

# Design of an innovation ecosystem within the Netherlands Fire Service

*Innovation is a team effort*

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July, 2022

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## Abstract

### **Purpose**

This research is focused on identifying the design principles of, and ultimately designing, an innovation within the Netherlands Fire Services (NFS), in order to promote and better support employee-driven innovation (EDI).

### **Design**

To start off, relevant literature was studied to identify known components of innovation ecosystems. The Netherlands Police was studied to serve as comparative input for the interviews and as inspiration for the design. Following this, a total of 24 interviews, both in-depth and expert interviews, were conducted. These interviews were coded and analysed to come to the results of this study.

### **Findings**

We not only found evidence for the existence of EDI within the NFS, but most importantly found preconditions and design principles for the formation and functioning of an innovation ecosystem, allowing us to design an innovation supporting ecosystem for the NFS. Additional insights beside the design suggest the individualistic role of innovating employees within the NFS, indicating the traditional nature of the organisation.

### **Value**

The main value of this research lies in the use for the NFS of the proposed ecosystem to better support EDI. After implementation of the full design, employees should perceive more support in generating and improving innovative ideas.

### **Implications**

New insights are added to the fields of innovation ecosystems, EDI and innovation supporting stakeholders literature. As the largest value lies in the practical contributions to the NFS, multiple short- and long-term recommendations to implement the ecosystem were formulated.

### **Key words**

Innovation ecosystem, innovation process, Employee Driven Innovation, Knowledge Intensive Public sector Organisation, Innovation Supporting Stakeholders, Internal Network, External Network

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# 1 Introduction

## 1.1 Innovation within organisations

Nowadays, many organisations struggle with keeping up with the competition and staying relevant in their field. Innovation is an important factor for sustaining their organisational success in today's continuously changing environment (Bos-Nehles et al., 2017; Kang & Snell, 2009; Seeck & Diehl, 2017). For this research, a definition similar to that of Damanpour (1991) is used, who defines innovation as *“the adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization”* (p. 556). The need for innovation is not solely necessary for organisations in the private sector that have to compete with organisations trying to take over their market share, but also for organisations in the public sector. The focus of this research will be those public organisations that also rely heavily on knowledge within the organisation, also defined as Knowledge Intensive Public Sector Organisations (KIPSOs) (Bos-Nehles et al., 2016). These KIPSO's have specific barriers in staying innovative, for example, the necessity of innovations having to increase public value (Borins, 2001; Bos-Nehles et al., 2016; Hartley, 2005).

The focal part of innovation, following the definition of Damanpour (1991), is the internal generation of something new to the organisation. While some organisations have dedicated R&D departments solely tasked with the generation of such new ideas, plenty of organisations have to rely on their employees to generate new ideas, or having to purchase new ways to stay competitive (Damanpour, 1991; Høyrup, 2010). In the existing literature, some define innovation by employees as bottom-up innovation (Borins, 2002; Bos-Nehles et al., 2016; Bysted & Hansen, 2015; Malik et al., 2017). Some argue however those innovations developed by employees are prime examples of employee-driven innovation (EDI) (Høyrup, 2010; Høyrup & Møller, 2012; Kesting & Ulhøi, 2010; Renkema et al., 2021). In essence, both refer to the generation and implementation of ideas that originate from work-floor employees that are not specifically tasked with the generation of these ideas. Therefore, EDI will be considered as the core concept for this research, and for which the literature-based definition of Renkema et al. (2021) will be followed. They state that EDI is *“the generation and implementation across organizational levels of new ideas, products, services, and/or processes that originate from one or more work-floor employees who are not overtly required to undertake such activities.”* (p. 6). This type of innovation is especially prevalent in KIPSOs, as previous research has shown that employees within public organisations tend to show more innovative behaviour than their private organisation counterparts (Borins, 2002; Bysted & Hansen, 2015; Hartley, 2005). Thus it is in an organisations best interest to support and promote in internal idea generation as good as possible.

Besides innovation being driven by employees in the case of EDI, many sources in literature (e.g. Crossan & Apaydin, 2010; De Spiegelaere, 2014; Hauschildt & Kirchmann, 2001; Høyrup, 2010; Mansfeld et al., 2010; Tushman, 1977) mention that innovation is more than simply an occurrence. It is a process, consisting of a variety of stages, defined differently by different bodies of literature. An extensive literature review by Bos-Nehles et al. (2017) points out that an employee's contribution to innovation consists out of three stages. These stages being idea generation, idea promotion, and idea implementation corresponds to the notion of innovation being a process. The employee contributions in these stages show multiple similarities with EDI, which was deemed to be the core concept of this research. Due to the many similarities, the structure of innovation being a process consisting of several stages will be the basis on which the innovation process will be further defined, as can be found in section 2.2.

## 1.2 Problem identification

While EDI in and of itself is a great concept, due to a lack of organisational support many innovative ideas are not developed further or implemented within KIPSOs like the Netherlands Fire Service (NFS) (Bos-Nehles et al., 2016). This notion is corroborated by data gathered during an educational press conference for the course HRM & Innovation at the University of Twente, indicating that the NFS indeed experiences these problems on a broad basis. Even though many employees have innovative ideas, or attempt to initiate innovative projects, the NFS has no clear structure in place to provide support to the employees. Despite the missing structure, a clear goal and need for innovation exists within the NFS. The endless need of staying relevant is seen as the main driver for this goal, and acts as a challenger to optimize the services that are provided to the general public. Nonetheless, the lacking structure hinders the progression and further development of those ideas and projects.

The aforementioned is reflected by existing literature, which brings forward that successful innovation through means of internal idea generation can be characterized by a process that consists of bottom-up aspects combined with suitable organisational support. While on one hand, the ideas can come from the bottom, the employees, of the organisation, the top of the organisation should support those employees adequately to be able to sustain the competitive advantage that was set out to achieve (Borins, 2002; Høyrup, 2010). This support from the top of the organisation is proven to be very important, as it allows for more innovative products to be introduced, which also tend to be more successful (Damanpour, 1991; De Spiegelaere, 2014). This notion is supported by the findings of Renkema et al. (2021), whom found that the support processes around EDI are of utmost importance for the successful implementation of the EDI outcomes. In the balance between organisational support and bottom-up elements within the innovation process, it thus turns out that the bottom-up aspect is covered, but the organisational support seems to lag behind.

The NFS describes itself as a public service organisation, which is specialized in preventing and tackling crises<sup>1</sup>. Examples of these are firefighting, rescue, fire safety & prevention, disaster management, and hazardous materials response. The NFS counts approximately 28.000 employees, divided over 25 so-called 'Regional Safety Units' (RSUs). Of all those employees, around 20.000 are volunteer firefighters, and the rest are professional and full-time firefighters or support staff. Even though they are called volunteer firefighters, both the volunteer and the professional firefighters receive the same training, and meet the same high standards. Due to the NFS relying heavily on professional knowledge of these employees, and being able to provide public services based on that knowledge, the NFS satisfies all requirements to qualify as a KIPSO, as posed by Bos-Nehles et al. (2016). The RSUs of the NFS and their safety partners are supported by a national safety institute called the Netherlands Institute of Public Safety (in Dutch: Nederlands Instituut Publieke Veiligheid (NIPV)). With its main activities, the NIPV supports the NFS with knowledge and research with the goal of better carrying out its 'core business' of preventing and tackling crises. In the light of this research, it is important to recognize the innovative efforts of the NIPV. Besides being the instigator of research into relevant topics, the NIPV is actively engaged in promoting the organisations internal innovative efforts. One such way this is achieved is through 'Innovation Fridays', a monthly meeting in which a central theme is publicly discussed with internal and external parties. This is a demonstration of the aforementioned drive of the NFS to 'stay relevant'.

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<sup>1</sup> <https://www.brandweer.nl/ons-werk>

### 1.3 Solution design direction

A myriad of literature exists that highlights the importance of involving different actors in the innovation process to help in making innovation more successful. More detailed accounts of how this involvement looks like is given in section 2.3. Besides including different actors, organisational support was found to be necessary for the successful progression throughout the innovation process. Often, the lack of support is the cause of ideas not being developed further, let alone being implemented within the organisation. This does not necessarily have to be like this, as enough different actors can play a role in developing an idea further, or gaining insight into the viability of an idea. To enable employees within a KIPSO to progress further in the innovation process, a solution must be found to tackle the loose internal and external coupling and KIPSO decentralization (Bos-Nehles et al., 2017), thus better facilitating and supporting employees in going through the process of innovation.

In the literature, it is suggested that a possible solution for this problem may be an innovation fostering ecosystem (Rabelo & Bernus, 2015), an internal innovation supporting platform (Daiberl et al., 2019), or a structure to facilitate both community building and focused innovation (Flocco et al., 2022). The core of these suggestions is the connecting of stakeholders to come to a better support structure. Other important aspects of the possible solution to the problem could be the multi-level aspect (Meijerink & Keegan, 2019), allowing employees the room for innovation (Bysted & Hansen, 2015), and making sure support from upper management and other organisational stakeholders is ensured (Bos-Nehles et al., 2016). A definition of innovation ecosystems by Granstrand and Holgersson (2020) stresses the importance of strong collaborative relations between internal actors, internal activities, and organisational artifacts within an organisation or institution, as is also corresponding with the view of Rabelo and Bernus (2015), whom emphasize the importance of considering all relevant actors and relationships in the innovation process. Following an efficient deployment of an innovation ecosystem, Rabelo and Bernus (2015) found that stakeholders are assisted in better time management, resource allocation, and complex task execution. The above description of the ecosystem aligns with the view of Leifer (2001), who describes innovation hubs as an ideal tool to provide oversight in projects, and more importantly to gather expertise about innovation projects and serve as a 'home base' for those that play an important role in making innovation happen.

### 1.4 Research goal and research question

The above-described solution design direction gives rise to the notion that in current literature, concepts exist that bring together all actors within the innovation process to improve the outcome of the process. However, no consensus exists on how such an innovation ecosystem should look like for KIPSOs. The goal of this research is thus to design a solution for the lack of connection between different actors in the innovation process, to allow and assist employees to progress further in the innovation process.

The research question is:

*“What should an innovation ecosystem for the Netherlands Fire Service be designed, in which innovation-supporting stakeholders can best facilitate the progression of bottom-up innovation through the innovation process?”*

To answer this question, the problem-solving cycle of Van Aken and Berends (2018) will be used, which can be seen in section 3.1. Besides typical elements like defining & analysing the problem, and implementing and evaluating the proposed solution, it highlights the importance of solution design within tackling a specific problem.

