & vraagteken op. De vragen:

Wat is het doel van de opdracht waartoe de samenwerking dient?
Antwoord in 2 zinnen.

Kom tot consensus over de vorige vragen en ga door naar stap 1.

Wat is het gewenste resultaat van de opdracht?

Antwoord in 1 zin.

Wat is de huidige situatie van de opdracht?

Antwoord in 2 zinnen.

Figure 52: Text game board, step A (1 / 5)

Created & Designed by Rolien Beijers

1 **Vul het elementen-formulier in dat bestaat uit twee lijsten.** (Gebruik de whiteboard marker en eventueel de bijgevoegde formulieren.) Vul eerst de linkerlijst in met de elementen* die u specifiek voor deze samenwerking te bieden heeft. Vul daarna de lijst in met wat u hoopt te ontvangen. Er is geen goed of fout antwoord.

** Elementen zijn interesses, competenties, expertises of ervaringen. Voorbeeld: Professional A is een praatjesmaker, ziet zichzelf als motivator, is snel afgeleid, heeft een masterstudie afgerond in de werktuigbouwkunde en is praktijkgericht. Professional A zoekt in de samenwerking naar iemand met planningsvaardigheden en die theoretisch georiënteerd is. Professional B is creatief, een filosofisch / abstract denker, een team speler en een introvert. Professional B hoopt iemand te vinden die medestal vragen stelt om onderhandelingen aan te moedigen en een economische achtergrond heeft. Definieer nu uw eigen competenties en kwaliteiten met behulp van de formulieren.*

2 **Identificeer de samenwerking. Maak gebruik van het speelbord, de veelhoeken en het mix&match-formulier.** Probeer elementen van beide partijen te combineren en definieer het elementen-koppel aan een van de drie type samenwerkingen en schrijf dit op het formulier. Voor extra ideeën, gebruik de perspectief kaarten.

Figure 53: Text game board, step 1 and 2 (2 / 5)

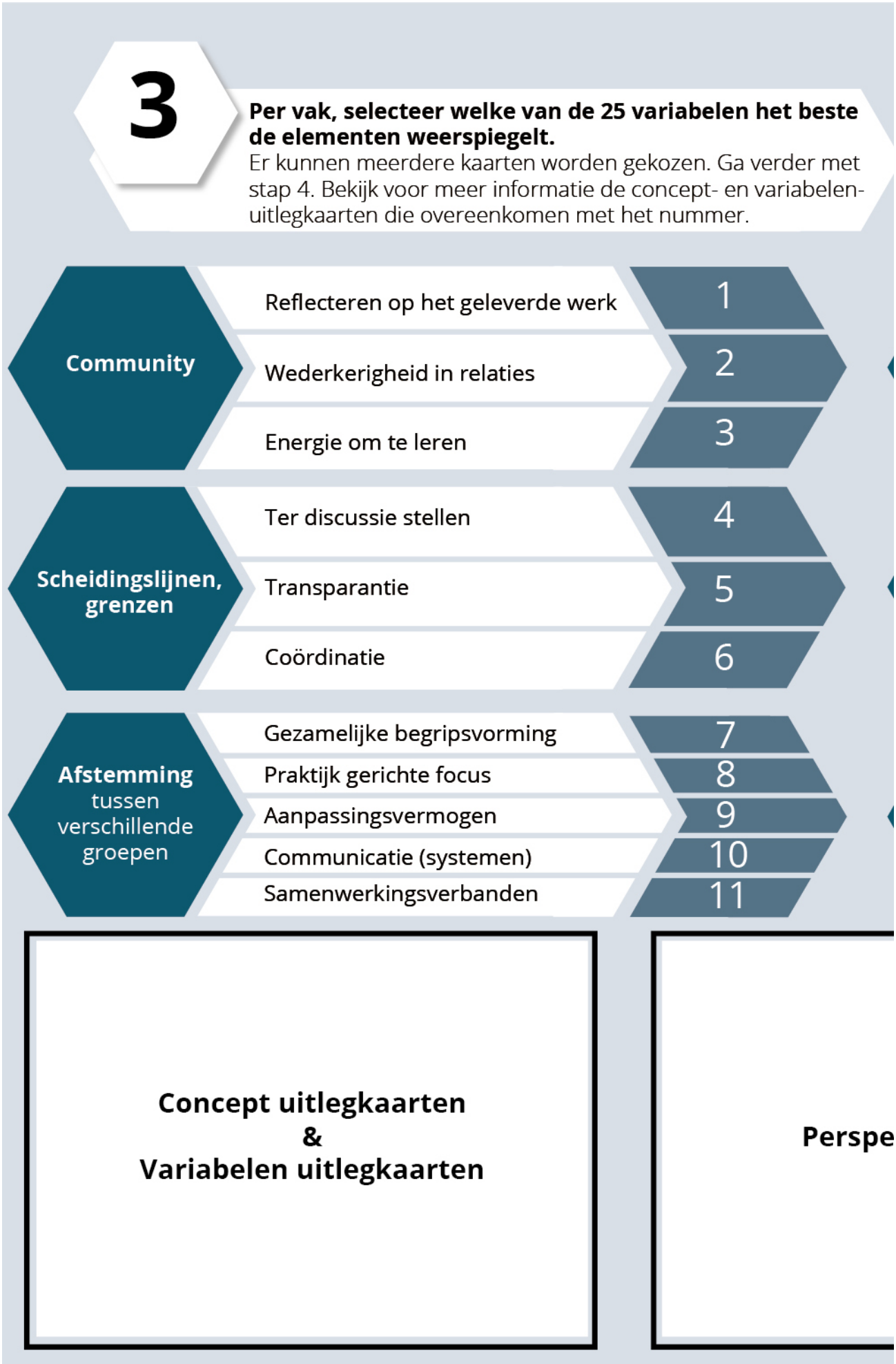


Figure 54: Text game board, step 3 (first part) (3 / 5)

Figure 55: Text game board, step 3 (second part) (4 / 5)

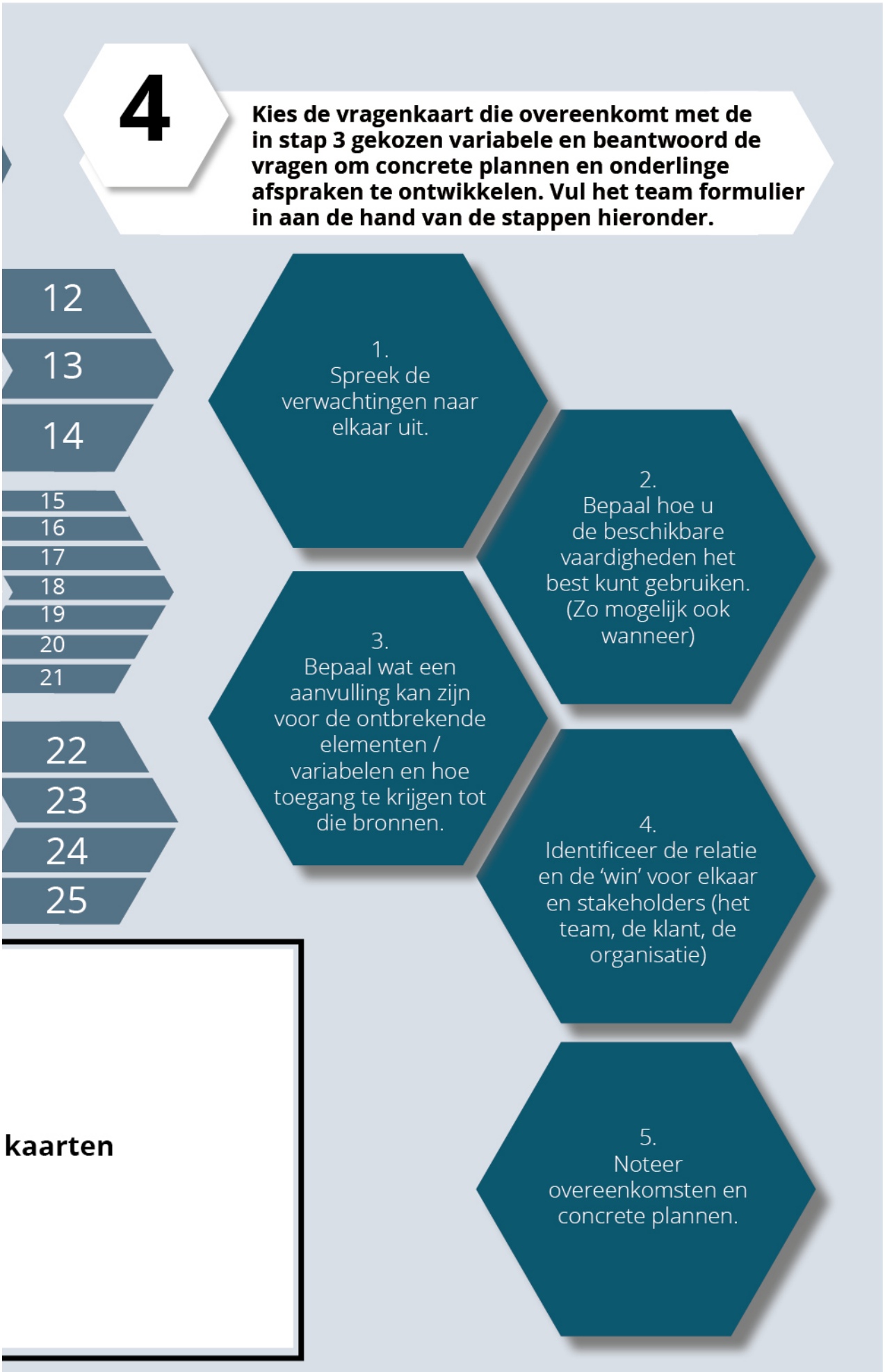


Figure 56: Text game board, step 4 (5 / 5)

11

Final design implementation

Having presented the final design, this chapter describes the answer to the sixth sub question what are the implementation requirements for DC? by presenting the implementation plan for the final design based on a roadmap. The roadmap is developed to define a path for implementation for Defensity College, over a time frame from June 2018 until December 2022. First, the roadmap framework will be shown and explained (11.1), followed by a full presentation of the roadmap and an explanation of the steps that have to be taken (11.2). The chapter finishes with an answer to the sixth sub question (11.3).

11.1 Roadmap framework

The design of the roadmap, e.g. the architectural framework and the visualization of the roadmap are developed based on the framework developed by Kerr & Phaal (2015) and Phaal & Muller (2009). The framework is depicted in Figure 58 and explains how the framework is build up.

11.2 Roadmap visualisation

The roadmap is visualised to show all steps that have to be taken over time based on the function perspectives. The roadmap is presented in Figure 57 and the legend of the roadmap is depicted in Figure 59. The legend explains the features used to indicate processes.

11.2.1 Explanation of roadmap links and teams

Link between product, service, system and science and its relation to technology: The product, service and system present what is done and seen in practice. For example, the tests are conducted and updates are implemented. The 'science' behind it, shows why those steps in practice are taken. For example, the tests conducted in practice are used as replicability and reliability tests which can be used by the collaboration expert for scientific research development. The technology supports the product, service and system using an app.

11.2.2 Taskforce teams

There are three task forces teams: the LEAD team, the APP develop team and the TOOL develop team.
The LEAD team consist of the design strategist, the collaboration expert, the facilitation manager and the app product owner.

- Design strategist: maintains the roadmap, the implementation and is the relation manager for partners except for the app development partners.
- App product owner: leads the application development team and maintains relations with app development partners. He/she is also responsible for the integration between the App, the CRM-system and LinkedIn integration and roll out of app for other COPs.
- Collaboration expert/ researcher: further develops the Collaboration Analyser. This can be done either by an external academic researcher or an internal employee (sociologist).
- Facilitation manager: leads the implementation of the tool (C-Booster), educates the TOOL team and facilitates the LEAD team sessions.