## 1.5 Theoretical & practical contributions

### 1.5.1 Theoretical contributions

The results from this research provide a meaningful contribution to the collection of literature on innovation ecosystems, the role of EDI in such an ecosystem, and the supporting roles of a selection of stakeholders. As little knowledge exists on setting up and maintaining an innovation ecosystem within a KIPSO, the results will provide some guidance for future scholars who wish to progress further in this field of study. By gathering and centralising the available literature on innovation ecosystems, this research will provide a comprehensible direction for those interested in the design and role of ecosystems. Additionally, by designing an ecosystem for the NFS regarding drivers and inhibitors of an innovation ecosystem, new knowledge about how such an ecosystem could be structured is generated. Examples of this new knowledge are either how supporting actors are positioned throughout the organisation, or how employees are to interact with the parties in place to support them. Additionally, by proposing an ecosystem structure the existing literature will be expanded upon with a complete example on the structure, role, and possible actors of an innovation ecosystem.

### 1.5.2 Practical contributions

Through describing the design of an innovation ecosystem, KIPSOs can use the results from this research in supporting their innovation efforts. An important opportunity for these organisations is the prevention of not utilizing the internal innovative capabilities. By preventing this underutilization, and thus supporting the internal idea generation, employees are enabled to contribute more to achieving the public goal of the organisation. Besides this, the NFS could benefit significantly by having an innovation ecosystem designed around their specific organisation.

## 1.6 Document outline

In the first chapter of this research, an introduction to the core concepts is given, followed by a problem statement detailing the situation and complication which we looked into. Also in the first chapter, a direction is presented for the final solution, after which the research goal and questions are given. At last the theoretical and practical contributions are discussed. In the second chapter, the core concepts of the research are outlined in detail, based on existing literature and relevant practice. The methodology that is used to answer the research questions is given in the third chapter, as well as the means of data collection and processing. The design principles of the ecosystem, that are based on the results of the interviews and the studying of a comparative KIPSO are presented in chapter four, after which the full ecosystem design is given in chapter five. At last, the discussion, implications and limitations can be found in chapter 6.



## 2 Theoretical Framework

### 2.1 Innovation in the public sector

As the goal of this research is to help employees progress through the innovation process, it is vital to know what the current available literature says about stakeholder support for the innovation process. Before that, we need to establish a theoretical background on innovation, the innovation process, and all different kinds of stakeholders that can have a role.

The definition of innovation, as given by Damanpour (1991), has been expanded through a subdivision into two sub-categories, with those being incremental and radical innovation (Malik et al., 2017). Supported by Subramaniam & Youndt (2005), Malik et al. (2017) describe incremental innovation as *“refin[ing] existing products, services, or technologies and reinforce the potential of established product/service designs and technologies”* (p. 452), and radical innovations as *“major transformations of existing products, services, or technologies that often make the prevailing product/service designs and technologies obsolete”* (p. 452). A supporting definition is that *“radical innovations produce fundamental changes in the activities of the organization and represent clear departure from existing practices, whereas incremental innovations result in a lesser degree of departure”* (Jiménez-Jiménez & Sanz-Valle, 2008, p. 652). This definition supports the fact that a main point from radical innovation is the significant change of how things are done in an organisation, while incremental innovations are aimed at improving aspects step by step. The distinction between radical and incremental innovation is important, as within KIPSOs it has been proven that incremental innovations are more likely to be implemented and supported by the organisation (Bos-Nehles et al., 2016). This was also indicated by Borins (2002), whom stated that bottom-up innovations are most prevalent in the public sector, and by Demircioglu & Audretsch (2017) whom explained that innovations in the public sector were carried out by employees themselves.

### 2.2 Innovation process

As was already introduced in chapter one is that several views exist regarding the structure and order of the different stages of the innovation process. Whereas we mentioned that innovative contributions by employees can exist of the idea generation, idea promotion, and idea implementation stages (Bos-Nehles et al., 2016), others formulate that ideas go through a life cycle, which consists of five different stages, being the idea generation, idea improvement, idea selection, idea implementation, and idea deployment stages (Westerski et al., 2011). This idea life cycle process is depicted in figure 1. The significant difference between these two process structures is the balance between bottom-up heavy and organisationally focussed stages. For example, the IWB idea generation stage might be very bottom-up oriented, while the IWB idea promotion stage might benefit greatly from idea champions at the top of the organisation. This is also the case for the idea life cycle, which consists of several stages mostly oriented around influences from higher in the organisation. However, a combination of organisational support and bottom-up initiatives in the innovation process is the most adequate in achieving successful innovations (Borins, 2002, 2006; Bos-Nehles et al., 2016; Hartley, 2005; Renkema et al., 2021). To this extent, a different idea life cycle is proposed based on the aforementioned models, to best combine bottom-up idea generation and organisational support. This four-stage idea life cycle consists of the following stages, and is visually represented in figure 2:

1. *Idea generation*, which is aimed at facilitating work-floor employees to come up with ways to improve products or processes, or to solve problems, by having those employees use the knowledge of their job.

2. *Idea promotion*, in which employees promote and champion their idea, to generate support within the organisation, and thus create a basis for support with upper management for the further development and eventual implementation of the idea.
3. *Idea improvement*, in which employees receive organisational support to further develop or improve their innovative idea, to enable employees to produce a viable business case and thus make the idea suitable for implementation.
4. *Idea implementation*, in which upper management is presented with a business case of the initially developed idea on which it has to decide to go into the actual implementation of the idea. If approval is given, a process of making a routine out of the proposed way of doing is entered, to ensure the innovation becomes a part of the work process within the organisation.

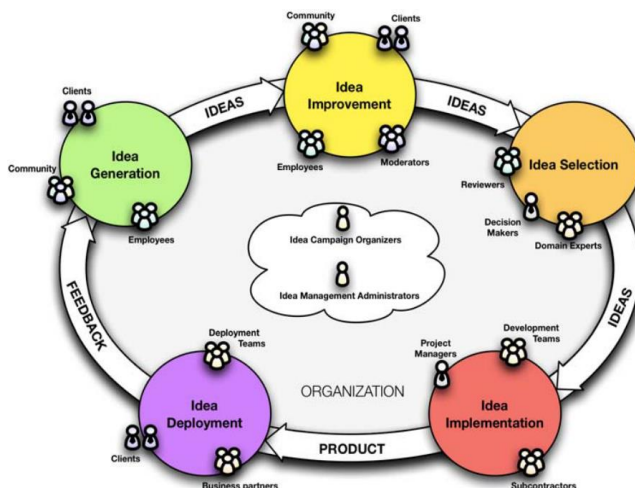


Figure 1. Idea life cycle (Westerski et al., 2011, p. 496)

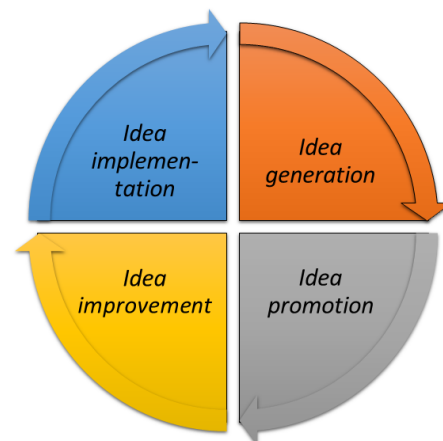


Figure 2. Proposed innovation process

### 2.3 Innovation supporting stakeholders

As was established earlier, is that there is a need for organisational initiatives that support employees in achieving successful innovation. Existing literature has shown that successful innovation starts with the supporting of innovative ideas by a varied selection of stakeholders, demonstrating the complexity of innovation (Borins, 2006; Bos-Nehles et al., 2017; De Spiegelaere, 2014; Gemünden et al., 2007). Within the innovation process, those stakeholders can possess a large variety of roles, largely dependent on their personal characteristics (Howell et al., 2005; Mansfeld et al., 2010). The success of innovative ideas is influenced significantly by the roles that employees have within the process.

Existing literature suggests several types of roles in the support of innovation. For example, the 'troika' promotor structure, as described by Hauschildt & Kirchmann (2001), consists of the *power*, *process*, and *technology* promoters. The *power* promoter is characterized as the inclusion of direct or top management, and supports innovation through hierarchical power, the *process* promoter is aimed at supporting through the use of organisational know-how, and the *technology* promoter instead uses its technological know-how to support the process. This traditional 'troika' structure was elaborated on by Gemünden et al. (2007), with the addition of a *relationship* promotor, which is defined to have "strong personal ties not only inside but especially outside the organization" (p. 409). What is most important from these different promotor roles, is that they are aimed at overcoming specific barriers, such as the technological know-how to develop an idea, or the network a promotor can use to the benefit of the innovative idea (Gemünden et al., 2007; Hauschildt & Kirchmann, 2001).

With the diversity of important functions these roles have, the filling of them is important for innovative employees to have assistance in going through the innovation process, and to receive support in the forms of experience or important network contacts. Research by Bos-Nehles et al. (2016) already looked at the role of supervisors on supporting innovation within a KIPSO. Their results indicate that while supervisors have a positive effect on employee innovation, failing to implement ideas seems to be caused by loose coupling between bottom-up innovation projects and supporting organisational initiatives, and decentralization within the KIPSO which requires leadership that emphasizes networking with public managers. These findings correspond with the 'troika' of promoters as described by Hauschildt & Kirchmann (2001), which highlights the fact that innovators within a KIPSO also need organisational support for progressing through the innovation process.

This is elaborated on by the need for external partners, which can also play a significant role in the innovation process. These external partners can be industrial companies or knowledge institutions which can assist in sharing and developing ideas further. This need for external partners aligns with the view on *relationship* promoters of Gemünden et al. (2007), but also with the suggestion of Tushman (1977) that boundary spanners fulfil the role of connecting employees with external partners. Regarding the making of connections with external partners, it is often the case of bringing together the know-how and the idea to facilitate a progression in the innovation process (Haas, 2015; Jemison, 1984). Boundary spanning is a phenomenon which is described as the transfer of knowledge, or connecting the organisation and the environment, but still little is known about the effects and roles of boundary spanners within KIPSOs specifically. Through his research, Drion (2021) has shown that boundary spanners play an important role with a KIPSO, and his results suggest that boundary spanners can hold one of the roles of *entrepreneur/innovator*, *messenger*, *reticulist* or *facilitator*, all in order to cross cultural, organisational or institutional boundaries. These individuals effectively span the boundaries that exist between an organisation and its environment, and are suggested to play an important role in the transfer of knowledge (Jemison, 1984).

For the purpose of this study, all stakeholders that can have a positive effect on innovation success are gathered under the term of innovation supporting stakeholders. These can have a large variety of positions and characteristics, but it is clear that in the innovation process it is critical that individuals with innovative ideas are linked to those that can help them.