The APP development team exists of the app product

ROADMAP

		PAST (DEC 2017 - MAY 2018)	SHORT TERM (June 2018 - Dec 2019)
MARKET	Employee research & segmentation	Target group identification and insights (students)	Creating persona's of student profiles
	Employer segmentation (deparment & level of operation)		Categorisation of assignments on: - department level - level of operations
BUSINESS	Strategy DC (COP)	**Awareness** Internal branding of program in MOD & pilots with early adopters	**Delivery** Focus on quality delivery of program to stakeholders (focus on employer satisfaction & employee experience)
	Strategy innovation clubs, e.g. FRONT (innovation strategy)	Map all differents COPs for innovation of FRONT (innovation hub)	Pitch project & design case studies to be applied in FRONT **Institutionalisation** Execute 4 case studies at FRONT: only maintaining and improving COPs Repeat case studies (only new COPs)
PRODUCT SERVICE SYSTEM	Community Builder Program (strategic level)		Start case studies **Proof of concept** Practice CPB & collect feedback Practice CPB & collect feedback Practice CPB & collect feedback
	Collaboration Analyser (tactical level)	Test with DC program participant	Test with DC management team Provide DC management team results Present final design Implement update Test with other COP managers Implement update Provide feedback (results to other COP managers) Implement update
	C-Booster (operational level)	Build and test MVP based on CA	Testing in DC (21 tests: S,T,O level * 7 departments). Collect results by hand Translate collected test results to account managers Convert info (test results) to app
	Communication / Marketing	Pitch CBP at Start up Summit	Word of mouth and DC news letter / Visit innovation events Innovation network meetings. Spread the word: "Development of adaptive leaders" Advertise Best Case Practice (DC & insights FRONT) Integrated in mailing / intranet:
	Distribution	Print suitcase (1st edition) for DC	Documentation in transferfile to DC Print revised suitcase (2nd edition) Present first insights of implementation
TECHNO-LOGY	Mobile Application (App)	Develop design brief for App	Tendering process Further development of design brief Development of App in co-creation sessions with users Launch App pilot Testing & updating app Launch connection with LinkedIn Implement update Implement update **Updates**
	CRM - system + data analysis	Adapt and implement existing CRM - system	Check possibilities for link between CRM & App Create link in CRM system for App for qualitative data analysis Add section for COP members' learning curve + LinkedIn connection
SCIENCE	Collaboration Analyser	Explorative research Development model	Validation by DC: research IPC factors & COP relationship Reliability tests in FRONT's COPs
	C-Booster	Agile development testing with potential end-user	Usability test (21 tests) for validation and replicability Usability for replicability in COPs between COP members & executive professionals
RESOURCE	Task force teams: - Lead - App development - Tool development	Establish LEAD taskforce team for implementation	LEAD team prepare rela-tionships and teams for start of implementation APP team develops and improves App based on user-insights & data security APP Develop team ready to start
	Partnerships	Facilitate account manager training TOOL team ready to start	TOOL team tests & improves tool in case studies FRONT JIVC Collaboration expert develops Collaboration Analyser
	Finance	€€€	€ €€

MID TERM (Jan 2020 - Dec 2021)

LONG TERM (2022 - 2025)

VISION

Growth: place, time, work

Focus on growth in other products (gap year, exchange program)

Upscaling

Present project Community Builder Program to CdS

Generation adaptive professionals

"Institutionalizing your COP? Three words: Community Builder Program"

Implement update

Implement update

Implement update

Implement update

Additions

Extensions

Design Strategist & App Product Owner lead process until full implementation

€€

TASKFORCE TEAMS*

LEAD

- Design strategist
- App Product owner
- Collaboration expert/researcher
- Facilitation manager

APP

- Jurist
- App developer back end
- UI designer

TOOL

- UX designer
- Psychologist
- Account manager

A solution is the Community Builder Program which focusses on facilitating adaptive professionals in collaboration and composes Communities of Practices embedding the S,T, O level in the Ministry of Defence

To realise the Communities of Practices designed for innovation implementation and educate professionals, an institutionalization program is re quired that manages bott om-up innovation initiatives

Creating adaptive professionals and effective innovation and knowledge sharing groups (Communities of Practices designed for innovation implementation)

Effective collaboration through knowledge sharing at strategic (S), tactical (T) and operational (O) level is key

The strategic concept the Ministry of Defence has devised: 'Adaptieve Krijgsmacht' (derivative of Total Force Concept)

Continue to guarantee the safety of the Netherlands in this new complex world

Roadmap

"Patience is a virtue, and I am learning patience. It's a tough lesson."

- Elon Musk

Figure 57: Roadmap (2018 - 2022) for the Community Builder Program to be implemented at Defensity College and in the Ministry of Defence at large.

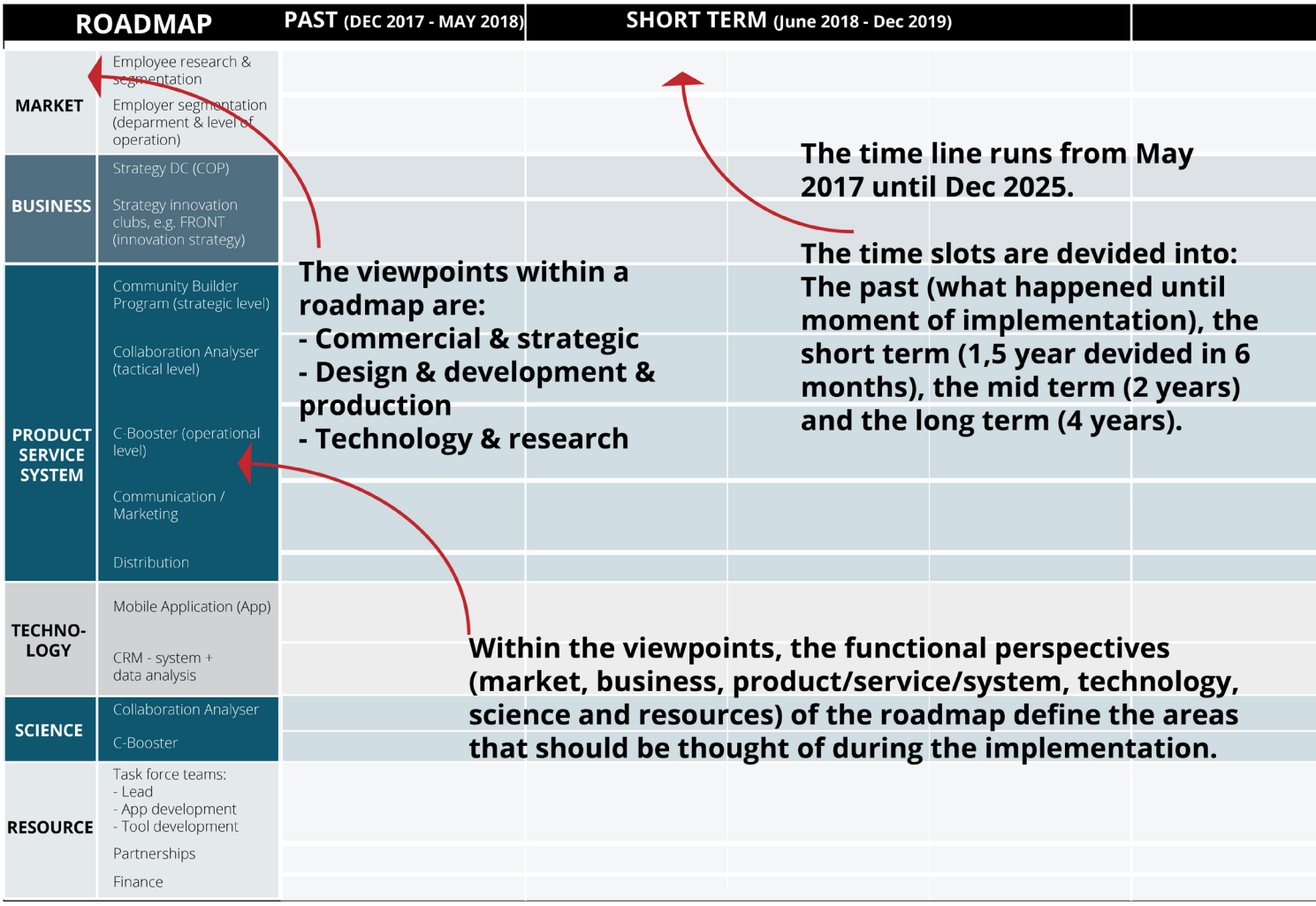


Figure 58: Roadmap framework (Kerr & Phaal, 2015; Phaal & Muller, 2009) for implementation of the Community Builder Program

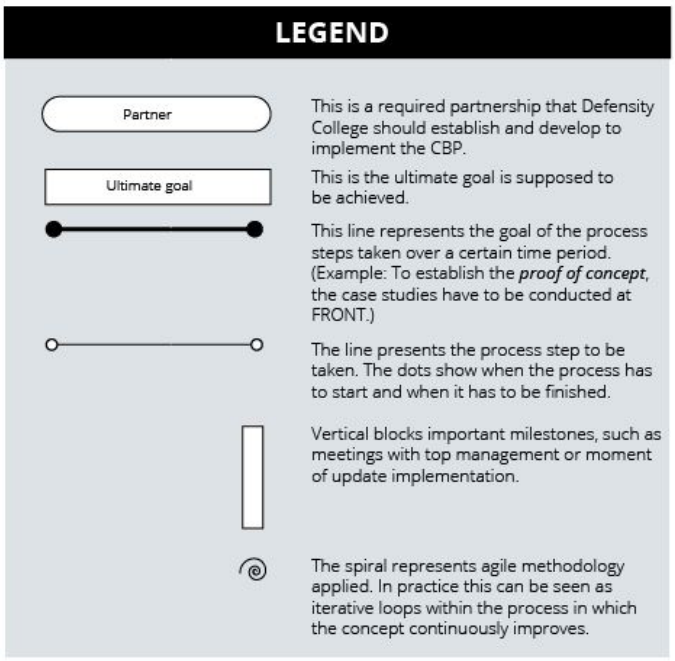
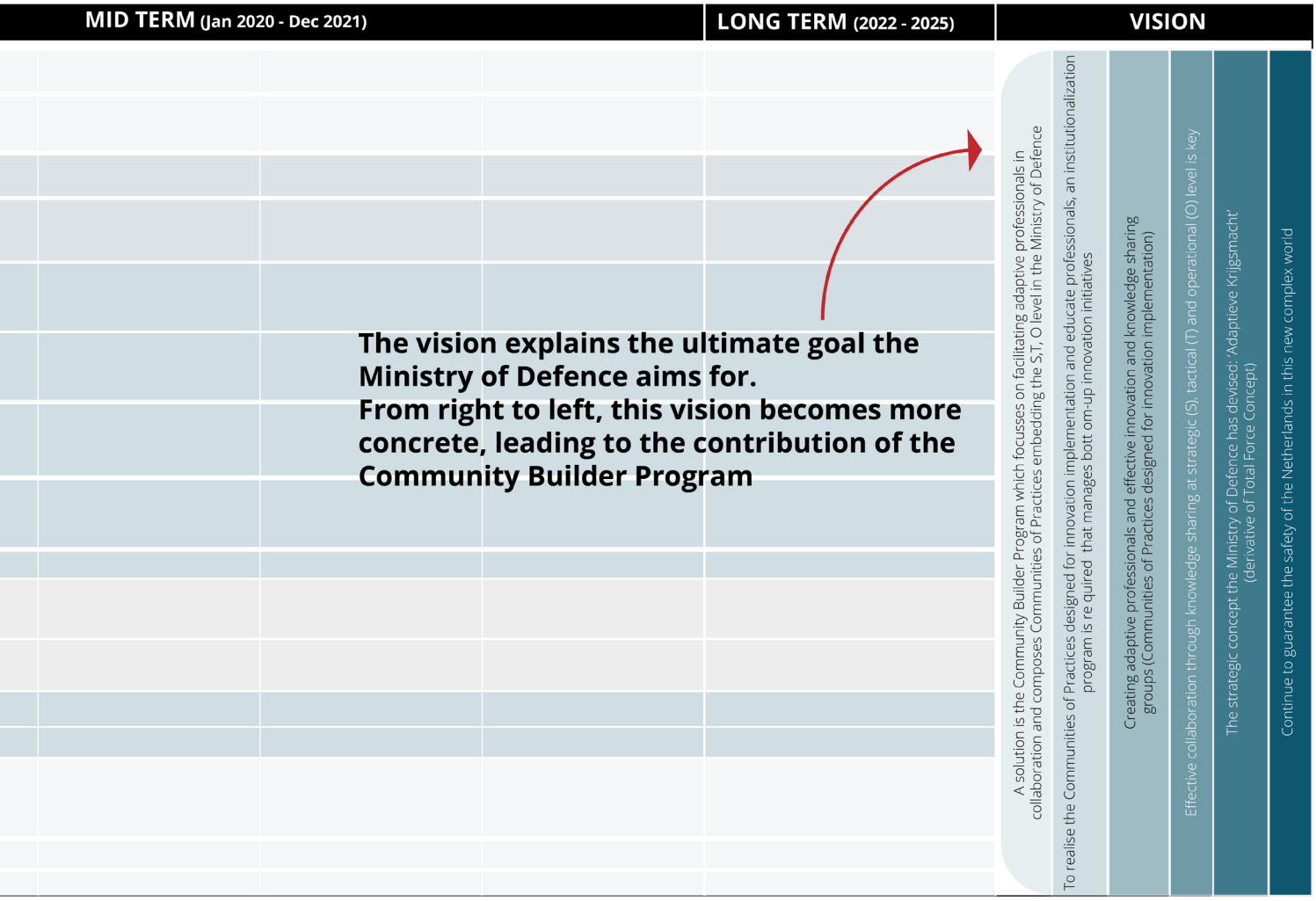


Figure 59: Legend of roadmap designed for the implementation of the Community Builder Program

owner, a UX designer, a UI designer, a jurist and a back end app developer.