## 2.4 Supportive ecosystem

Following the different roles of innovation supporting stakeholders, clear similarities can be seen with the incorporation of a suggested ecosystem. Facilitating the collaboration between all relevant stakeholders is not only important in an ecosystem (Bos-Nehles et al., 2016; Granstrand & Holgersson, 2020; Leifer, 2001; Rabelo & Bernus, 2015), but also important to the concept of innovation supporting stakeholders (Borins, 2006; Bos-Nehles et al., 2017; De Spiegelaere, 2014; Gemünden et al., 2007). The similarities also extend in the functions of the different stakeholders. Proposed functions of innovation supporting stakeholders are both providing internal support to other stakeholders (Bos-Nehles et al., 2016; Gemünden et al., 2007; Hauschildt & Kirchmann, 2001), or seeking supporting with external stakeholders (Drion, 2021; Haas, 2015; Tushman, 1977). Ecosystems can also provide assistance in facilitating internal support (Granstrand & Holgersson, 2020; Rabelo & Bernus, 2015), as well as seeking the connection with external partners (Leifer, 2001; Rabelo & Bernus, 2015). Additionally, an ecosystem may provide a structure to facilitating both community building and focused innovation within an organisation (Flocco et al., 2022).

Though we established that actors can possess a large variety of supporting roles within the innovation process, an actor cannot contribute to or support the process if it is not involved in it. This effect is also demonstrated by the loose coupling and decentralization within KIPSOs found by Bos-Nehles et al.

(2016). Thus facilitating the connection between innovation supporting actors and innovative employees is vital in ensuring ideas can progress further through the innovation process. As was already suggested in the introduction, a suitable solution for connecting actors from the in- and outside of an organisation is a platform or ecosystem. Several definitions of such an innovation ecosystem were presented in the introduction, but it turned out that some inconsistencies exist between different sources. An extensive systematic literature review executed by Gomes et al. (2018) resulted in a more inclusive and all-round definition, centred around the most prevalent and shared concepts in the existing literature. They state that an innovation ecosystem is “set for the co-creation, or the jointly creation of value.” (p. 45), and that it connects a large selection of actors in a network. Gomes et al. (2018) describe this as the ecosystem being “composed of interconnected and interdependent networked actors, which includes the focal firm, customers, suppliers, complementary innovators and other agents as regulators.” (p. 45). It thus seems that the core of an innovation ecosystem is the connecting of actors, varying from those inside the organisation, to innovators such as knowledge institutions or industrial partners. With that connectedness also comes a degree of depending on each other for project success (Adner & Kapoor, 2010; Iansiti & Levien, 2004), as working together allows organisations and actors to create value that they could not have created alone (Adner, 2006). That latter notion is extremely important, as it is a recurring theme also in other literature, that value in innovation projects is best created when the collaboration between different stakeholders is smooth and efficient. To combine all the theoretical elements into one, figure 3 presents the research model that incorporates the relevant fields of literature.

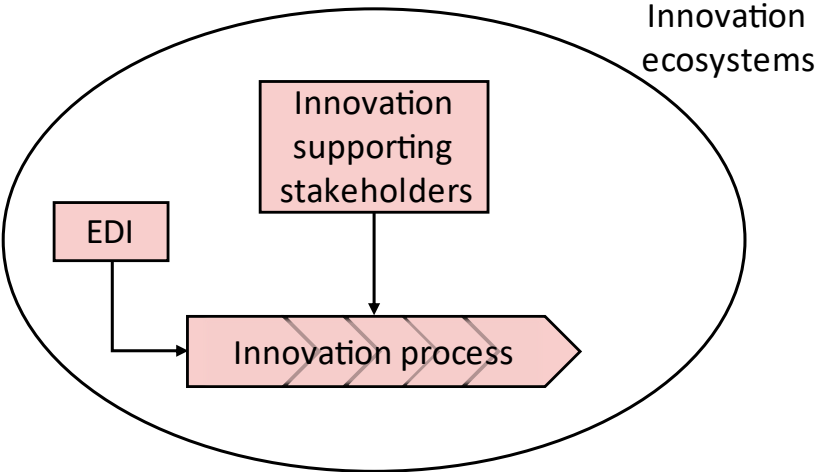


Figure 3. Research model

### 3 Methodology

#### 3.1 Research design

To answer the research question posed in section 1.4, the problem-solving cycle of Van Aken & Berends (2018) will be used, which can be seen in figure 4. Besides typical elements like defining & analysing the problem, and implementing and evaluating the proposed solution, it highlights the importance of solution design within tackling a specific problem. The usage of this cycle corresponds with the design element expressed in the research question, and means that a proposed solution design will be part of this research. How this is done will be discussed in the next section.

Due to this research nature, a qualitative approach to data collection was used. At first, an analysis of available literature and examples from practice were analysed to give an indication of how an ecosystem would look in practice. A part of this analysis was the identification of best practices in KIPSO ecosystem design. As a real-life example on how an innovation ecosystem might be structured within a KIPSO, the Netherlands Police, a comparative organisation to the NFS, was analysed on the stance of their innovative efforts. This analysis of best practices was complemented with the conduction of expert interviews. Through their experience and extensive knowledge, these experts were able to provide valuable insights into how innovation works within a KIPSO, and how an ecosystem looks like, or should look like. Parallel with the conducting of the expert interviews, and with the goal of establishing a basis of information about innovation within the NFS, interviews were held with employees of several RSUs in the Netherlands. The choice for these employees was made based on their history with championing or contributing to a bottom-up initiated innovative project that either succeeded or failed. As the sharing of knowledge on how to overcome barriers in the innovation process has been suggested to help diminish those same barriers (Demircioglu & Audretsch, 2017; Este et al., 2012; Torugsa & Arundel, 2014), it is important that the experiences that interviewees have highlight those barriers. Further selection criteria for the innovative projects are detailed in section 3.3.1.

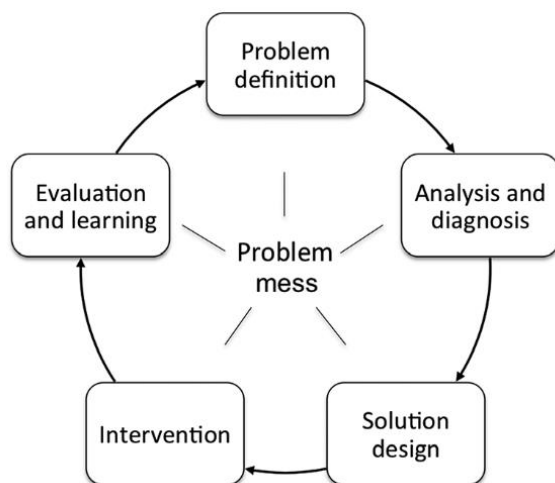


Figure 4. Problem-Solving Cycle (van Aken & Berends, 2018, p. 13)

#### 3.2 Application of the problem-solving cycle

As we are using the problem-solving cycle as a basis for executing a design research, it is of added value to the clarity of the research to describe how the problem-solving cycle is applied, and how it incorporates all elements of a design research. A design research can be divided up into three main stages, being the formation of design principles, making the design, and lastly prototyping the design. Translating this to the problem-solving cycle means that the stages 'Problem definition' and 'Analysis

and diagnosis' correspond with forming the design principles, 'Solution design' corresponds with making the design, and 'Intervention' and 'Evaluation and learning' align with the iterative process of prototyping the design.

Not all of the design research stages are represented in this study. The formation of design principles and making the design are executed thoroughly, the iterative prototyping and implementing of the design was not included in the scope of this research, and thus remain as a recommendation for the NFS. The two design research elements that are included in the research are represented in the following manner. The formation of design principles is given in chapter four, based on the findings from the interviews and the findings within the Netherlands Police. The resulting design from these principles can be found in chapter five.

### 3.3 Data collection methods

#### 3.3.1 In-depth interviews

As the main data collection method for this research, multiple in-depth interviews were conducted. For these interviews 18 (former) innovative projects throughout 13 different RSUs were selected out of the database of submitted innovative projects between 2013 and 2017. In this selection a variety of criteria were satisfied in order to ensure that the roles of all described actors could be analysed. This sample was later expanded on with successful bottom-up innovation projects out of 2020 and 2021, as the connected innovators were very eager to share their experiences, and the added value of recent innovation projects was deemed substantial. The aforementioned criteria are:

1. The inclusion of partners outside of the organisation;
2. The inclusion of partners within the organisation;
3. Was the project implemented in the organisation or not;
4. Diverse selection of different RSUs;
5. Different categories of projects;
6. The project was initiated in a bottom-up fashion;
7. Equal spread over the years 2013 through 2017.
  - a. The more recent included projects do not satisfy this criteria, yet do satisfy all other criteria

For most interviews, one respondent was selected, whom was either involved with the project in one of several roles: either he/she was appointed as a project leader, or was the initiator of a project, or was involved as a general team member of the project. For ease of reading, the title of 'innovator' or 'respondent' will be used for all respondents linked to a specific innovation project. The specific roles of each respondent can however be found in table 1.

For these interviews a set of questions was developed, focussed on discovering what hindering factors the employees ran into, or what organisational mechanisms aided or frustrated their innovative efforts. These questions were also shaped by the input gathered from the Netherlands Police, and how they shaped and guided their innovative efforts. The list of questions for these interviews can be found in appendix 1. The interviews themselves were conducted in a semi-structured manner, thus instead of following the questions to the letter, plenty of room remained for respondents to add their personal experiences and insights in their answers, or to ask follow-up questions. These interviews were then transcribed and coded to allow for a structured collection of data, which will be explained more in section 3.5. An overview of all the in-depth interviews can also be found in table 1.

#### 3.3.2 Expert interviews

As explained in section 3.1, expert interviews were conducted to expand on the knowledge of innovation ecosystems, specifically through their substantive experience on innovation within a KIPSO.



A total of 5 experts, all with considerable experience in innovation, were consulted for these interviews. Through having extensive experience with innovation, on a different level than the in-depth interviews, these experts were able to provide additional valuable insights into the ecosystem design and further substantiate findings from the in-depth interviews. To ensure reliability and validity of this sample, several expert selection criteria were adhered to. These criteria were:

1. Employee of the NFS;
2. Demonstrable experience with innovation;
3. Adequate spread over different organisational levels, departments and regions.

As the goal of these expert interviews was to allow the experts to share their knowledge and expertise on the matter, only a few guidelines for the interviews were set up, which can be found in appendix 2. By conducting the interviews in this way it was ensured that several relevant subjects were discussed, but enough room was left for the experts' input. This way of conducting interviews is best described as a semi-structured manner, which fits best with the research setup as described in section 3.1. Similar to the in-depth interviews these interviews were transcribed and coded, following the procedure as described in section 3.5. An overview of the expert interviews can be found in table 2.