- (App product owner)
- UX designer: has to focus on the full experience of all participants and integration between the app and the tool. He/she also reports back to the design strategist about the progress.
- UI designer: has to develop the interface of the App. As the concept is currently developed for Defensity College's purposes the corporate entity and branding. However over time, the app should be used by other COPs, having their own corporate identity/branding.
- Jurist: should look into the data confidentiality of the users, but also the information shared via the CRM-system and to what extend the employers can describe the assignments. Together with the app backend developer they have to look at how they can guarantee data security.



- Back end app developer: develops, improves and updates the back end of the app.

The last team, the TOOL team comprises the facilitation manager; account manager, the (same) UX designer and a psychologist.

- (Facilitation manager)
- Account manager: goes to the introduction meetings, guides the professionals through the process, collects the generated data of the collaboration and keeps track using CRM-system.
- (UX designer)
- Psychologist: further develops the psychological test of the new COP members and further focusses in collaboration with the UX designer and the Collaboration expert how the tool and model could be improved from a socio-psychological view.

11.2.3 Financial support

A very generic financial estimation is made. For implementation, a full calculation is required.

Human rescources

Billable hours are calculated based on yearly salary for a 40 h work week. (*Gemiddeld-inkomen.nl, April 2018)*

- LEAD:

Design strategist, 3 years (20 h / w), 80.000 E, = 120.000 E
App Product Owner, 3 years (20 h / w), 80.000 = 120.000 E
Collaboration researcher (40 h / w), 1.5 years, 50.000 = 75.000 E
Facilitation manager, (10 h / w) 1.5 years, 60.000 = 22.500 E

- APP development:

UX designer, 1.5 years (10 h / w), 80.000 = 30.000 E
Jurist, 3 years (5 h / w), 70.000 = 26.250 E
App developer, 3 years (10 h / w), 70.000 = 52.500 E
UI designer, 1.5 years (10 h / w), 60.000 = 22.500 E

- TOOL:

Psychologist, 1,5 years (5 h/w), 50.000 = 9.375 E
Account manager, 3 years (10 h/w), 50.000 = 37.500 E
The expenses for HR are: 515.625 E

App and Tool development
App development, maintenance and improvement = 150.000 E
Tool development, printing and distribution costs = 60 E per print, 20 pieces = 1.200 E

The expenses for App & Tool development are: 151.200 E. Total expenses are: 515.625 + 151.200 = 666.825 E. The expenses roughly calculated for the 2018 June - Dec are: 666.825 E / 8 * 3= **250.000 E**

11.3 Conclusion

In this chapter, the sixth sub question was used to design an implementation plan for Defensity College. Therefore, the question was formulated as: **What are the implementation requirements for DC?**

To answer the question, an implementation plan by means of a roadmap for the upcoming five active years is proposed for Defensity College. The answer is provided based on the initial half year of the roadmap.

The critical requirements are starting capital of 250.000 E and a collaboration with FRONT (the innovation catalyser of the MOD) to start case studies and simultaneously 21 usability tests within the DC should be conducted for validity, replicability and adaptation of the model for potential generalizability. In addition, the tender process for the app development must be initiated and the task force teams must be set up.

The requirements are based upon a roadmap that present which steps should be applied when in a time span from June 2018 until December 2021 steps to implement the Community Builder Program within the Ministry Of Defence. The steps are based on what is foreseen in the market, how the business is assumed to react and how the product/service/system should be aligned. The roadmap also presents which steps should be taken reading technological and scientific developments. The supporting resources, such as human capital and financial investments have been shortly discussed.

To conclude, the final design is presented, the implementation plan is explained and an answer to the six sub question is provided. Therefore, the deliver phase can be closed. In the remaining chapters, the research will be discussed and the answers to the research questions will be provided.

The road

Dicussion, conclusion and reflection

In the previous phase, an integrated program was presented that facilitates COP managers in innovation implementation through a model and a tool. The model (that supports discussion prior to defining COP strategies on tactic level) and tool (that supports knowledge sharing in the design of collaborations between professionals at operational level) were tested in the context of the case study. Having proposed an implementation plan for the case owner, the next and last part of this thesis contains a discussion, conclusion and reflection. This part starts with a discussion of the methodology and the results in chapter 12. In chapter 13, the main research question will be answered. In chapter 14, a reflection of the project and suggestions for the Ministry of Defence, Defensity College, the theory and the integration between the research fields will be given.

12

Discussion

The discussion provides room for evaluation and critical reflection on the methodology used in this project and the results found. The methodology and results will be discussed according to the research phases; discover, define, develop and deliver (12.1), then the Collaboration-Analyser (model) and the C-Booster (tool) and the Community Builder Program (integrated program) will be discussed (12.2). The chapter finalises with a reflection on the research method, design-based research (12.3).

12.1 Discussion of the methodology and results per phase

This thesis contributes to science communication studies, specifically to knowledge- and innovation management literature by a first exploration into interprofessional collaboration using Communities of Practice (COP) as a means to enhance innovation capabilities in hierarchical organisations. The contribution of this thesis can be observed both on practical and on conceptual level. This will be discussed by means of the methodology and results summarized in a section that describes the overall project. Subsequently, the steps taken in the process will be discussed according to the research phases of the Double Diamond model applied in this research; discover, define, develop and deliver.

12.1.1 Overall project

During the explorative research a conceptual model named the 'Collaboration-Analyser', was designed. This model supports knowledge sharing when 'boundary-spanning' professionals design their collaborations. Also, it supports COP-management in the analysis and strategy formulation of their COP. As there was no model found in literature, this model is used as a base for the remaining project.

As a next step the model is used as a base for the tool development. The tool 'C-Booster' creates open communication and knowledge sharing when 'boundary-spanning' professionals design their collaborations in practical situations and is thus created using a case study. For the implementation of the model and tool, the Community Builder Program (CBP) is written. The CPB is a program to facilitate knowledge sharing and implementation from innovation strategy up to working floor implementation. The CBP captures both the model and tool. In addition, a mobile application (app) is used connect from the working floor implementation back to the COP-management and strategies

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Given the single case study, the analysis should be considered exploratory and cannot be generalized. Also, the (sub) research questions are more complex and do not have a single conclusive answer. The proposed model should be further researched to validate the factors in practical context taken a COP-approach. This was out of scope and therefore not investigated in this project. The tool (C-Booster) is mainly based on the conceptual model. The tool was developed within the context, but the final design is not yet tested during a matchings meeting. Based on the test sessions it is expected that the tool is applicable for it proposed purpose (the matchings meeting). This has not been validated, due to Defensity College' current development phase and no test possibilities have occurred.

Nevertheless, the presented Community Builder Program is the first concept that allows for alignment between COP-managers (tactical level), the organisations' innovation strategy (strategic level) and the executive professionals that function as boundary spanners (operational level). It allows for alignment, because it integrates Collaboration-Analyser and the C-Booster. The Collaboration Analyser (model) provides support in the discussion prior to the COP strategy development. The C-Booster (tool) facilitates in the design phase of the collaboration between professionals that function as boundary spanners on micro level between management and practitioners in other parts of the organisation. As boundary spanners, they can contribute - either being a peripheral or marginal member of the other group, by using the potential of the collaboration to its fullest.

12.1.2 Discover

The aim of this phase was to discover how the Community of Practice (COP)-approach can be used to contribute to the institutionalisation process of a knowledge sharing initiative within a hierarchical organisation. An in-depth case study is conducted and making it possible to pinpoint the barriers (also called 'nodes') within DC which could benefit from the COP theory. The outcome of the discover phase was a list of barriers ('nodes') found in the case study connected into a loop and a theoretical scope the research.

The case study is based on the program of Defensity College, a project which aims to reconnect academic students to the Armed Forces of the Dutch Ministry of Defence. To identify the barriers in the product of the case owner pilot and in-depth interviews (based on a sensitizing booklet) with participants of the program were conducted (chapter 4). The sensitizing booklets and interviews defined the practical issues that were perceived by stakeholders and helped to understand which barriers occur in the case study. The barriers were connected and formed a continuous loop.

As part of the case, a preliminary literature study is conducted to understand the COP-approach with regards to knowledge management and innovation and in relation with the most mentioned potential limitation: 'power' (chapter 3). Along with the thirty years of research into the COP- approach, an extensive range of perspectives has arisen. Clearly, the complex phenomenon of collaboration and power dynamics are too complex to be researched in a single master thesis project. This resulted in the specific direction of this study: to focus on interprofessional collaboration in and between COPs. These specific insights are translated into the construction of the model and tool.

12.1.3 Define

In the define phase base elements of the COP theory were taken and the critical node (the most critical point in the loop of barriers) was defined. The base elements were extended by a literature study into factors influencing interprofessional collaboration. In addition, practical insights were incorporated. The define phase resulted in a conceptual model that can be used as a discussion starter for COP-managers to base their COP strategy on and as base for the tool development.

The critical node is the point in the loop that prevents the case owner from its institutionalization process. The research project was restricted to the relation between the students and the employers using the COP theory which limited the researcher to investigate other possible solutions for the institutionalization process. In the future, the establishment of the critical node should be done in cooperation with the professionals to strengthen the reliability of the identified problems.

After defining the critical node, the theory of COPs designed for innovation was applied to Defensity College to further scope the research and to create the social problem statement and the design challenge. The social problem statement and design challenge were translated into a design goal for the conceptual model. This design goal was established by the researcher and validated by the case owner and the research supervisor. The design goal is a mean to guide the researcher throughout the design process and indicated that a theoretical background (literature study) was required.

A literature study was therefore conducted to find a starting point for the development of a conceptual model. Most models found in literature focussed on the evaluation part of the collaboration and no dynamic models were found that focus on the creation of the collaboration, the 'fuzzy front – design phase'. This indicated that there was a gap between practice and literature and presented the need for this explorative research. Since limited literature was available, the practical context played a major role in the development of the model.

The literature study concluded in a list of factors that influence knowledge sharing in/between communities of practice on micro level retrieved investigated in the health care sector. The assumption to relate the defence sector to the health care sector has been a decisive step in the research. The list was extended by factors that were suggested in practice (chapter 5).

The design goal, the base elements of the COP theory, the factors found in literature and the initial draft provided by

van der Sanden (2016) provided input for the design of the conceptual model. As the purpose of the model served a different goal than intended by van der Sanden (2016), therefore the purpose of the tool was discussed resulting in the revised framework (Figure 24) prior to the design of the conceptual model.

The purpose of this explorative, conceptual, intervention *model* was to support COP managers in designing (establish, maintain or improve) their COP. Therefore, the model is based on the previously found literature on COPs designed for innovation including the concept of power and factors that influence interprofessional collaborations.

This resulted in the conceptual model, called the *Collaboration Analyser,* which was introduced in chapter 6. The model was based on van der Sanden (2016)'s initial draft for a framework (called Circle of Collaboration) and on the relational and structural dimensions of the COP theory.

The relationship between concepts and variables (example, concept power with variable leadership) are based upon literature. (Illustrative quotes from gathered literature were used to indicate those relationships.) The relationships have not been validated in this research due to scope of the research and time constraints.

The Collaboration-Analyser was tested on applicability in one pilot test within the Ministry of Defence. The participant is familiar with the context of the case study and is experienced in health care collaborations. Hence, was able to identify the factors of the model. All factors were recognized and acknowledged being present at the MOD.

Next, derived from the critical node in the case, there was a need for a support *tool* for professionals in shaping their collaboration. Thereby supporting the collaboration between the student (subordinate position, employee) and the employer (supervisor). During the analysis of the case study other barriers have been identified which could have served by the COP theory and a model. However, three of the four Ministry of Defence participants of the test sessions acknowledged the need for a collaboration-design tool. Also, the case owner noted that a 'tool would speed up the selection procedure of students if it could function as an indicator how the collaboration could perform'. These arguments are in favour of the identified problem and support the development of the tool.

12.1.4 Develop

In third part of the double diamond model, the design criteria are developed (chapter 7) and prototypes of the tool are designed (chapter 8) and tested (chapter 9) using an iterative testing method. The research steps will be discussed, in the following order: first the arguments for designing a game are provided and put in context with other possible design tools. Subsequently, the limitations of the tool development are discussed, followed by a discussion how the development process is validated. The section concludes with a discussion to what extend the process is valid and reliable.

The perspective taken in this research is theory-based designing as the initial design of the tool was based on the model. Henceforth the model served as a base for the design of a prototype for practical use. A restriction of the literature was that the factors only apply to physical (not virtual) COPs. Therefore, the researcher was restricted to create a physical tool.

The physical tool has become a board game (with cards) because physical games create effective collaborations and engaged professionals (Zagal, Rick & Hsi, 2006). The development of the game required the following: a minimal viable product (MVP) framed within principles of a board and card games to be tested with the (potential end users). This format supports professionals in sharing 'relevant' information and design the collaboration together. (Relevant in this case is information shared what leads to the substantive design of the collaboration.)

Other forms, such as a booklet, assessment list, workshop or masterclass could also have served the aim of designing collaboration through knowledge sharing. Those forms could have been easier in duplication (booklet, assessment list) or reach more people simultaneously (masterclass or workshop). However, using game elements is suggested to "stimulate new radical, multidisciplinary innovation and involve company employees in the knowledge sharing activities for innovation performance" (Žemaitis, 2014, p. 172).

For the development of the game (interface and content of the tool), the researcher shortly investigated in literature on game design and communication theories (including creative decision making) and visited a war gaming-specialist. The literature, together with the Collaboration Analyser is the base for the tool. The insights gathered from reading the theory and from the consult with game-experts facilitated in the design process of the tool.

A limit of this research phase is that only one concept is designed. Therefore, this concept is a solution, but there might be other solutions out here based on the same theory and designed within the same list of criteria.

To validate the prototypes of the tool, usability tests were conducted. The results are far apart in terms of usability

to design the collaboration, but were uniformly positive in using a method based on 'collaborative gaming theory' (Zagal et al., 2006). There have been five tests with five couples. Four couples existed of two participants and one 'couple' exists of three participants.

Three of the four MOD couples (located at the strategic and innovation departments at the Ministry) who participated, acknowledged that the prototype could support in the design of the collaboration, the other couple (located at a more executive department within the Armed Forces, the Army) 'did not acknowledged the tool [iteration of the prototype] in its current presence as relevant'.
All participants found the gaming method attractive.
Also, the method was perceived as a method for open communication, according to the discussion sessions at the end. These insights suggest that game design would fit in the organisation, yet the prototype, in its presented state needed some further exploration.

There are two reasons for the limited test rounds:

- (1) time constraint of the project and;
- (2) no other participants (students) than the five that participated in the test sessions (that have been conducted) were available prior to the final design.

All participants were already familiar with one another and were collaborating for at least two weeks. The assignment they are working on was already shaped and according to all participants the "collaboration between them (prior to the tests) went well". There was no test sessions conducted with participants who described their collaboration as "poorly functioning collaborations'. Meaning, participants who have been asked for participation declined as the cooperation did not worked well. Also, no test sessions were conducted with participants that were in the design phase of their collaborations.

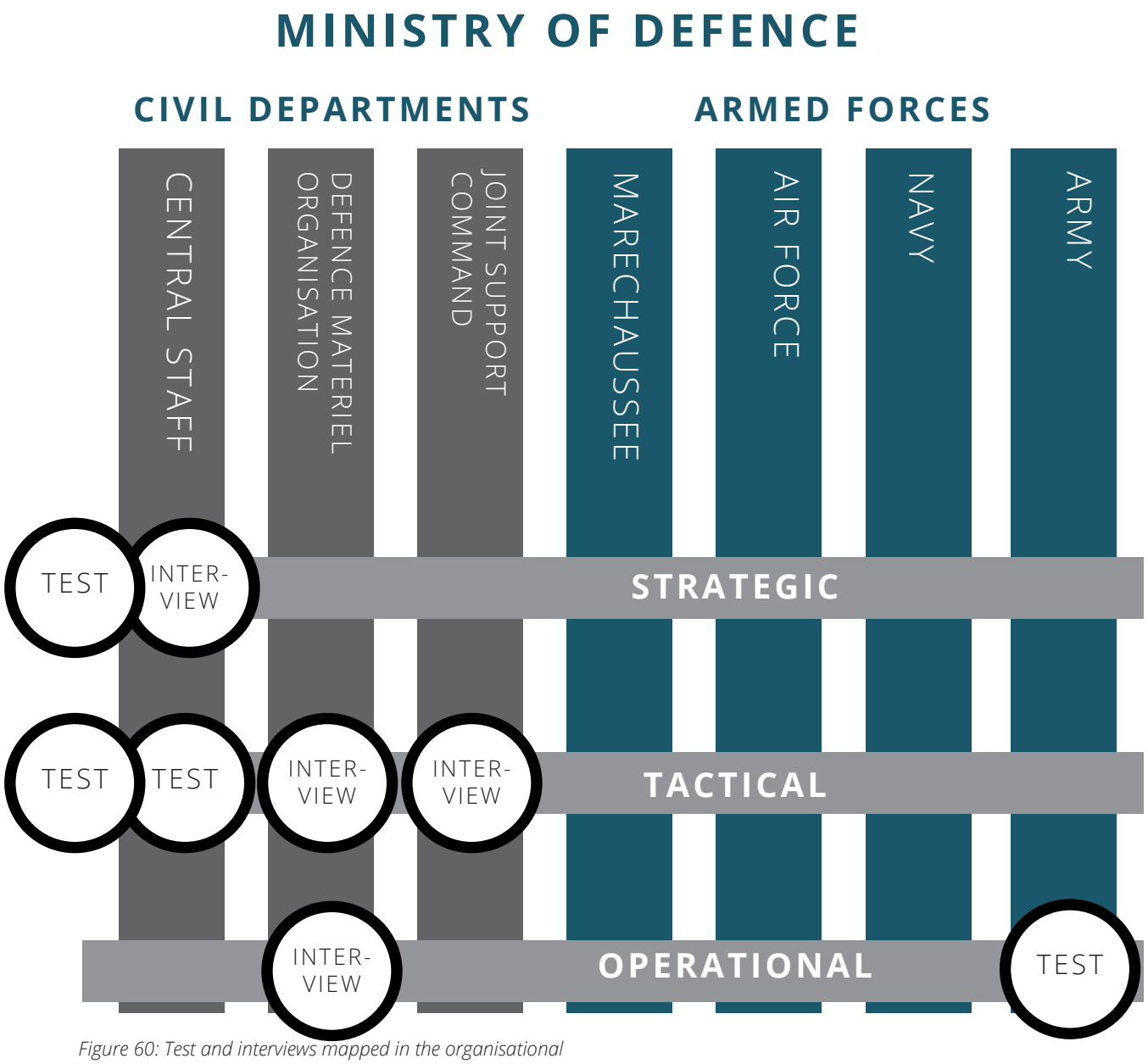

Figure 60: Test and interviews mapped in the organisational departments on strategic, tactical and operational level.

All twenty-five other approached 'subordinate' participants (students) indicated that they could not participate due to time restrictions, not able to be physically present at the same time as their employer or did not want to participate in the research, the most frequently mentioned reason for those were 'fear of the consequences'. This suggests that dedication to exploration for innovation in the Armed Forces is still limited. However, the results cannot be generalized in terms of reliability due to the small number of participants. For reliability, (more) tests are required in its actual context; where the collaboration has to be formed.

The test results indicate how the prototypes are perceived on different levels (strategic, tactical and operational) and are perceived between two different departments, one civil and one military (Central Staff and Army). Figure 60 presents an overview of the conducted tests and interviews. The aim of the tool has been valued on strategic and on tactical level in the civil department (thus translating strategy to operational in the area of innovation management and implementation) the prototype appears to work between two professionals.

However, the test conducted on operation level in the Army has not considered not useful nor effective. A participant of the test in the Army identified the tool as useless, as 'the work has to be executed anyway'.

Therefore it is expected that the tool functions on strategic and tactical level in the central staff and likely to be of interest for the Defence Materiel Organisation and the Joint Support Command, based on the interview. As only one test and no interviews are conducted within the context of the Armed Forces, no conclusions can be drawn. Yet, interview and test participants are reservists and were able to use their own experience of the cultures in the armed forces to think about potential implementation of the tool. It was suggested that the tool could be of use at strategic level at the Armed Forces (mainly within the Air Force and Marechaussee).

However, for validity of the tool, longitudinal tests are needed. This requires two participants (of which one has a higher rank of organisational authority) at the start of a potential collaboration in the MOD. To see if the outcome has been experiences as valid, both participants should be interviewed separately after at least one-third of the time they have been working together. Also, the research has been conducted with professionals working in the same organisational culture and under the same work ethics. More research to investigate if the model would be applicable between professionals of different departments (having different organisational cultures, e.g. the Navy, and MO or the Army and the Central Staff) and on different levels is required.

The prototype tests were audio recorded, observed by the researcher and notes were taken. The information is summarized based on the researcher's observation, the recordings and the discussion session with the participants afterwards. The summary and several quotes are used as validation material to identify the main errors. The recordings, notes and discussion were done to minimize researchers' subjectivity (as result of false memory or imagination). All insights are used for improvement of the tool. It could be questioned to what extend the changes were necessary as future research might differ in results.

This method is considered biased as it mainly relies on the interpretation of the researcher. Non-biased and replicable test results can be realised when multiple researchers would transcribe the records and code separately first and then combine the insights.

Although, the reliability and validity of the prototypes might be remaining, most participants expressed a great appreciation for the conceptual thinking of the value of collaborations. Therefore, the evidence found provide reasonable support that facilitating the design phase of collaboration on micro level in line with the innovation goals of the COP, has a positive effect on using a student's fullest potential in the collaboration with their supervisor.

12.1.5 Deliver

In the deliver phase, the final concept of the tool has been designed and an implementation plan for a period of five years is proposed. The implementation plan is proposed in form of the Community Builder Program (CBP) and a roadmap (chapter 10 & 11). First, the CBP will be discussed, followed by the model, tool, mobile application and the roadmap.

The Community Builder Program is the integrated program that connects the innovation strategists and COP-managers on implementation of innovation strategies with the executive professionals that work as 'boundary spanners' on the working floor. The CBP comprises the model, the tool and should in the future be supported by a mobile application (app). For the scope of this research, only a design brief of the app is presented.

The program is designed to facilitate COP management teams in the discussion of their Community of Practice strategy development which has to be aligned with the innovation strategy. It also structures the introduction meetings between professionals to create effective collaborations at the work floor and gathers feedback from the collaborations via an app to present the innovation

strategists how the strategy is implemented in practice.

The model focusses on the implementation of innovation strategies using COPs as mechanisms. A guideline is written to support COP-managers in their design of the COP. Yet, the model has not been tested with new COP-managers as the research was conducted using a single case study. For future research longitudinal studies are recommended with innovation strategists and COP-managers. Such studies should provide insights in terms of applicability and usability of the model.

The tool focusses on the 'mix&match' conversation, which is the introduction meeting where both professionals get to know each other and further define the assignment they will be working on and the form of their cooperation. However, the functioning of the tool and how the tool is perceived during actual usage has not been tested due to limited availability of participants. Although, findings for direct implementation are required, case study insights and tests indicate that the tool would be suitable during this meeting. Thus, more case studies are required within DC to collect findings.

Games require guidance so participants are supported when they get stuck in the process. This tool requires a facilitator and guideline booklet, as the translation from the discussion about the assignment to the concepts of the model is perceived as 'sometimes too complex'. The main drawback is that the collaboration-design process partially depends on the skills of the facilitators. Therefore a facilitator-training of the researcher is required to offer a solid guidance process. Future tests should demonstrate if the final version of the tool, along with an educated facilitator would serve its goal.

In addition to the implementation of the model and tool, a design brief is written for a mobile application (app). This app aims to support COP-managers as follows: During the collaboration between the executive professionals (the boundary spanners) with other employees, the COP managers (or account managers) collect feedback about the innovation implementation strategy put in practice. The feedback can be delivered to the COP-managers via the app, who collects the data and create a visualisation that can be presented to the innovation strategists. Then, the strategists can adapt their strategy to practical implications.