*Table 1. Overview in-depth interviews*

<b>Interview #</b>	<b>Role of the respondent</b>	<b>RSU / Organisation</b>	<b>Innovation project category</b>	<b>Founding year of project</b>	<b>Duration of interview (minutes)</b>
1	Project member	Brabant-Zuidoost	Physical tool	2013	45:47
2	Project initiator	Utrecht	Way of working	2016	39:29
3	Project initiator	Kennemerland	Physical tool / way of working	2016	49:40
4	Project initiator	Amsterdam-Amstelland	Physical tool / way of working	2017	45:24
5	Project initiator	Amsterdam-Amstelland	Physical tool	2020	48:58
6	Project initiator	Drenthe	Way of working	2015	36:25
7	Project member	Twente	Physical tool	2016	64:07
8	Project initiator	Brabant-Noord	Way of working	2017	32:29
9	Project initiator	Gelderland-Midden	Digital tool / way of working	2017	33:29
10	Project initiator	Gelderland-Zuid	Physical tool	2014	23:46
11	Project member	NIPV	Digital tool / way of working	2017	28:24
12	Project leader	NIPV / Rotterdam-Rijnmond	Digital tool / way of working	2021	57:16
13	Project initiator	Groningen	Physical tool	2017	42:55
14	Project initiator	Twente	Physical tool	2021	37:56
15	Project initiator	Flevoland	Way of working	2015	39:44
16	Project initiator	Rotterdam-Rijnmond	Physical tool / way of working	2021	41:21

17	Project leader	NIPV	Digital tool / way of working	2020	50:01
18	Project initiator	Gelderland-Zuid	Physical tool	2017	34:14

Table 2. Overview of expert interviews

Interview #	RSU / Organisation	Kind of innovation project	Duration of interview (minutes)
19	Twente	Expert	49:20
20	Twente	Expert	46:43
21	Brabant-Zuidoost	Expert	55:21
22	NIPV	Expert	46:38
23	NIPV	Expert	47:38

### 3.3.3 Innovative KIPSO comparison

To provide a comparative frame for our findings, we looked towards organisations that are already familiar with investing in innovation, and ideally would have some experience with an innovation ecosystem. Preferably this organisation would also be a KIPSO, as to provide the best possible insights for the design of an ecosystem for the NFS. The Netherlands Police turned out to be such an organisation, as significant investments in the innovation support structure have been made in past and recent years. Additionally, the structure of the Netherlands Police somewhat resembles that of the NFS. It also has strong local/regional components, and a national organisation that acts as an umbrella over the different regions. The Netherlands Police reports to have already implemented organisational changes to foster the implementation of all kinds of internal innovation projects (Politieacademie, 2019). More concrete examples of these implemented changes are demonstrated through the innovation cycle (Wolfert & Hammer, 2019), the Q-Lab working document (Oost-Nederland, 2020), and the working book Innovation Box (Bingen & Rotgers, 2019). In these documents, real-life examples and organisational procedures regarding innovation are explained and illustrated. Examples of such were an innovation catalogue, a nationwide innovation network, a pop-up innovation workspace, and an innovation broker. The role of such an innovation broker stood out as very important, as it filled the task of connecting innovative employees with internal and external stakeholders, much like the aforementioned boundary spanner. Based on these examples, it was deemed very interesting to gain more insights from the Netherlands Police. An interview with one of the innovation brokers was held which led to the insights as described in section 4.1.

### 3.4 Validity and Reliability

For gathering and processing data for qualitative research, Noble and Smith (2015) describe several issues of validity and reliability. They also present different measures that researchers can take to ensure that validity and reliability of a research are not compromised. Examples of such measures are *'Acknowledging biases in sampling and ongoing critical reflection of methods to ensure sufficient depth and relevance of data collection and analysis'* and *'Including rich and thick verbatim descriptions of participants' accounts to support finding'*. Several suggested measures were incorporated within the described criteria for respondents selection. These incorporated measures are the *accounting for personal biases* (1), *acknowledging sampling biases* (2), *establishing a comparison case* (4), *including verbatim descriptions of participants accounts* (5), and *demonstrating clarity in the data analysis thought process* (6). These numbers correspond with the numbers on the list described by Noble & Smith (2015). Also Tracy (2010) describes a number of criteria to ensure the quality of qualitative research. With examples of having a worthy topic, ensuring credibility, and results having resonance with a variety of audiences, we can provide for a greater quality of research. In the case of our research we satisfy, amongst others, the following criteria: having a relevant and interesting topic, a sufficient use of theoretical constructs and collected data, a thick description of the findings, having transferable



findings, providing significant theoretical and practical contributions, considering procedural ethics, and achieving the goal of the study through using firing methods. All described measures were implemented to aid in ensuring that the results from the research can be deemed valid, reliable, credible, and of good quality.

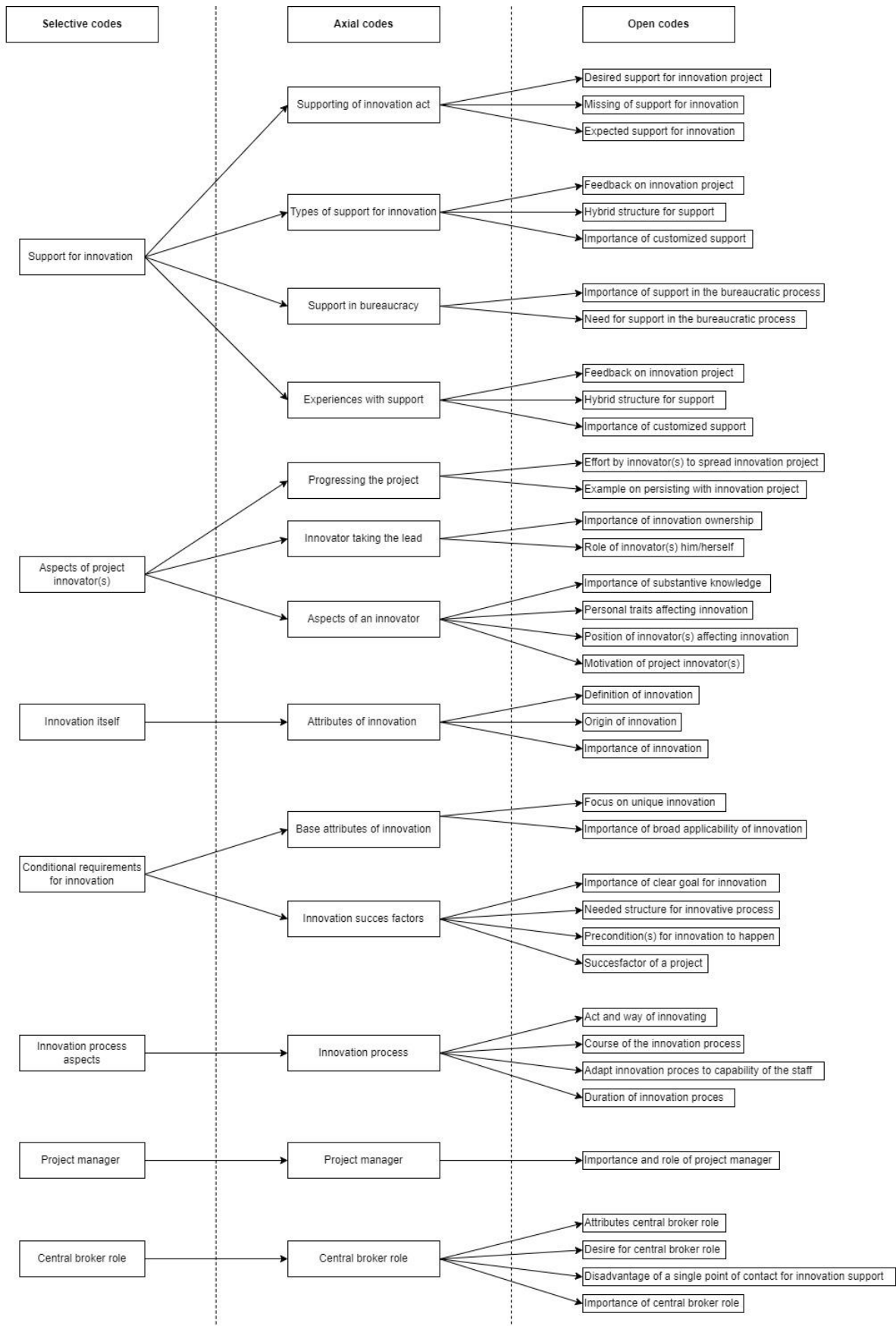
Nevertheless, a reliability issue might be caused by using inaccurate transcriptions of the interviews. By using a recording of the interview, a first step is taken to ensure the transcript is accurate word-for-word. After the initial transcription, the transcript was re-read while listening to the recording, and adjusted where the recording was not accurately reflected. With this method, the reliability of data is guarded. A related issue is the representability of the used data, and thus the research. As described earlier, by including respondents from different RSUs and different innovative projects, the used data is deemed to provide a representable sample of the experiences with innovation throughout the NFS, and thus allows for the applicability of the findings to the entirety of the NFS.

### 3.5 Data analysis

The data that was generated as part of the comparison between the NFS and the Netherlands Police was used in several ways. Initially it was used as input for the formation of the interview questions, and served as a frame of reference for the initial drafting of the ecosystem structure. After that initial draft, all design elements followed out of the interviews. Additionally, the final design of the ecosystem for the NFS was compared with the structure of the innovation support at the Netherlands Police. This was done to provide further context to the design choices that were made.

The executed interviews, as shortly described in section 3.3.1 and 3.3.2, were transcribed and coded to allow for the structured extraction of useable data. The coding was executed using the software ATLAS.ti, which allows for easy coding of blocks of text. The codes have been structured according to the data structure as described by Gioia et al. (2013), and the codes were generated in several successive manners. First, the knowledge of existing literature was used to generate codes. The generated codes were based on, amongst others, interactions with known actors within the innovation process, known elements of innovation ecosystems and how the interviewees experienced their progression through the innovation process. Besides these deductively extracted codes, inductive coding were used to identify information that was not covered by the existing literature. Both the inductive and deductive codes were then compared to align the codes with existing literature, and identify potential theoretical contributions (Corbin & Strauss, 1990). This dual process allowed for the most information to be extracted from the interviews as possible, in the search for answering the posed research question.

After extracting open codes out of the interviews, the codes were processed using axial coding to identify relationships between codes, and thus translate the codes into categories (Corbin & Strauss, 1990; Locke et al., 2020). This has resulted in a full codebook consisting of 94 open codes, and 36 axial codes, which can be found in appendix 3. As more codes and information was extracted from the interviews than were relevant for answering the posed research question, not all codes were eventually used to shape the results. This more compact codebook, with only the used codes, can be found in figure 5. Additionally, as the interviews were conducted in Dutch, the codes used in the next chapter are translated from their original transcription to English.