At last, the roadmap is designed to create an implementation plan for the upcoming five years (see roadmap, chapter 11, Figure 57). The roadmap is proposed by the researcher, but should be discussed with the DC-management and app developers, before put into practice as allocated time and resources should be committed to execution of the plan.

12.2 Collaboration-Analyser and C-Booster (model & tool)

This paragraph elaborates on the strengths of the model and the tool. First the model, the Collaboration –Analyser will be discussed, followed by the tool, the C-Booster.

12.2.1 Collaboration-Analyser

The Collaboration-Analyser is a model that helps COP-managers to analyse, establish, maintain and improve the interprofessional collaboration between COP-members that are part of a COP designed for organisations' innovation capabilities. The one pager form helps COP management teams to scope their COP strategy direction. The model was presented in chapter 6, Figure 28.

The strength of this model is that it is the first conceptual model that integrates the COP-approach with the (interprofessional collaboration) IPC-theory to design collaborations between professionals in hierarchical organisations (HO). It supports professionals in the analysis phase of their collaboration in three steps:

- Identification of presented factors in the collaboration
- Co-creation of the professionals to see the potentials of their collaboration
- Defining concrete tasks for successful cooperation

Recognizing all factors which are relevant for the collaboration between COPs for innovation can be difficult for professionals, especially for novice subordinate-professionals. Therefore, the strength of this model is that it provides a visual overview of the identified factors (variables) that influence interprofessional collaboration in relation to the identified concepts related to COPs.

The relational dimensions are: alignment, engagement and imagination (which are seen as building blocks to establish the community). The structural dimensions are community and boundary (to create knowledge sharing between different communities). The concept of power is added to create decision-making power over the concrete solutions of the innovation process and power to implement the decisions into practice.

In comparison with other models or frameworks based on factors that influence interprofessional professional collaboration, this model establishes a relationship between community building, COP members and other professionals at micro level. Existing models, such as D'Amour (2008)'s *structuration model* and Li et al. (2018)'s i*nterprofessional*

teamwork innovation model (ITIM) both focus the analysis of collaboration efficiency between professionals but do not relate to community development. Frameworks, such as Weiseth et al., (2006)'s *Wheel of Collaboration Tools (WCT)* and Bainbridge and Orchard (2010)'s *competency framework* are focussed on designing strategies for of interprofessional collaboration. However, none of the models capture both the improvements of the interprofessional collaboration on micro level and strategic community development for the organisations' innovation goals.
Furthermore, given the large influence of knowledge management in organisations, the CBP is an innovative solution to tell how members of a community, in practice, change their practice or innovate. This is in contrast to Fox (2000)'s earlier statement that the COP theory does not offer insight in how members learn or innovate in practice. The strength of this model therefore, is that it offers guidance for the COP-management to facilitate interprofessional collaboration for organisations' innovation goals. Hence, the model does not only focus on the interprofessional collaboration on micro level, but also analyses the community professionals as part of the COP designed as a tool for enhancing innovation capabilities.

Furthermore, unlike other COP-models or -frameworks, this model focusses on the 'design phase' of the collaboration, instead of the evaluation phase or keeping track of the process. Doing so, it can help to prevent from issues that form during the collaboration instead of problem solving afterwards.

In addition, the inclusion of the form (which aims to support in the discussion to define the COP strategy) makes the proposed conceptual model tangibly understood for COP management. In comparison with the previous literature this is a benefit, as most models are considered too abstract (Huang, Wei & Chang, 2007, p. 610).

12.2.2 C-Booster

The C-Booster is the knowledge management game to facilitate professionals on micro level in the design-process to establish their collaboration. The tool offers a result-driven practical guidance (step by step) in the 'fuzzy front stage' of the collaboration between professionals. The abstract concept of 'defining the collaboration' becomes concrete by the structured approach of the tool. After five steps, three possibilities emerge of what can be done if the two professionals will work together and how concrete steps and mutual agreements can support knowledge sharing in the collaboration. This tool is therefore useful for turning the abstract concept of collaboration into practical results.

In comparison with other studies, this study combines both a top-down and bottom-up approach by facilitating the management in the analysis of the COP and facilitating professionals within or between COPs in designing collaborations that contribute to the goals of the COP(s). Previous studies facilitate managers by either contributing to the strategic design of a COP, cultivating the COP (e.g. Loyarte & Rivera, 2007; Soto, Vizcaíno & Piattini, 2015; Frank et al., 2017) or evaluating the performance (e.g. Huberman & Hogg, 1995; Millen & Fontaine, 2003), but none of them provide concrete steps for the implementation of the strategy by focussing on the collaboration between the members of COP.

However, this exploratory study has shown that a combination between a model and a tool (based on the model) may contribute to the strategic design, maintenance and improvement of the COP for management purposes as well as for the collaboration between community members (professionals) by facilitating them in making mutual agreements and to concretize steps for implementation of those agreements at micro level.

This is done using a strategic design perspective taken during the development of the C-Booster. Strategic design has, among other things; strategic design has a focus on designing tools that create value for organisations. The value creation in this tool is illustrated by the creation of 'competitive advantage' of the collaboration between two professionals. The tool facilitates in a structured approach in defining competitive advantage of the collaborations in three steps by:

- Collaboratively searching for 'unique selling points' of collaboration elements that seem complementary
- Defining required resources that is still missing when the two professionals collaborate
- Identifying possible assignments in which the collaboration can create added value for the innovation goals of the community and the organisation (a similar thought as the development of new business units)

Also, the C-Booster has collaborative board gaming-elements incorporated, such as cards with open questions and cards with creative decision making forms (based on the 'six hats' theory of Bono, 1985) and hexagon pieces to collaboratively establish 'best collaboration combinations', which creates a team's utility and encourages engagement between professionals (Zagal et al., 2006). Since the assignment (the professionals work on) differs every time, the collaboration will be shaped differently. Consequently the game is not only useful as a design tool, but can also be used as an assessment tool (of a running collaboration).

The previous theoretical assumptions have been validated in the tests. The results of this research revealed that establishing mutual goals and professionals discussing potential success factors of the collaboration contribute to define future tasks in which both can excel. This is highlighted in three tests (A, D and E), which are conducted at institute of the 'IGK' (the independent institute that mediates on request in individual issues concerning Defence) and the 'innovation direction and innovation operation control department', part of the Ministry of Defence.

The results highlight that most participant couples highly value the discussion to design their collaboration. The couples also value the collaboratively reflection on how they can best use their collaboration to achieve the innovation goals of the organisation. These results are considered positive for further development.

However, there are two main arguments for more tests: 1) there was a limited amount of tests, and 2) due to the fact that none of the tests were carried out in the designated phase of the collaboration. Therefore, more tests should be conducted in different departments of the MOD. Recommendations about the to-be-conducted tests have been discussed in chapter 11.

In conclusion, this integrated program (CBP), including the model, the tool and the app provides continuous feedback from executive COP members about how the innovations are implemented on the work floor through knowledge sharing. COP management thus facilitates knowledge sharing by acting as bridge between the innovation strategists and the executive community members (they become boundary spanners themselves).

12.3 Reflection on Design-Based Research

Overall taken, the DBR approach is considered being applied accordingly, as A) the intervention model Collaboration-Analyser is based on theory and serves as content for the tool. The tool is designed using insights derived from practice (case study) and B) the researcher incorporated moments for knowledge sharing between the research departments and the case owner. According to the approach, various tests have to be conducted within context of the case study, which indicates that the researcher created a solid base for testing. Although the actual context for which the tool is designed has not been tested, previous results indicate potential for further (practice-based) development of tool by implementing the tool in desired context.

Despite applying DBR accordingly, there are some limitations that are inevitable in a DBR based study. These will be discussed: lack of theoretical foundation, generalisation, validity and replicability, researchers' bias and level of experience, other research methodologies and DBR applied in other context than the field of education.

"Lack of" theoretical foundation

ISessa and Cobb (2004) argue many design based studies lack a strong theoretical foundation and does not attempt to generate findings important for the refinement and evolution of theory. In this explorative research the initial focus was to deliver a contribution to theory, because it was initiated to investigate the possibilities of a new conceptual model for establishing collaborations using the COP theory. An explorative research in nature cannot be generalized directly, but in any case explores a knowledge gap in literature. Therefore, this research can be valued for theoretical purposes.

However, this explorative research has a focus on delivering a contribution to COP-theory by having the main focus the further development of the concept of power in relation to the theory of Communities of Practice. The contribution of this research with regards to the COP-approach in combination with power will be discussed in 12.4 Reflection on theory.

Generalisation, validity and replicability

DBR is in its nature interactive between practice and theory, leading to continuous adjustments in the implementation of an intervention tool. It is therefore difficult to define what combinations of features contribute to success. Generalisation is rather difficult because of the complexity and changing dynamic context in which the intervention tool is implemented and the lack of identification of successful features (O'Donnell, 2004). Also, unlike quantitative studies, most DBR studies do not produce significant measurable effects that can demonstrate 'what works and what not'.

Referring to this thesis, the intervention model is based on based on theory and designed in (and for) practice, using only a single case study. Results cannot be generalised as:

- All test participates have noted upfront their collaboration went well and the assignment was already established. There has no tests been conducted within the actual user-scenario.
- The tests have been conducted at the 'IGK', 'Central Staff' and the 'Knowledge Centre', leaving other departments out of scope.

Thus, the results based on a single case study and a small test panel.

Regarding generalisation, validity and replicability, a

drawback of a single case study is that the theoretical knowledge is applied to the characteristics of one context in a specific time frame and place. This limits the validity and the reliability of the results. Hence, the validity and reliability of the tool is therefore requires more research.

However, looking at the purpose of this research – and explorative research in general for that matter, the researcher argues that a single case study is used to identify research problems in practice and limitations in theory and to better understand the impact of those problems for both theory and practice. As an explorative research does not have a specific outcome, it mostly diverges and only converges to define the problems which require further research. A single case study therefore should be seen as starting point for defining those specific problems. Especially problems that occur in dynamic practical contexts, such as the context of Defensity College. Despite the lack of generalisation, validity and replicability, a single case study is therefore in this thesis considered a valid research method.

Researcher 's bias: 'Searching for the problem'
Ensuring that researchers can make credible and trustworthy assertions (Barab and Squire, 2004) has been introduced as one of the major limitations of DBR, as it is a narrow line between objectivity and bias. As suggested by Field & Kafai (2009), once the researcher gets involved in the project, researcher bias is inevitable, which has obviously a large influence on the research credibility.

Dede (2004, p. 107) made his point by suggesting that [researchers] fascinated by art[e]facts also are often tempted to start with a predetermined "solution" and seek educational problems to which it can be applied, a strategy that frequently leads to under-conceptualized research". If the researcher considered this position to be true, it could be argued that there would be no problem (or so small) within the context of Defensity College that it is irrelevant to investigate an intervention model.

It is indeed a limitation that can be claimed to be valid as some models, based on theory, can be perceived by researchers as 'a breakthrough' in science, but do not make a substantive contribution in practice. However, in this study, the initial idea of van der Sanden (2016) was in such a preliminary state that no function or elaboration had yet been developed. "Searching for a problem" in practice was therefore not an issue in this thesis. The researcher has developed the tool based on the problems found in the case.

The main concern of the researcher however, has been supporting in the daily processes of the program and could therefore be biased in findings in favour of the case owner. As a challenge of doing DBR is maintaining collaborative partnerships with the stakeholders, researchers have to investigate the social, cultural, psychological and political dynamics in situations and outline the needs of all sides. Therefore, to limit this bias, the researcher stepped out of these processes after five months and worked mainly from a different location.

Besides that, the case itself was very dynamic and there was limited access to participants due to the small number of participants. In-depth interviews with a group of students with the same background and at the same department within the Defence were therefore not possible. During the project, all actors that were able to participate in the research were in favour of the case owners' project. Partially, as a result of internal political relations that made the institutionalization process of the case 'uncertain', the researcher gained only one perspective on the problem. The researcher should have expanded the research to opponents of the case to gain a broader perspective of the research context. However, over time the sample size of participants has grown and the population of new participants validated and recognized the indicated problem.

Although the limiting sample size, the participations have different backgrounds and work at different departments within the organisation. The researcher did observe different contexts in which people collaborate.

To prevent researcher bias, this research should be repeated according the steps by other researchers in form of longitudinal studies. This method can also critically reflect on the research steps taken and provide in depth results.

13

Conclusion

This chapter presents the conclusion of the research project. First the findings of the sub-questions will be presented (13.1), followed by a summary of the problem statement and context (13.2). Subsequently, the answer to the main research question (13.3). The chapter concludes with the recommendations for future research (13.4) and the implications for science and practice (13.5).

13.1 Summary of findings

Many organisations would benefit form a structured knowledge management tool to guide them to open innovation. Therefore, this research aimed to provide the management of a Communities of Practice (COP)-based initiative with a dynamic communication tool to promote knowledge sharing (KS) between members at the boundaries of a COP and contribute to research in the field of science communication in particular to 'communication design for innovation' by an explorative research into a KS-tool using the concept of power. In this paragraph the summary of the findings is presented according the four phases of the double diamond model, including the six sub questions.

13.1.1 Discover

To design a tool that would support in KS between professionals in hierarchical organisations (HO), one first need to understand the practical context and the barriers of that specific context. Therefore, the first sub-question was formulated as:

- **SQ1: Which barriers occur in the case study?**

There were three barriers identified that occur in the case study, of which one barriers was identified as critical node. The critical node identified is the point where professionals of the DC-community (the students) function as boundary spanners between the 'outside world' and the organisation, as they are bringing state-of-the-art academic knowledge into the organisation. If the students are supported in their collaboration with their employers, all parties, e.g. the student, DC and the organisation, create advantage of the situation. Therefore, the objective of the tool is to ensure that the students' knowledge is translated so that the entire team can use it, regardless of the students' hierarchical position.

The other two barriers identified were (1) the MOD needs to become a networked-organization, but suffers from the bureaucracy in the organisation and (2) to keep track of the growing amount of DC students, Defensity College adopted the same hierarchical structure of the MOD, leading to bureaucratic and slow processes).

The SQ1 was answered using findings from an in-depth-case study (chapter 4) including a preliminary literature study into COP designed for innovations (chapter 3). According to the case study analysis, a critical node in the approach of the DC-program causes a continuous loop that prevents DC from the creation of a COP for innovation in light of the concept of the Ministry of Defence; the "Adaptieve Krijgsmacht", a concept based on the Total Force Concept, to involve society more closely with the

Defence. The literature study introduces Defensity College from two perspectives: bottom-up and top-down. Taken the bottom-up perspective, DC can be viewed as a social initiative to create a dispersed collaborative configuration. The top-down point of view indicates that DC is a designed as a governance structure to deliver a contribution the 'Adaptieve Krijgsmacht'.

13.1.2 Define

Being aware of the critical node in the DC-program, the next step was to define what elements could support the collaboration between the students and their employers. Therefore the second sub question was formulated as;

- **SQ2: Which factors influence KS in and between COPs on micro level?**

The answer to SQ2 is provided by means of a conceptual model that captures a list of 25 identified factors that have an influence on knowledge sharing in the collaboration between professionals (23 out of the literature study and two added based on practical insights). These factors are related to the basic COP structural (only *community* and *boundary*) and relational dimensions (*alignment*, *imagination* and *engagement*) and the concept of '*power*' (as was discussed in chapter 3).

An in-depth literature study was conducted into factors that influence COPs for innovation on micro level (chapter 5). As there was limited literature to be found, the study was expanded to the literature about interprofessional collaboration which is researched in the context of the health care sector. The similarities between the defence and health care sector are suggested being of substantial matter. Hence, the 25 identified factors that have an influence on the collaboration between professionals are used to design a model in combination with the basic COP dimensions and power (chapter 6).

The model comprises three layers. The first layer contains the six concepts (power, boundary, community, alignment imagination and engagement), the second layer captures the 25 factors that influence interprofessional collaboration and the third layer contains the explanation of the variables in the context of case study, based on the sensitizing design technique 'probing'. The model is presented in Figure 28.

The conceptual model supports COP-managers in the design (e.g. the establishment, maintenance or improvement) of their COP by taking the steps;

- (1) By aligning the purpose of the COP with the innovation implementation strategy of the organisation
- (2) By defining the communities variables of attention
- (3) By specifying the three variables to what the COP should on. The outcome forms the basis for the COP strategy.

13.1.3 Develop

Having defined the critical node of the case study and having designed a conceptual model that could provide support in the COP-managers in the COP design, a practical tool had to be created. The aim of the tool was to support in the design phase of the collaboration between professionals in hierarchical organisations (HO). Therefore, two sub-questions provided guidance in the process:

- **SQ3: What are the preconditions the prototypes for the tool must meet?**
- **SQ4: How is the usability and applicability of the prototypes perceived by employer and employee?**

The answer to SQ3 was provided by a set of design criteria of which the most important list was to achieve the tool's objective (create open communication between two professionals and effective collaborations), incorporate physical game elements, should lead to mutual agreements and concrete next steps and has to be practical applicable at the start of a collaboration (during introduction meetings) in a maximum time span of thirty minutes (see chapter 7).

The prototypes aimed support professionals from a different level within the hierarchy to create effective collaborations in which both professionals can use their competencies to its fullest potential by focussing on the design phase of the collaboration. The prototypes, designed in form of a game board and cards facilitated by taking the steps: 1) identification of the assignment for the collaboration 2) co-creation of the professionals to see the potential of their collaboration and 3) defining mutual agreements and concrete tasks for successful cooperation (see chapter 8).

The answer to SQ4 was given after five usability tests with users aiming to identify points of improvement in the prototypes for the final design (see chapter 9). The usability and applicability tests resulted in that the gaming elements were considered attractive, but the steps in the prototypes were too complex. The openness between players was encouraged during the game, as well as the creativity and collaborative thinking, which was aimed. The switch between conceptual thinking about the value of the collaboration and defining mutual agreements and practical

implementation of concrete steps was considered highly appreciated, but experienced as very complex. Therefore, the structure of the interface and transition between steps should be improved. A facilitator must be trained to decrease complexity. Also, to ensure that the agreements are also implemented, an app will be developed that provides reminders.

13.1.4 Deliver

In order to deliver the final design, the fifth and six sub question are formulated as:

- **SQ5: How does the final design work?**
- **SQ6: What are the implementation requirements for DC?**

Prior the answering the fifth sub question, the insights from the prototypes were collected and integrated in the final design of the tool. The developed tool is a knowledge sharing-game that supports professionals in the analysis phase of the collaboration, called the C-Booster. However, the final design comprises the Collaboration Analyser, the C-Booster and a design brief for an app which together form the Community Builder Program.

The answer to SQ5 was provided by presenting the final design to be delivered to Defensity College, which is called the Community Builder Program (see chapter 10) and consists of the Collaboration Analyser, the C-Booster and a design brief for a mobile application that should be developed in the near future. The app is supposed to be designed as a tool to provide a connection to the game and the CRM system of Defensity College so their account-managers can keep track of the collaboration and the students (boundary spanners). Obviously the approval of both professionals is required.

The answer to SQ6 is given by proposing an implementation plan by means of a roadmap to deliver the designed Community Builder Program to Defensity College. The roadmap is presented in chapter 11, Figure 57. The roadmap comprises five years of execution, starting from June 2018. It describes the steps that have to be applied on product/service/system, technological and scientific developments and which supporting resources are required.

The most critical steps to be taken at the start of June 2018 until December 2018 are setting up the task force teams, starting the tender process for the app development, roll out the case studies over FRONT and simultaneously execute 21 usability tests within the DC.

Clearly, a starting capital is needed which is rougly estimated on 250.000 E to kick start the program. However, a concrete financial estimation has to be made prior to execution.

13.2 Summary problem statement and context

In this paragraph, the problem statement and the context are repeated by means of a summary. In the next paragraph, the main research question will be answered. The problem statement was defined as: Communities of Practice might not be effective as innovation catalysers at the work floor if members feel restricted by the hierarchy within the organisation. The Community-of-Practice (COP) theory is widely known for its knowledge sharing opportunities, which is in theory an appreciated approach for implementation of open innovation ideas. Yet, researchers (e.g. Meyer & Zucker, 1989; Kerno, 2008) argue that hierarchy and power issues might limit the community's potential if the majority of individuals are being more concerned about the hierarchal ordering than maximizing the organisational performance. That led to the problem that lots has been written about the COP theory with regards to (open) innovation, but no models were to be found that support the knowledge sharing (KS) in the design of the collaboration between professional under organisational power inequality, such as hierarchy or authority.

The goal of this research was therefore to provide COP – managers with a dynamic communication tool based on the COP-theory to promote knowledge sharing between members at the boundary of a COP and contribute to science by an explorative research into a knowledge sharing tool using the concept of power.

To answer the main research question this explorative research used an in-depth case study at Defensity College, (a social initiative to reconnect academic students to the Armed Forces) within the Dutch Ministry of Defence, located in Amsterdam. Defensity College was acknowledged by the minister of Defence (2017) for its contribution to the MOD's vision of becoming a network-based organisation, both knowledge-oriented and result-driven. Therefore, it could serve as a case study to design and develop an institutionalisation program for bottom up innovation initiatives within large organisations. This research was conducted over a time frame from April 2017 until April 2018 during its institutionalization phase.

13.3 Answer to the main question

The answers of the sub-questions discussed in the previous section have been combined to answer the main research question, which is formulated as;

- **How can 'community of practice' - managers facilitate knowledge sharing in the collaboration between professionals in hierarchical organisations to achieve durable innovation?**

In this section, the answer to main research question is provided based on this research project. Subsequently, an explanation is provided how to put the solution into practice. The next section discusses the recommendations for further research.

13.3.1 The solution

Communities of Practice managers can facilitate knowledge sharing in hierarchical organizations by actively fulfilling the connecting role between the innovation strategy managers and the executive professionals at the working floor. The COP managers can facilitate knowledge sharing by integrating the three levels (strategic, tactical and operational). Therefore, three steps need to be taken:

- *(1) develop close connections between the innovation strategists and themselves to align the organisation's innovation strategy with their communities of practices' raison d'être.*
- *(2) Design a COP strategy aligned with the innovation strategy and simultaneously should all COP managers' personal perspectives be aligned prior to the execution of the COP strategy.*
- *(3) Facilitate knowledge sharing and open communication in the design of the collaboration between COP members and their employers they are working with to share the gathered COP knowledge and put into practice. This will be further elaborated in the following paragraphs.*

Implementing abstract (social) innovation strategies (strategic level) can be done by COP management teams, as COPs form the connection between the innovation strategy and the professionals at the working floor that should execute the strategy. COP managers (such as DC's management team) have to facilitate the translation from the abstract innovation strategy into a COP strategy to a specific domain (on tactical level). Once the strategy is developed and executed, the COP members can put the COP strategy into practice by starting to collaborate with other professionals outside the COP in order to realize knowledge sharing for innovation at the working floor (operational level).

Also, here is a role for COP managers: By facilitating in the 'fuzzy front stage' (the design) of the collaboration during the introduction meeting between COP member and the other professional (higher in the hierarchy), where knowledge sharing is realized in a collaborative and creative way. During the collaborations, the COP members have to be supported to provide feedback to the COP-management about how the innovation strategy is implemented into practice. Then, the COP managers have to collect feedback from all COP members of how the execution of the innovation / COP strategy in practice is conducted (for example, possible problems that cause innovation stagnation or misunderstanding of the strategy by floor workers).

Finally, the COP managers have to translate the feedback gather from the different community members into constructive feedback to the innovation strategist so they can adapt their communication around the innovation strategy or slow down/fasten the process steps required in the innovation strategy.

13.3.2 How to put this solution into practice (using the Community Builder Program)

The Community Builder Program supports COP-managers according the following steps:

- (1) Aligning the purpose of their COP with the innovation strategy of the organisation developed by the innovation strategists.
- (2) Defining their COP strategy using the Collaboration – Analyser.
- (3) Using the C-Booster to support professionals within and between COPs in their introduction phase of their collaboration. Up from December 2018, the mobile application is supposed to be developed and used to:
- (4) Collect data of the professionals' cooperation and their insights of the applied strategy in practice and to
- (5) deliver the gathered feedback in a visual presentation to the innovation strategy managers. The Collaboration Analyser and C-Booster will be discussed next.

The *Collaboration Analyser* is a one pager form based on a conceptual model developed to support COP-managers to analyse (establish, maintain or improve) their COP designed for organisation' innovation capabilities. This is realized by

the identification of three main variables of attention (which are factors that influence interprofessional collaboration) that they can use as building blocks to develop their strategy focus on.

The *C-Booster* is an interactive board game that stimulates executive professionals within and between COPs to design the collaboration for a new project or to see where their cooperation can provide added value for the organization.