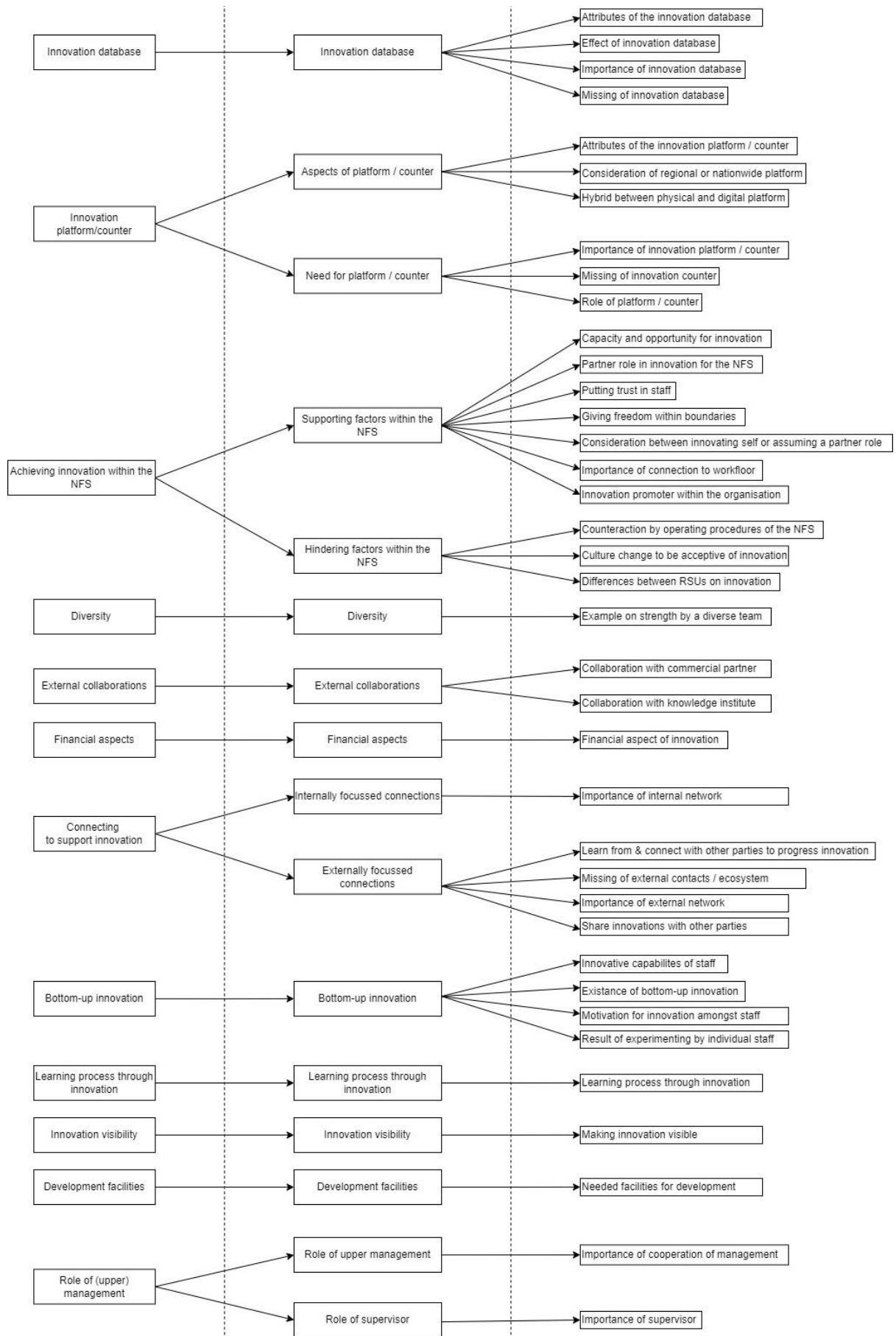


Figure 5. Codebook used codes

## 4 Design principles of the NFS innovation ecosystem

In this chapter the design principle for the NFS ecosystem will be presented. These are gathered from the interviews and from the comparison with the Netherlands Police, and are divided up into several sections. The findings regarding the design of an innovation ecosystem within the Netherlands Police will be presented first. After that, the existence of EDI and the process surrounding EDI within the NFS will be presented, as well as the position and role of those with innovative ideas within the NFS. These serve as the main background regarding EDI within the NFS, and are a precursor for the sections detailing the design principles for the ecosystem. As further insight in the structure of the NFS innovation ecosystem, the last two sections delve into the roles of innovation supporting stakeholders, and their effect within the ecosystem.

### 4.1 Findings within a comparative KIPSO

As was described in section 3.3.3, the Netherlands Police was identified as a KIPSO comparative to the NFS, and it was established that efforts in support of innovation are in a more advanced stage than within the NFS. The findings from the study of documents and an interview with the Netherlands Police are presented in this section. This chapter thus not only presents an overview of how innovation is supported within the Netherlands Police, but also what the general perception of innovation is within the organisation.

#### 4.1.1 Core of innovation

Within the Netherlands Police, innovating is not just seen as the generation of a nice idea, but innovation is made or broken by the perseverance that exists to make the idea succeed. It is therefore important to recognize that it could take years for an idea to come to fruition. This concept often constitutes a reality check for innovators, as they realize that every step taken in the process contributes to a learning process, while maybe not progressing the innovation process as they would like.

Oftentimes, the innovation process is compared with a brainteaser puzzle. Sometimes the problem is solved almost instantly, and sometimes the process of solving can take a very long time. And that is exactly what those that occupy themselves with innovation from the working floor experience. It is a constant search for how to solve an issue, which sometimes includes looking at other causes or solutions for different societal issues.

#### 4.1.2 Important actors and components

Several key roles were identified within the Netherlands Police regarding the innovation process. The main role is that of the innovation broker, whom has several functions. The broker acts as an intake counter for innovative ideas, as an connector between internal innovators and external stakeholders, and maintains a network of internal and external parties throughout the country. Only several brokers exist with the Police, as they operate in a region transcending fashion, yet all innovation brokers are part of a nationwide meeting of all innovation brokers to facilitate a connection throughout the entire country. A selection of tasks of these brokers are defined in the following list:

- Assess if the innovative idea is unique, by asking the nationwide network;
- Find the support and route through the process that best fits the idea;
- Help the innovator 'from problem to pitch', in which the pitch is meant for upper management to provide support for the idea;
- Sometimes help to get further than the pitch, and help develop a business case;
- Help the innovator to get the innovative idea to be considered by the innovation council, as described below;

- Maintain and utilize a very large network of internal and external stakeholders, varying from other innovation brokers to different departments of the Netherlands Police to industry partners that can contribute to an innovation process;
- Help to generate visibility for innovative ideas, as visibility leads to connecting with others and dialogue about the idea;
- Assist with training of innovation frontrunners in the organisation, whose role is explained later on. Besides that, also be involved in setting up the network of these innovation frontrunners throughout the organisation;
- Collect operational issues from throughout the organisation and connect stakeholders to tackle those problems.

In addition to the innovation broker that provides support to innovative initiatives, innovation portfolio holders are appointed within each region to be the Single Point Of Contact (SPOC) regarding innovation for their region. It allows for a portfolio holder to have extensive internal contacts, and be known in the region. The portfolio holders are connected in a nationwide network of all portfolio holders, which is supplemented by several inter-regional innovation brokers, who specialise in making the connection between portfolio holders, and external parties. Additionally, an innovation council which consists of a diverse selection of stakeholders from a region has a role in the process. It acts as a committee to assess the viability of ideas, as further elaborated on in section 4.1.4. The composition of this council is at the discretion of the region's innovation portfolio holder, to best reflect the region and to give the best advice in the innovation process.

#### 4.1.3 Q-lab

Another important part of the innovation support structure of the Netherlands Police is the Q-lab, which is formally recognized as innovation lab within the organisation. This lab assists a selection of innovation projects in progressing further through the innovation process, by assisting in the development of the project. Besides this assistance, the Q-lab is also responsible for hosting trainings to help with changing the culture regarding innovation within the organisation.

#### 4.1.4 Innovation process in 4 steps

The Netherlands Police utilizes a somewhat rigid innovation process, that is comprised of four successive steps. These steps are:

1. All projects are submitted in an innovation funnel, through the innovation brokers. In this first step, the innovation brokers have the goal to identify what the problem is that is being solved, and for whom. Through the assessment of all projects by the innovation broker, suitable solutions for all projects are found. While some projects might benefit from help in the form of writing a business case, some projects might be better helped with practical help in developing a prototype, and some projects might be unfeasible to continue.
2. In the second stage of the process, all projects that progressed through the first stage of the funnel are assessed by the innovation council. This innovation council reports its findings, together with an advice, to a region's innovation portfolio holder. This portfolio holder has the power and resources to support projects in his/her region.
3. In this third phase, ideas that were selected by the innovation council are supported by the Q-lab in further developing the idea. This lab has a lot of available tools and resources to support projects in their development. Examples of such resources are maker spaces, additional capacity of colleagues to work on the project, or development workshops. Due to the process that precedes, not many projects progress into this stage. Usually only complex, risky, or urgent and very relevant projects get the full support in such labs, as the less complicated projects do not need such elaborate support. This does not mean that these project are not supported at all. It means that

these ideas require a different kind of support, thus allowing the Q-Lab to save capacity for more complex projects. Projects that are not deemed suitable for support by the Q-Lab are left to be developed without centralized support, at the discretion of the involved team(s).

4. In the fourth and final stage, projects that were further developed and deemed suitable to be shared with other regions are prepared to actually be shared throughout the country. Adaptations or alterations are made to ensure a project is not only relevant in one region, but can also be used in a different region.

It was made clear that the most gain is achieved in the first step, with the assessment if an idea is truly unique and new, or if the project has the potential to join forces with another project that is very relatable to the idea. The Netherlands Police chose this method to avoid putting capacity in the so-called letting a thousand flowers bloom, and focussing more on connecting those that want to pour effort in similar projects in different places. This circumvents the issue of not supporting the staff in engaging in bottom-up innovation, and simultaneously avoids putting effort in multiple similar projects.

#### 4.1.5 Critical success factors for innovation within the Netherlands Police

Some critical success factors were listed regarding innovation. The main factor was assessing ideas before starting, and compare them with all innovative projects within the country (1). The assessment of idea viability was repeated several times as the main driver behind project success. Another factor that was mentioned was shaping the organisation for development capacity (2). Staff is not always in the position to invest time in the development of innovation, or is not always motivated to do so. Some capacity exists at the Q-lab, but as mentioned earlier that capacity is focussed at complex projects. By organising that capacity out of the different portfolio holders, some interest and room is generated, but the crux always remains to be an individual who has time and energy for innovation. Furthermore, working in a bottom-up fashion was mentioned as another important success factor for innovation (3). By having staff trained to engage in innovative working ways, having them be involved in an innovation project, and having them been in contact with an innovation broker, an innovation frontrunner is created within the organisation. Having these frontrunners distributed throughout the region, per station or smaller area, can help the innovation broker in knowing what is going in within the organisation innovation-wise. At last, one should consider the role that the organisation has in the innovation process (4). Instead of taking the role of 'inventor' or 'producer', the role of 'problem holder, expert partner, or financier' could be better suited for the Netherlands Police as a KIPSO. In and of itself the Netherlands Police has no suitable developing facilities compared to potential industry partners that can take the role of developer.

The struggle for capacity is seen throughout the organisation. An important aspect of mitigating that struggle is the involvement of a driven and well-connected project leader who has time to be occupied with the project, and has a budget at his/her disposal to make (small) investments as needed.

#### 4.1.6 Wish for connection

The Netherlands Police has indicated a wish for a platform which enables a better and more continuous connection with knowledge institutes. This platform would enable the Netherlands Police to share problems that are being experienced with the knowledge institute, which then can link a student to the problem, to work on a solution. The next step after a better connection with knowledge institutes is the inclusion of industry partners, in the pursuit of a more open organisation.

#### 4.1.7 Concluding remark

In conclusion, a lot of valuable organisational aspects were mentioned regarding innovation within the Netherlands Police. As both the NFS and the Netherlands Police are comparable KIPSOs, the found concepts and aspects will be compared to the results of the interviews.

### 4.2 Current existence of EDI within the NFS

#### 4.2.1 Importance of EDI

The first major section of these results pertains to the existence of EDI within the NFS, and serves as a confirmation of the context within the NFS. Relevant literature to EDI within KIPSOs already suggested the large prevalence of the EDI type within KIPSOs, compared to private organisations (Borins, 2002; Bos-Nehles et al., 2016; Demircioglu & Audretsch, 2017). Evidence from the interviews with both the innovators and the experts indicates that employees who are driven to innovate are indeed a substantial driver of innovation within the NFS. For example, one respondent stated:

*“...those guys [work floor employees] came up with a problem and said: we are going to find a solution for it...” – (Interview 20).*

Our findings also support the notion that innovation within KIPSOs is of significant added value, which corresponds with EDI being essential for an innovation ecosystem within an organisation. We already found existing literature that writes about staying competitive as an organisation as an explanation of why innovation is important. However, the need for innovation for KIPSOs lies almost exclusively in an ever-constant need of staying relevant. This need is mainly focused on the services the NFS provides for society and the search for ways to always be better at providing those services. Respondents described this as:

*“...because that [innovation] eventually makes it so you keep developing yourself and join in on what developments contribute most to society...” – Interview 10*

Another respondent also described this accurately by stating:

*“... especially for a public organisation, like the NFS, innovation is about staying relevant to be able to provide the best service to the citizens.” – Interview 12*

#### 4.2.2 Motivation for innovation

We not only found evidence for the existence and importance of EDI, but also clarification on why employees might be more inclined to innovate for/within the NFS. What was mentioned as a cause for increased innovative behaviour by employees, was the passion and commitment that employees have for the work they carry out for the NFS. The passion that employees feel is not necessarily directed towards being employed by the NFS, but for being there to help those in need. Out of that passion, a desire of being better able to help is born. One respondent sketched this as follows:

*“Firefighters are curious and really want to make their profession better, so they can perform better...” – (Interview 22)*

And another respondent supported this by stating:

*“...what you notice within the NFS is that people are super involved, they really want to [innovate]...” – (interview 2)*

Oftentimes, this passion that firefighters have led to individuals experimenting with and prototyping their ideas at home and/or in their own time. A large number of examples were found in different interviews of innovators describing the innovation process they went through which included



experimenting on their own before seeking support or involvement from the NFS. Examples of these individual innovative efforts include innovators sharing their experiences with spending time on innovations in their free evenings or weekends, and how they experienced the reactions to these individual efforts. This finding could be indicative of a relationship between the passion that employees have for their work, and the drive they feel to innovate. An added benefit to having firefighters with the drive to innovate is well defined by one of the respondents, who stated:

*“They [firefighters] are very good in making technical things, using them to demonstrate their purpose, and showing if it has an added value or not.” – Interview 22*

#### 4.2.3 Innovative capabilities

In other words, the capabilities of the firefighters to think of practical solutions, and being able to use the result of those efforts to invigorate their innovative idea, could be considered a strength of innovators within the NFS. However, one respondent counteracted this notion and was very adamant on the view that the NFS should be transferring the ‘making’ part of innovation projects to industry partners with expertise in constructing matters. This different role will be discussed in more detail later on.

Next to examples of innovators using their practical capabilities on their own, more mentions of the innovative capabilities of firefighters were found in the interviews. Respondents described these capabilities as:

*“You notice that the NFS consists of a lot of ‘do-ers’, people who go out there and solve things...” – Interview 8*

*“...Innovation is actually inside of every function...” and “...Innovating as an organisation is really in the innovative capabilities of the staff, and the mindset.” – Interview 19*

This shows that throughout the different interviews, the innovative capabilities of firefighters are recognized and respected. One especially recurring theme was the practical nature of the abilities of the staff, and the fact that those skills contribute not only to the work that firefighters do, but also to their input for innovative projects. Being aware of these capabilities is the first step in utilizing the strengths of NFS staff better for innovative ideas, and it becomes even more relevant to organise a tailormade innovation ecosystem around these somewhat unique characteristics.

### 4.3 Traditional position of innovator within the NFS

#### 4.3.1 In-depth knowledge

Supportive of the findings below is the importance regarding the involvement of those with in-depth knowledge in the innovative process. Where some respondents shared how their own knowledge on specific subjects turned out to be of added value in the process, others shared how involving supporting stakeholders with knowledge regarding certain topics helped move the project along. More prevalent in the interviews were examples of utilizing the expertise of others, as specific knowledge on further developing projects oftentimes exists elsewhere. One innovator described the role of someone with in-depth knowledge as:

*“...seeking connection with an expert on the subject, who can say: ‘I know a lot about this, and we should do this or that. We should or should not continue with it as an organisation’.”  
– Interview 13*



The inclusion of someone with more in-depth knowledge is also recognized by the expert respondents. With the following quotes, these two experts describe their view on how such individuals with in-depth knowledge should be used in the innovation process:

*“... and then I make sure to include colleagues with in-depth knowledge, who can contribute to the project from a more in-depth and technical perspective ...” – Interview 21*

*“ We at the NIPV are not involved with the content, the professionals themselves are involved with it, because they know like no other where their needs and demands lie, but also what things they already thought out a solution for.” – Interview 23*

In other words, the inclusion of stakeholders with knowledge about the subject one is innovating in is deemed as very valuable by the respondents. While this notion could be considered as another ecosystem design principle, we deem the relying on individuals with in-depth knowledge as an integral part of innovating within an ecosystem, and not as a precondition for the functioning of an ecosystem. The importance of collaborating within a team instead of focussing on individual performance is inherent to this consideration.

#### 4.3.2 Personal role of innovators

One finding which is congruent with the traditional view of the NFS as a bureaucratic organisation, is that the role of innovators is unnecessarily large and influential in comparison with peers in private organisations. Where in other organisations a more elaborate structure regarding innovation is present, formalized in for example a R&D department or an individual support structure for EDI, we found evidence for something entirely different at the NFS. All shared experiences from the innovators indicated that if they themselves did not continue to put a substantial effort in the furthering of their innovative ideas, those ideas would not progress at all. While this demonstrates the importance of someone being involved with the project and taking ownership, as sketched by the following quote, it has become clear that solely relying on individual innovators to take care of all innovative efforts is not a feasible structure. This highlights the importance of creating an innovation ecosystem to facilitating a more team effort focussed approach.

*“... I think that ownership is characteristic for projects in general; Such a project must be taken ownership over otherwise it will not take off at all.” – Interview 2*

The reason we found for the fact that taking ownership is oftentimes still done by innovators, is the personal drive that innovators possess. While common sense and restrictions by their day-to-day tasks might influence their ability to spend time on innovation, the intrinsic drive that innovators feel was found to be strong enough to still motivate innovators to innovate in multiple cases. This intrinsic drive often found its origin in a personal conviction that an idea could truly add value. Also when the origin of an idea could be found in, sometimes traumatic, experiences from the innovator, that personal conviction became a strong driver.

*“... I ran this project from the conviction of ‘I do not want to go through this again’.” – Interview 18*

Additional examples of the substantial role of innovators are linked to several matters. First of all to the efforts of individuals to make sure innovation projects are spread throughout specific RSUs, and between different RSUs. This can require quite an effort from innovators, which might hinder some from proceeding with activities in that direction. One innovator gave an example of such efforts by stating:

*“... and we drove around the Netherlands and gave a tremendous amount of demonstrations and lectures throughout the country.” – Interview 1*

Something to note with the efforts from innovators, is that it occurred multiple times that the position of innovators within the organisation was of influence on the innovation project. It could be the case that innovators managed budgets which they could employ to support their innovative idea, or that they were internally positioned closely to a stakeholder who could support them in their innovation efforts.

A final addition to strengthen the notion that the brunt of the innovative efforts lies on the shoulders of innovators themselves, holds regard to the aforementioned duration of the innovative process. While the majority of innovators mentioned they experienced the duration of the innovation process as very lengthy, only one of the experts who were interviewed referred to the time aspect of innovation. This could be indicative of experts being detached from the everyday innovative efforts, and might support the need for a redesign of the support for innovation within the NFS. Another remark that flows out of these findings is that while we see a need for focussing on the team effort within an innovation ecosystem, the role of individuals for innovation within the NFS remains vital, and the NFS should not move away from EDI. Instead, the suggestions for how the innovation ecosystem should function in the next section embrace EDI and propose a way to better support it.

#### 4.4 Design principles of the NFS innovation ecosystem

Another category of findings is that besides the existence of EDI within the NFS, numerous requirements and preconditions for innovation were mentioned as success factors for innovation. Most of these preconditions were mentioned independently of each other by different respondents, and oftentimes were formulated in varying ways. We consolidated all these different notions and viewpoints in several design principles, which serve as the foundation for the proper functioning of an innovation ecosystem.

##### 4.4.1 Goal and structure clarity

One of the most recurring ecosystem design principles was to ensure a clear goal for innovation. Without the presence of a clear goal for innovation, innovative efforts will go unguided and are more inclined to end in failed projects or unusable results. This notion stretches from having a common, organisational vision to which innovative ideas must be related, towards determining the exact goal of a project during the first phases of a project. A large aspect of goal clarity as a design principle for an ecosystem is generating and sharing a clear vision as a direction for all innovative projects.