In contrast with other COP management models (Wheel of Collaboration Tools, Competency Framework or the Interprofessional Teamwork Innovation Model), this model establishes a relationship between innovation managers on strategic level with COP managers on tactical level and COP members and other professionals at operational level. Furthermore, inclusion of a mobile application would complete the vicious circle of the process with feedback retrieved from the professional in practice delivered via the COP-managers to the innovation strategists.

This tool is specifically interesting for COP managers of which the COP is meant as an innovation implementation tool of an organisation and for COP managers of bottom-up innovation initiatives that aim to institutionalise their 'start up' within a large organisation.

The CBP is based on the OODA-loop (Orient, Observe, Decide, Act), a decision-making model highly appreciated and used within the MOD and therefore there is a good probability that this program will be easily adopted by innovation and COP managers within other civil departments of the MOD.

Furthermore, given the large influence of knowledge management in organisations, the CBP is an innovative solution to tell how members of a community, in practice, change their practice or innovate.

Although other concepts could yield the same results, this integrated program (CBP), including the model, the tool and the app provides continuous feedback from executive COP members about how the innovations are implemented on the work floor through knowledge sharing. COP management thus facilitates by acting as a bridge between the innovation strategists and the executive community members. The CBP is therefore a dynamic tool that constantly optimizes the innovation strategies ready for implementation into operation through COP members that use knowledge sharing as their implementation mechanism.

Taking this all together, it can be stated that knowledge sharing in and between professionals in regardless of the organisational hierarchy can be facilitated, reviewed on content and linked to the innovation goals of the organization using the Community Builder Program to achieve durable innovation.

13.4 Suggestions for future research

While discussing the research results, several recommendations for future research were suggested. In this section, the most relevant suggestions for future research are discussed to further enhance the model and tool in terms of practice and science.

- **Usability test in actual user context:** The final design (e.g. the program including the tool and model) should be tested in the user context of Defensity College to validate if the final design is considered applicable and improved for actual use. The model should be tested by the COP – management (Defensity College managers), and validated using a structured interview aiming to understand if the models serves its purpose of defining strategy variables. The C-Booster should be tested at least four more times with COP-members (students); two with newcomers and their employers and two with students and their employers that at will start working on their second assignment. This way, the final concept can be assessed on usability and defining potential other problems.
- **COP institutionalization processes for innovation implementation:** The problems identified in this project were based on a single case study and one researchers' view. There could be other potential problems that occur during the institutionalization process of a COP built for innovation implementation. Therefore, more case studies are required to understand the institutionalization processes of COPs build for innovation to enhance knowledge sharing between different departments within one (large) organisation.
- **Validity:** Validity tests are required to determine if and to what extent the final design actually supports the COP-management in the facilitation process and the boundary spanning professionals in the design of their collaboration. It is suggested to at least conduct at least two more longitudinal case studies within the civil departments of the MOD, to compare results. After the usability test in actual user context, the final design should be tested in validity tests throughout the MOD in other COPs that are built for innovation implementation.
- **Reliability:** Multiple reliability tests should be conducted to determine the extent the final design

provide the same support to all COP-managers that lead innovation designed COPs within large military organisations. In these test there are two distinctions to be made upfront: It differs if the COP-managers are novices themselves and if the COP needs to be established, maintained or improved. Therefore, the reliability of this thesis relies on COP managers as novices and the establishment of a COP. Therefore four types of test should be conducted; a) novice COP-managers with COPs that should be established, b) novice managers that should maintain or improve a COP, c) experienced COP-managers aiming to establish a new COP and d) experienced COP-managers that aim to maintain or improve a COP.

For the validity and reliability tests, it is suggested to conduct eight (two times the four types) different case studies within the network FRONT. As FRONT (Future Relevant Operations with Next-generation Technology) is the contract point for the MOD for external and internal innovators of innovation, it is likely to be a suitable context for case studies. A follow up study could look like this: The case conducted case studies should be done with the innovation management of FRONT and 8 different COPs. The outcomes and use of the model should be discussed in interviews with the COP-managers as well as the management of FRONT to validate if they perceive the interactive program with innovation strategists as valuable and to what extent the model helps to define a COP strategy. The C-Booster should again be tested with the COP-members in interactive sessions and after their assignment is finished (and they do not continue collaborating) they have to be interviewed to know to what extent the designing the collaboration using the C-Booster contributes to more effective collaborations.

Other departments or organisations: Apart from the innovation and strategy departments in the MOD, it could be questioned which departments or even other organisations would benefit from applying the program. Research conducted in other context would also increase the generalizability of the CBP. A few are suggested;

- Other departments within the MOD are divided into military versus non-military and into strategical, tactical, operational level. The program might support in other civil departments strategic and tactical level or for educational purposes. In 'purely' executive military work, the applicability of the tool is considered limited as organisational hierarchy is required and discussion between professionals is restricted to carrying out missions where safety is put first. It is therefore not likely the program will be of use. During the testing sessions is was suggested that the model could be of use for civil and military personnel on strategic and tactical level, as military personnel rotate at max every three years in function and thus many employees in civil departments will start new collaborations with their employer or employees. Also, is was suggested that the NLDA (Dutch Defence Academy) could benefit from a tool that supports adaptive expertise in collaborations as they are also adapting their educational methods to the 'Adaptieve Krijgsmacht'-strategy. Therefore, the NLDA needs to focus more on education that encourages its military students to become professionals in a simultaneously knowledge-oriented and result-driven network.

- Other governmental organisations, such as other ministries, provincial states and municipalities or provincial states that aiming for communities of practices as mechanisms for innovation implementation and also need to attract new and young talent might encounter similar problems which can be supported by the Community Builder Program.

- Large commercial organisations, such as Unilever, NN or medium sized organisations (between 200 – 800 employers) such as NRGValue are in the middle of reorganisations of the company. Such organisations might be supported by the CBP as many new assignments (in light of innovation) and collaborations (different and new employees) have to be established. The researcher suggests further research in 'retention and deployment of personnel' in Human Resources departments.

- Large (mature) organisations as described above, aiming for collaborations with young ventures. "Young ventures can be excellent partners for conceptual development and bringing in new technologies (Hogenhuis, van den Hende and Hultink, 2017, p. 28), but large organisations require complete understanding of the limitations of partnerships with young ventures (e.g. financial means, knowledge and capacity)." The researchers argue that also clear and elaborate communication is essential (in form of setting up the collaboration and manage expectations) to help young ventures anticipate on important processes and decisions.

13.5 Scientific and practical relevance

The limitations of this research have already been discussed in chapter 11. This section elaborates on the contribution of this research for science and practice. The scientific relevance derives from a conceptual model for intra organisational community building in hierarchical organisations. As no models have been found in knowledge

management literature that support knowledge sharing to design the collaboration between professionals under organisational power inequality (such as hierarchy and autonomy), the presentation of this model is considered explorative and therefore not 'the' answer to the knowledge gap. However, this model should be seen as a promising first attempt into a new research area that requires more investigation.

Another contribution to science, in particular to innovation management implementation literature, is the reflection of Communities of Practice in relation to power, based on case study insights (which will be discussed in section 14.1). In chapter 1, contrasting arguments were provided about the effect of power on COPs. This research extends the current literature by presenting that COP-managers should aim to facilitate 'decision-making' power by using expertise, leadership, experience and mandate as enabling factors. As this research is provides an answer based on one case study, the researcher encourages others for more research on these factors.

The thesis project contributes to in particular to three groups; reorganisation / COP-managers, academics and innovation strategists:

- As many organisations today struggle to retain young high potentials and deploy effectively, reorganisation managers and COP-managers might be supported by providing them with a novel integrated program that facilitates COP-management both on (innovation) strategic level (the program and model), and on operational level within and between COPs (the tool).
- The other group are strategic design academics, as this research presented an empirical conceptual model that supports community building in hierarchical organisations. The added value of this model is that facilitates in the analysis and design of communities of practice for innovation implementation purposes accepting the hierarchical organisation structure. It aims to encourage this group to further investigate in the innovation implementation using COPs within hierarchical organisations.
- The last group, the innovations strategists could potentially benefit from adopting the program as the final step in their innovation to get buy-in on the working floor.

14

Reflections & Suggestions

In this chapter, a reflection of the project and suggestions for the Ministry of Defence and Defensity College will be given. To start with the contributions of this research to theory (14.1) and the integration between the research fields SC and SPD (14.2). The chapter continues with suggestions for Defensity College (14.3), for the MOD regarding the 'Adaptieve Krijgsmacht' (14.4) and a personal reflection (14.5).

14.1 Contributions of this research to theory

This research focuses on the knowledge gap defined as the effect of power on Communities of Practice and its relation to the development of COPs that need to function as innovation capabilities of an organization. The contribution of this study can be found in the development of a conceptual model which focusses on the design phase of collaborations between two professionals differing in hierarchy. This study combines two highly valued theories (IPC and COP) as a means to establish COPs that are created by the organisation (top down) or by the employees (bottom-up) to facilitate innovation implementation. This will be further elaborated in the following paragraphs.

Previous literature mentioned the ambiguity of power (several different opinions are given indicating power both as an enabler and limitation) in relation to COPs that are designed as innovation capabilities. The contribution of this study can be found in the development of a conceptual model based on a successful case study. Meaning, in the case study, a COP designed for innovation purposes has shown to be successful within a hierarchical organization.

Compared with previous literature, hierarchy (power) seems to be able to be eliminated by focusing on other possibilities of obtaining power. The variables 'mandate', expertise, leadership and cognitive authority have been identified in this study as such.

Additionally, little was known about how COP managers could facilitate in knowledge sharing between their COP members and other employers 'higher in rank'. This study contributed to theory of COPs by first proposing a conceptual model that indicates factors required for effective interprofessional collaborations, followed by linking the identified indicators to the COP strategy development.

In addition, the proposed model in this explorative research focusses on designing interprofessional collaborations. This model is therefore, in contrary to the present evaluations models, considerably an innovative method. First insights suggest that the conceptual model could eliminate the negative side effects of power by changing hierarchical-oriented interprofessional collaborations to knowledge-oriented interprofessional collaborations. However, the assumptions made regarding definitions, the relationships between power and authority, mandate, leadership and expertise are not significantly substantiated.

Although more research is needed to validate the assumptions made during the development of the model, the scientific relevance of this research is in exploring

the interprofessional collaborations on operational level and proposing a conceptual model as a means to create innovation capabilities. This is to implement abstract innovation strategies throughout the organisation at large on different levels.

14.2 Reflection on Science Communication and Strategic Product design

This chapter explains the value of an integrated research for the master programs Science Communication (SC) and Strategic Product Design (SPD) at Delft, University of Technology. This research project was initially set up within the SEC department, but incorporates SPD-specific knowledge as the researcher did a major (60/120 ECTS) in SPD. Prior to explanation of how this research project integrates both research areas, an introduction of the separated programs is given. Explaining the integration is done using both perspectives of the programs.

During the research program of Science Communication, the aim is to design communication processes for both business and social innovation. The program focusses therefore on the conceptual level of designing communication processes, policies and strategies and on the operational level by focus on intra organisational collaboration tools for innovation implementation. This research project therefore, comprises both parts as it contains both a program and model for innovation implementation and a tool to help professionals collaborate.

The master program Strategic Product Design (SPD) mission statement is to "master design's impact on business and markets" (SPD, 2018). The program focusses on the analysis of market and business that could be supported by a design of experiences, products and services and on the marketing of new concepts. The research area, to which this research project contributes, is product innovation management with a focus on launching strategies for new products. Having both programs defined, the contribution of this research can be explained accordingly. The value of the integrated research project can be seen in Figure 61.

In Figure 61 Iis presenteed what the added value of the different programs was in this research project. SPD has practical methods and tools for the research analysis phase such as; sensitizing tools, customer journey (used to establish the critical node) and creative thinking methods. The theoretical framework and the development of the conceptual model are based on research methods and literature found in science communication studies. The content of the tool was based on the conceptual model, hence has a SC focus.

The interface of tool was based on a set of design criteria and agile testing which is at the core of SPD. Later, the design of the program as a whole for implementation and the roadmap for execution are part of the SPD process. The execution of the roadmap is envisioned to be implemented using an institutionalisation process of a (social) innovation. This process might be valid for more integration projects of SPD and SC.

In sum, the master program SC benefits from this integrated research by gaining more insights in the use of the focus on the launch strategy for the implementation of the design. Furthermore, SC develops and only focusses on communication processes and strategies for innovation, but leaves out other possibilities of innovations, such as experiences and services that are at the core of SPD. Therefore, those two fields or resources can be of great benefit for one another.