Not only the goal clarity was deemed to be a design principle, knowing how to progress after having an innovative idea was also indicated to be highly relevant. Multiple innovators indicated that knowing who to approach and ask for help, and also with which question they should approach them, helped in the progressing of their innovative idea. The importance of this design principle was described clearly by one of the respondents:

*“... if you are a volunteer at our station, you must be able to find out: ... which road to I need to take? Do I have to talk to my team leader, my station commander? And does he know what the next steps of the road are?” – Interview 8*

Next to having the goal clear, the structure of the different phases should be clear to innovators. However, important to note when formalizing a structure is that some degree of flexibility should be offered. Multiple respondents emphasized that when making the process of innovation a rigid thing, and forcing employees to follow a set of steps in a fixed order, the innovation efforts of staff would not be affected positively. However, letting the process remain in a more organic state, and less

formalizing how and which steps employees should take was also not deemed desirable. Process clarity can therefore be deemed to be an important design principle, while also challenging an organisation to make a choice in the trade-off between a rigid or organic innovation process. One respondent formulated a proposal on making the process a more dynamic form, and customizing the exact content and order of the described steps in the innovation process, in line with the notion of finding a middle ground between flexibility and formalisation:

*“... in the end, it should go along more organically. If you look at it in a purely procedural form, you know by definition it will not succeed. And at the same time, the bureaucratic, formal way of working should still be there to keep things somewhat in control.” – Interview*

22

One respondent summarized the above preconditions perfectly, while adding a third design principle regarding the culture and social aspect of innovation within organisation. These aspects will be discussed later on in more detail. This respondent said:

*“So you need: Ensuring people have the space and capacity [to innovate], growing the culture within your organisation [to actually find innovation important], and providing focus to your innovative efforts.” – Interview 20*

#### 4.4.2 Unique innovations

Two other important ecosystem design principles were found to be the uniqueness of an innovative idea, as well as the broader applicability of an idea. The first requirement, that of an idea being unique to have an increased chance of succeeding, was shared by several respondents. These respondents were unanimous in sharing that innovative ideas should truly be unique in order to succeed. If ideas were already considered and worked out by others, they would not be truly innovative anymore, and would therefore be unfit for being worked on again.

The same holds for the broader applicability of innovative ideas. While this is only applicable to innovative ideas that are related to a product, which eventually will have to be produced and sold, the principle is similar. If an idea is not unique or has no applications outside of the niche NFS industry, manufacturers will most likely not be interested in having a role in the development of such a product. Thus as design principles for an ecosystem, these hinderances can be translated to ensuring both the uniqueness and broad applicability of ideas to allow for further stakeholder involvement. As an innovation ecosystem is built around stakeholder involvement, these design principles are vital for the NFS innovation ecosystem.

#### 4.4.3 Duration of the innovation process

One thing that an overwhelming majority of innovators mentioned in their interviews was how lengthy they experienced the innovation process to be. Examples of these are projects dragging on for years, waiting very long before they received an answer on questions for help, and cases of a continuously expanding time frame during the project's execution. As respondents shared that such a long duration might lead to projects slowly losing the attention of project members, and eventually dying off or being forgotten, we consider a clear communication about the project duration to be a very important design principle to the innovation ecosystem. The importance of this design principle is demonstrated by respondents bringing up the notion that by having innovation projects drag on for a prolonged period of time, those who initiate innovative ideas and feel driven to innovate within the organisation feel more and more let down by the organisation. This in turn causes them to lose energy and interest in innovating, thus killing off the innovative capabilities of the organisation. One respondent demonstrated this by stating:

*“...if ideas go into the process, and it takes so long before something comes out of it, the energy decreases, and that is noticeable.” – Interview 3*

Special attention was paid to determining if increased efforts in shortening the innovation process would be feasible to include as a design principle. However, it was found that speeding up the innovation process would not be achieved easily, and could even lead to a deterioration of project results. Hence why we solely consider the clear communication about project duration to be an important innovation ecosystem design principle on this point.

#### 4.5 Innovation supporting stakeholders within the innovation ecosystem

At the core of improving support for innovation lies the connection between stakeholders. Whether that connection occurs at the conception, further development, or implementation of an innovative idea, it has become clear that no singular innovator can develop and implement an idea alone. This notion was shared and supported by almost all interviewees, from those involved with innovative projects to experts. Important remarks regarding the improvement of these connections are directed at the better and more structured involvement of different departments throughout a RSU, or fire station. So not only involving those from the work floor, but also specialists from the ‘repression’, ‘operational preparation’, ‘prevention’, ‘ICT’, and ‘material and maintenance’ departments. Only then, a true organisation-wide ecosystem in which all specialisms within the organisation can contribute exists. In the extension of including different departments lies the notion for diversity within the organisation, and within project teams in particular. Here, diversity lies not only in gender and ethnicity, but also in knowledge, position within the organisation, and background of members. The inclusion of more stakeholders from within the organisation extends to also including stakeholders from outside of the organisation. One respondent summarized this as:

*“... a key notion within innovation is: networking. Know and be known. So innovating is knowing who you have to approach for what, and having a lot of people you know.” – Interview 21*

An important part of organisation wide connecting of different stakeholders is the strong internal network of a stakeholder. It was mentioned that already having the contacts within the organisation and knowing who to approach for which questions is of significant added value. This was suggested to be even more so for a network with external stakeholders. Interviewees suggested that a pre-existing and/or long-lasting nature of external contact worked in their advantage when approaching those contacts with requests for advice or cooperation. Many interviewees who shared examples of their collaboration with external parties mentioned that they were already familiar with the external stakeholder, or already had a pre-existing connection that led to the collaboration being kickstarted.

The importance of a pre-existing network has several implications for our findings. It raises questions regarding the formation and maintenance of the existing network, and if the network should be project centred, or more broadly focused. When combining the evidence from the interviews, we come to suggest that a hybrid form between a personal and trust-based network, and a more broadly shared organisational network is most suitable for the NFS. With such a structure, a first step in the innovation process is supported by the personal or local network of an innovator or supporting stakeholder, and further steps might be more supported by a more broad and organisationally supported network. While innovators themselves might have and maintain their own personal network, this suggestion would put the burden of maintaining networks specifically for supporting innovation with specific innovation supporting stakeholders. As maintaining a network can bring with it a significant time investment for an individual, we suggest to integrate the responsibility for maintaining both the personal network and constructing that network in such a fashion that it can be used in a broader

context, in a single role. This entails several consequences for the person filling this intended role. As the personal traits and the attitude towards change and innovation of someone in such a role are important, the recruitment and selection of such an individual should focus on more open and social traits. Next to personal traits, the cultural position of an individual regarding innovation should not be of a conservative nature, as this found to be a large inhibitor of innovation within the NFS. A striking description of such an individual was given by one of the interviewees:

*“... you need someone with the network within an organisation, ... who can get people together. A real jack-of-all-trades within the organisation!” – Interview 3*

The suggested manner of better stakeholder involvement was hinted at by interviewees to be of an added value to supporting innovation. By ensuring a better involvement of not only the work floor, but also middle and upper management, ideas or projects might find those stakeholders that they miss in further progressing their innovative idea. Those missing innovation supporting stakeholders might be able to help a project by their own efforts, but sometimes they can also provide some sort of network to projects. For example, the facilitating of more contact between RSUs was indicated to be a strong point of innovation supporting stakeholders. Additional examples from innovation ideas being supported by stakeholders through skills and networks of those innovation supporting stakeholders were also shared by the Netherlands Police interview in section 4.1, and by one of the interviewees.

#### 4.6 Intended effects of innovation supporting stakeholders and examples of supporting factors

Out of the interviews a diverse collection of examples how innovation is supported throughout the NFS has been gathered. These examples varied from a RSU that had a specific department focussed at supporting knowledge and innovation, to individual innovators simply asking co-workers or contacts out of their network to help them. An interesting suggestion that was made on how to cement EDI more into the foundation of the NFS, was to allow all employees to be able to freely use a small fraction of their working hours to work on an idea they have, or to take a look into a different part of the organisation for once. By doing so, employees were suggested to behave in a more innovative and creative manner, and be more inclined to create ideas and projects together. It was noted that this act of letting employees more free with their time is likely to ask a large mindset change of supervisors. This shows significant parallels with the aforementioned needed culture change to a more acceptive stance for innovation.

While giving more freedom to employees is a very organic way of promoting innovation within the organisation, examples of more strict and unambiguous manners of encouraging and weighing innovation were also found in the interviews. One such example was about a rigid rubric to assess if an innovative idea would be feasible enough to continue with. In this example, an innovative idea would immediately be written off if a clear business case could not be provided. This way of working was sketched to conflict with giving employees the freedom to learn from the act of innovating, and perhaps prevents successful collaborations on innovative ideas to come off the ground. Especially those collaborations were suggested to be of great value, with several examples extracted out of the interviews about employees helping each other, and engaging in collaborations with external parties.

A structure that was found throughout several interviews was that of a central group that is available to support employees when they have an innovative idea. One respondent suggested having a group that exists to promote innovative behaviour and provide assistance to ideas that have potential. Another respondent described a structure with such central groups as follows:

*“I mean, you see a number of regions that work with a continuous department for fire or for rescue. That means that people with good ideas almost always can go to such a department...” – Interview 22*

From the interviews, no conclusive suggestion can be made for the most optimal way of setting up such a central group. However, from the number of mentions of the potential added value of a central supporting group for innovation, we deem it important to include it in our proposed ecosystem structure later in this section.

Besides finding a way to support innovators, another supporting factor that was identified and shows parallels with helping individual innovators progress with their innovative projects was unburdening them of the large bureaucratic and administrative aspects of innovating. *‘Keeping innovation fun’* is a term used by several of the respondents in regard to letting innovative employees focus more on the innovating part of a project, and taking over the writing of a project proposal, giving updates in management meetings and accounting for expenses. In the case of the NFS, the innovative employees are better at thinking about the content portion of their project, than occupying themselves with the business side of things. Here lies a great opportunity for the proposed design of an innovation ecosystem, as this is a suggestion multiple respondents were adamant about, as its value is shown by the following quote:

*“So putting effort into the components that no one wants to do, and really keeping them away from the people, putting as less burden on them as possible” – Interview 17*

A fairly different factor that also plays a large role in innovation, especially in a KIPSO that is financed with public funds, is the financial aspect of innovation. While we found a number of negative experiences regarding the financing of innovation within the NFS, our main finding is the potential for improvement of the funding of innovation that exists. A more detailed structure is proposed in the next sub-sections, yet a combination between a decentral and regional central budget seems to be most feasible following the interviews.