On the other hand, the SPD master program focusses on innovation by creating experiences, product - or service concepts for organisations to gain a competitive advantage. When designs are proposed to the organisations, they come with an innovation roadmap for implementation. However, the SPD master program does not focus on the stakeholder collaboration management required for the 'actual' collaboration being implemented. SC contributes to SPD as SC also takes a more scientific-oriented and abstract level of thinking in comparison with SPD, which helps to strengthen the arguments to communicate the innovation throughout the organisation. To conclude, the Community Builder Program can be an addition to both research fields as it provides a communication structure for innovation implementation.

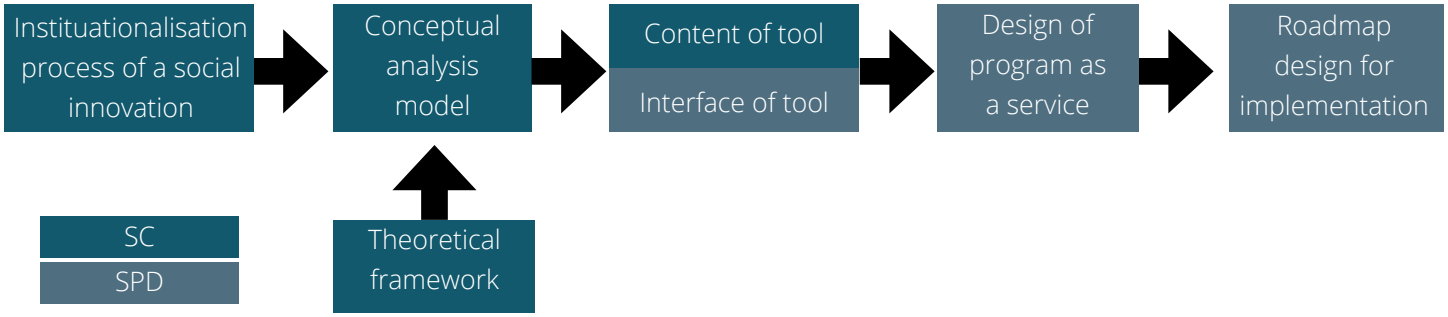

Figure 61: Integration of how the research fields Science Communication and Strategic Product Design are applied in this project

14.3 Suggestions for Defensity College

There are three main suggestions for Defensity College identified based on the purpose of the COP; maintaining by delivering quality and provide more autonomy to the members.

- **(1) Structure the 'quality delivery' strategy towards two interprofessional variables of attention based on the Collaboration Analyser.**

The Defensity College management team (COP managers) has already shifted their (main) focus from the institutionalization process to quality delivery of its core product and adjusted their strategy. However, when using the Collaboration Analyser, it turned out that all managers have a different interpretation of the strategy, which results in different execution intensions of the COP strategy. This causes that their strategy does not seem to have a fully structured approach in its implementation. As a result, stakeholders and community members perceive the message of Defensity College as 'chaotic' and its innovation strategy as a 'bouncing ball'.

Therefore, it is highly recommended to use the Collaboration Analyser and identify 3 variables that are related to two different concepts and slightly redefine the COP strategy. The COP strategy will be built around those variables. Henceforth, use those variables as core values of attention in all communication for institutionalisation and quality delivery.

- **(2) Be an example of innovation implementation and create more formal connections between the innovation management of the MOD, COP management teams and the community members at the work floor.**

Defensity College is currently used as an example for social innovation implementation of the 'Adaptieve Krijgsmacht' at large. Currently, DC management team focusses on 'informal' peer-to-peer connections with the top level innovation management. During the 'start up' phase, this is a logical step, because informally the connections between different layers in the organization are developed and guaranteed.

However, in order to create momentum from start up to institutionalized program, not only the COP strategy must be good and unambiguously, but the development process from starting an initiative to an adult program should be clear and be able to be copied as well. Therefore, to really create a momentum of their work into the organization, they have to focus on creating formal connections between the innovation management and the community. They should no longer be only the 'inspiration', but they can start a wave of innovation implementations by using the structured Community Builder Program, where Defensity College can position itself as frontier of this institutionalization program, showing their development potential and further establish trust and credibility within the MOD.

- **(3) Develop adaptive expertise among the COP members (DC students) and anticipate on innovation stagnation by focusing on the development of the trust relationship between non-commissioned officers and the members.**

Adaptive experts are those professionals who can lead others as they "understand their operational environment, can assess their own capabilities, determine their own strengths and weaknesses, and actively learn to overcome their weaknesses." To create adaptive experts, organisations must offer opportunities to professionals to be able to develop their capabilities both on a theoretical level and on a practical level. In case of the Ministry of Defence, this means that new, academic personnel need to (better) understand the operational environment. The non-commissioned officers (NCOs) and troops have a lot of practical experience that new reservists do not have (yet).

For Defensity College, this means that the relationship between the COP members (students) and non-commissioned officers have to be connected and strengthened, as the NCO's have a lot of substantive experiences in the actual execution of operations. The students do not have this knowledge (yet). The (General Military Training) GMT is a good start, but the COP members do not have details of possible issues that may have a negative effect on the implementation of innovation initiatives related to the 'Adaptieve Krijgsmacht'. It is therefore crucial that the members have trust relationship to create clear picture of the potential issues in practice. By developing the bond of trust between COP members and NCO's, these potential (sensitive) issues bleak to the surface and COP members can use their overall strategic thinking to prevent innovation stagnation. The development of the bond of trust between (older) under-officers and (young) sacrifices is already being applied in the MOD and has proven to be successful.

By applying this principle to Defensity College members, the students gain more understanding over the operational environment and over time develop into adaptive experts to bridge the gap between military departments (their operational expertise) and civil departments (their knowledge domain). Therefore, it is recommended to invite NCO's to masterclasses or other community events. Vice

versa the COP management can stimulate trust building by organising community master classes at the work floor of the NCO's. An additional effect is the peer-to-peer branding that is already part of the current DC brand awareness strategy.

In sum, Defensity College should first focus on their COP strategy by defining three variables of attention using the Collaboration Analyser to build their strategy on. Then, focus on establishing formal connections with the innovation management of the MOD and be an example of innovation implementation while using the structured steps in the Community Builder Program. Last, enhance adaptive expertise among COP members to avoid innovation stagnation by focusing on (trust) relationship building with non-commissioned officers.

14.4 Suggestions for MOD regarding the 'Adaptieve Krijgsmacht'

The recommendation of the Ministry Of Defence regarding the 'Adaptieve Krijgsmacht' follows after a recap of what the 'Adaptieve Krijgsmacht' is.

14.4.1 Recap of the definition of the 'Adaptieve Krijgsmacht'

The 'Adaptieve Krijgsmacht' is a concept to involve society more closely with the Defence. "More exchange of people, equipment and services with companies, organizations and other authorities. The characteristics of the organization of the future "(Ministry of Defence, 2017), is it is a derivative of the Total Force Concept, already implemented in (among others) Belgium, UK and Germany.

14.4.2 Suggestions for the Ministry Of Defence

The Ministry of Defence might decide to adopt the Community Builder Program and roll it out over the civil departments to support communities of practices that aim to implement innovation initiatives in line with the Adaptieve Krijgsmacht (as innovation strategy) accordingly. It is recommended to incorporate the Community Builder Program in the activities of bureau FRONT, since FRONT aims to support bottom-up initiatives in the MOD without disrupting the existing structures and processes.

The Ministry of Defence has received many investment- and tender opportunities to develop towards the 'Adaptieve Krijgsmacht'. Therefore, since 2013, the MOD focusses on providing and encouraging 'bottom-up' innovation by using project FRONT as an innovation catalyst. Project FRONT is established to function as "a booster in the reinforcement and renewal of Defence's innovative capacity" (SKIA, 2016-2020, p. 48). FRONT explicitly focusses on relevant development outside the Defence and supports existing, successful bottom-up initiatives of the operational commands. Without disrupting existing structures and processes, FRONT aims to act as a catalyst for successful, short-cycle innovation. The Community Builder Program would thus be an addition to FRONT, as the institutionalization program offers a structured support program without disrupting existing structures.

Another argument to put forth is that Defensity College already developed both informal and formal partnerships with FRONT. DC can therefore act as 'best case practice' that can easily be contacted by other COPs that fall under the umbrella of FRONT. The extended implementation plan is written in chapter 11.

By further developing the program on the one hand, Defence accepts an adaptive process that attracts new adaptive experts. On the other hand, by implementing the program, more and more initiatives such as Defensity College can be developed and current personnel will be rolled into the process of becoming an adaptive expert. In time, the MOD will therefore be able to implement civil innovation initiatives that are fully in line with the concept 'Adaptieve Krijgsmacht'.

14.5 Personal reflection

In the last part of the reflection, I will discuss my greatest challenges and learnings of this project. I will reflect on the following three topics: (1) decision-making: ambiguity of uncertainty and curiosity, (2) practical challenges and (3) discovering the definition of communication design or design for communication.

14.5.1 Decision-making: the ambiguity of uncertainty and curiosity

The intrinsic motivation to understand situations is a well-known phenomenon within the Technical University of Delft. Certainly, when novice researchers aim to combine two research fields. However, this form of curiosity never comes alone: the uncertainty that comes with not being able to find the 'right' answer is therefore something that has often come back to me in this project. Making choices based on my gut feeling or the 'logical' scientific writing has been a difficult task. I wondered, "what if I should have known more? Can I make a comprehensive decision? Or, can I ever in research, for that matter?

I experienced this struggle right at the start of this project. This project did not start from a concrete (practical) problem, which is often the case in SPD, but started from a scientific exploration within the context of a practical case. In contrary to previous SPD project that I have done, this made me feel limited in exploring multiple solutions. Over time, I reversed the project and saw Defensity College more as a best case practice and used it to structure the

collaboration process and translate it into a tool. In the future, I would like to analyse several practical cases in the first phase instead of one, to create a clearer picture of both theory and practice.

However, I have learned, especially in the final phase of my graduation, that the uncertainty is a great complementary issue of interest. Because precisely this insecurity is how I have learned a lot more about what communication is from other perspectives (psychology, sociology compared with technically oriented issues) and what role large organizations play in this (such as 'power' of the large system influences our daily doing) and, may be most interesting, how to influence it.

14.5.2 Practical challenges

One of the greatest experienced difficulties was to work individually. In previous projects, I always collaborated with others as SPD requires students to work in teams. I found it difficult to set boundaries for what should have been researched and not having a sparring partner. During this phase, I kept reading but did not make any decisions, being afraid to make the wrong one. However, as I learned during this project, without making choices you cannot explore new possibilities.

Another challenge was writing the report. From my design background, I am used to present my work visually. When, after a while, I wrote down my presentations, it became clearer, but writing remains a difficult task. In the follow-up I have learned quickly to have pieces checked by others and to discuss how things could be improved.

14.5.3 Communication design or design for communication

First of all, I want to define what I understand by the concepts 'communication design' and 'design for communication'. 'Communication design' is the solution of specific communication processes that take communication theories as a starting point. I see 'design for communication' as using a structured design method for problem solving, in which those problems can lie within the communication field, but it can also be a solution for something else that indirectly improves the communication.

If someone would have asked me at the beginning of this project if I could have defined the difference, I would not have done so. Let alone be able to integrate those perspectives in such a way that it creates a unique intersection. It is exactly at the intersection that provides a certain expertise (knowledge) that is valued in today's economy.

During this project, I have experienced this intersection. It started via the route of communication design by solving a communication problem from a communication theory (COP). The road continued via communication for design by using structured design methods and looking at a wider scope of (other) problems. As a result, I learned how to start at the smallest level of collaboration management (between two individuals) and changed this, followed by zooming out to put these insights into the conceptual innovation strategy implementation. This project has therefore played a decisive role in understanding this valuable intersection.

In addition, during this project I have shifted multiple times from operational to strategic and from meso to micro level. Until this project, I was not familiar with simultaneously operating at those levels. Previous projects were mostly related to the tactical or strategic level, such as developing innovation or communication strategies. Therefore, I am very pleased gaining experience in shifting from conceptual to practice, from operational to strategic and from micro to meso level.

Overall, I am grateful for this opportunity, including all ups and downs. The project results, the very theoretical start, the practical implications I came across (such as lack of interview participants), the introduction to the special, but yet so complex organization the Ministry of Defence and the fresh, chaotic start up. For now, I walked the road until the last mile, so now it is time for the next step.

Thank you for reading this report. For any questions or suggestions, I'll be happy to get in contact.

Figure 62: Presentation of Defensity College' success by the case owner and the first presentation of the final design

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