## 5 NFS innovation ecosystem design

### 5.1 Design aspects of the innovation ecosystem - peripherals

Following all design principles that were described, the roles of innovation supporting stakeholders, and supporting factors, a design for the NFS innovation ecosystem can be proposed. In this ecosystem, several peripheral issues are to be tackled besides implementing a supportive structure. The first and foremost issue that is to be addressed throughout the entire organisation, which immediately is one of the most difficult changes that an organisation can go through, is establishing a shift in culture. In alignment with Leifer (2001), such a culture should be appealing to innovators who are most likely to promote innovation. Our findings suggest that the current culture of the NFS is one with a very conservative nature, not focussed on the broader support and acceptance of innovation. While certain individuals or groups within the organisation might be more positive towards innovation, the respondents indicated they experienced a majority of the organisation to not be very acceptive of innovation. Sadly, our findings provide no clear roadmap on how to address cultural change within the NFS. They do however provide some focal points that might help steer the changing efforts, these being the aspects of sharing and collaboration. The lack of both these aspects was mainly found between different RSUs, and were found only in relation to innovation by our research. While both aspects seem similar, there are some inherent differences between the two, leading to the need to mention both of them. RSUs were indicated to sometimes be reluctant in sharing results from innovation project, with the results being either knowledge, ways of working or products. The feeling of giving other RSUs free information that employees worked for was named as a large reason for this. However, the aversion of sharing between RSUs also works the other way around. RSUs were also found to be averse of accepting the results of innovation projects carried out by different regions. Reasons that were mentioned by the respondents were the lack of trust in the methods of another region, not seeing the need for a specific project, and the feeling that by doing it themselves they would get a 'better' result. The aspect of collaboration between RSUs focusses on different regions working together in innovation projects, to better spread costs and organisational burden, and benefit from the knowledge and network of another RSU. However, we found similar reasons for the lack of collaboration between RSUs in conducting innovation projects as reasons for the lack of sharing of information between RSUs. Not seeing the need for a project, having a low level of trust for the capabilities of another region, and sometimes even a personal prejudice against working with employees from another RSU. These reluctancies are reflected by a quote from the experiences on the work floor from a respondent:

*"... you see that people just do not want to believe what I have to say ... they ask 'who are you? You are from [another city], I don't have anything to do with that'." – Interview 18*

In other words, the internal competition and aversion between RSUs is an issue that is to be addressed. One way that was suggested these internal barriers might be overcome is the inclusion of an instrument that somewhat forcibly connects these different regions. By connecting the regions on one or more levels, either formally or informally, the slow process of eroding existing perceptions and practices was suggested to move forward

Besides the large need for social innovation and cultural change, another peripheral issue needs tackling for a proper implementation of an innovation ecosystem. An internal discussion needs to take place on the role the NFS should have in the innovation process, that role being either the problem owner or the developer of an innovation. As this is an issue that most firms with dedicated R&D departments do not face, no information to guide this discussion was found in existing literature. Multiple respondents had something to say about this, and no clear consensus could be extracted from



their answers. While on the one hand, the volunteers within the NFS are very practically oriented and motivated to translate their ideas to real life solutions, on the other hand the NFS is a KIPSO, and is not in the idea development or manufacturing business. As the latter direction is a more continuity proof and operationally sound focus, multiple important factors come into play. These are mainly the adequate involvement of innovative employees to ensure their motivation is not lost and guarding the scope of NFS' role in the process. An example of adequate employee involvement with the development of innovative ideas was described by one of the respondents as:

*“...[involve the employees] more for their creative thinking capacities, instead of letting them craft something in their shed and build a machine on their own. No you have to let a manufacturer deal with that, and just make a connection with them.” – Interview 21*

Another standpoint on this internal discussion, which was presented as a concurring view to the aforementioned approach, is that an organisation cannot manage innovation, but it can manage innovative potential in its employee. In line with this view, respondents were adamant on the view that innovative employees should be given the space and support they need to work on innovative projects, as in line with Granstrand & Holgersson (2020) and Leifer (2001). However, upon comparing both standpoints, striking similarities were discovered. While it is true that instead of giving every innovative employee the chance to work on their innovative idea, a selection will have to be made to enable those with promising and unique ideas to collaborate with external partners. While we cannot dictate what the right choice is for the NFS, our findings suggest that choosing an approach centred around the knowledge character of the NFS suits best. The result of this discussion and choice has an effect on the goals and more in-depth functioning of the proposed ecosystem components. However, the overall ecosystem structure remains well adapted to the organisational workings of the NFS, and should achieve its objective of better supporting innovative employees to progress their innovative ideas and projects.

## 5.2 Design aspects of the innovation ecosystem – structural components

In the previous section of this chapter we have mentioned a selection of supporting aspects that are required for more successful EDI within the NFS. By combining these with the design principles explained in chapter four, we draft a design tailor-made to the organisational characteristics of the NFS. At its core, we deem the ecosystem to work best when it consists of a regional and a national part of the infrastructure, similar to the combination of a centralized and decentralized structure of Leifer (2001).

For the regional part, multiple important functions were identified. First, it is to be approachable and recognizable by employees from the work floor through having local representatives and ensuring familiarity of the innovation counter throughout the organisation. Besides that, the ability to offer support to employees regarding any aspect of the innovation process is an important function. The third pillar of the regional part of the ecosystem is at the centre of its functioning, and is focussed on a single innovation ambassador who acts as a network holder and point of contact regarding innovation for all RSU employees.

A large variety of descriptions of such an ambassador was gathered from the respondents, detailing multiple core characteristics. First and foremost we found that creating and maintaining a network requires a single innovation ambassador who has the right personal skills and characteristics. Additionally it was found that an innovation ambassador has to have a degree of responsibility for innovative ideas, and together with the regional part of the ecosystem provide any support that innovators need. With the role of ambassador also has to come a degree of authority to make decisions regarding budgets and the continuation of projects. Especially in a hierarchical organisation as the NFS



this is an important consideration, as budgets are tight, and innovation is not yet seen as a core activity everywhere. By giving an ambassador the authority to handle a budget, of which the exact dimensions remain to be determined by the NFS in the prototype phase, an actor that has innovation as a priority is able to maintain momentum and much needed financing for projects. An important sidenote remains the upholding of clear goal and uniqueness criteria for projects, as was established earlier, and is supported by Flocco et al. (2022).

By combining all these aspects of the regional ecosystem part, we come to best describe it as innovation counter. A counter that is easily recognizable and approachable for all those within the RSU that need support for their innovative ideas, of which a regional ambassador is a vital part in utilizing the in- and external network he/she holds to connect ideas, innovators, and all kinds of stakeholders. Organizing this support is also deemed vital in existing literature, for example brought forward by Flocco et al. (2022). Additionally, respondents shared the need to organize the bridging of the gap from local fire stations to the regional platform. Concerns were raised that employees operating at the lowest levels of the NFS would lack the connection to the organisational levels of the RSU, and thus would still not be able to connect and receive support for their innovative ideas. One way that was proposed to bridge the gap, which aligns with the structure of the Police presented in section 4.1, was the attracting and binding of local representatives at fire stations, as was also mentioned earlier, and aligns with notions from Leifer (2001). Such individuals would ideally be familiar with the workings of the innovation counter and innovative projects, and thus know how to reach the innovation counter or ambassador. By implementing such a structure, the threshold for employees to seek support for their innovative idea is lowered significantly. A vital part of this is overcoming the barriers that volunteer firefighters often encounter in wanting to seek such support. As volunteer firefighters are usually less connected to the NFS organisation outside of their fire station, finding a supporter for their innovative idea can turn out to be a significant barrier. In line with the hierarchic structure of the NFS, a team leader or someone with a comparable position can be an important stepping stone to a local representative or innovation ambassador.

An important complementary part of the regional innovation counter that we propose out of the input from respondents is a national connecting platform. This platform serves the role of connecting all regional counters, by form of meetings between the innovation ambassadors. It serves a similar purpose to how the Netherlands Police shares projects around the country. Having such a periodic meeting between ambassadors was not only suggested to be of assistance in forming networks between different RSUs, but most importantly was described to be of an important role in connecting innovative initiatives to relevant stakeholders through networks of other ambassadors. One respondent described it as follows:

*“...for example: I am very regionally oriented, and have no idea what is going in at the University of Amsterdam, or Tilburg. While they are probably do fantastic things.” –  
Interview 19*

Such a national platform might thus help with ensuring that innovative ideas from specific regions not only get connected to stakeholders who can be of service to the idea, but also might be connected with similar or comparable ideas that are founded across the country. Some respondents also raised concerns regarding the institution of ‘another periodic meeting to discuss even more’. Experiences brought forward by several respondents indicate that different groups ‘talking’ about innovation are often perceived as negative, due to a lack of tangible outcomes from those meetings. This is a remark that is not to be forgotten in the formation and position of the platform in the organisation. A suggestion that was made to partially solve this aversion was the improvement of transparency around what was discussed in these meeting, and the more actively sharing of the results of such meetings.

One might think of newsletters or brief online videos that can be used as a medium for sharing these results. In line with the goal of achieving even further national connectedness, in addition to a counter that assists innovative employees with their innovative ideas, a national platform aligns with the ideas presented by respondents.

Another aspect of sharing and connecting between stakeholders and innovative projects that was mentioned numerous times by respondents, was a manner to share and be updated about innovative projects in a continuous fashion. In accordance with respondent suggestions, the formation of a database in which innovative projects can be uploaded and viewed is included in the design. While it might seem such a database serves a double role compared to the national platform, or can even be perceived as obstructive, the respondents suggested the database as complementary to the proposed structure. Additionally, such a database might help bridge a gap between innovative projects, and employees who might want to contribute to projects, but are not on the radar of the innovation ambassador, counter or platform. Some practical matters do deserve some more attention in the eventual implementation of a database. These being who can access the database, and view information on projects, who can upload ideas, problems, or projects, and who is able to see contact details for project owners. These practical considerations were all suggested to be important by respondents, as an incorrect approach might hinder the willingness to accept and implement such a database. The development and implementation of such a database is already being worked on by the innovation department of the NIPV, and the above considerations can be seen as an addition to those efforts.

Lastly, an important factor in providing support for innovation within the NFS is instating a structure for financing innovative initiatives. As we pointed out earlier, the public and bureaucratic nature of the NFS is suggested to be of a negative influence in ensuring financial support for innovative employees and projects. The importance of structuring financing is also repeated by Leifer (2001), and even suggested to be easier as part of an ecosystem. Respondents suggested several important notions about the financing of innovation projects, mostly pertaining to the managing and who is responsible for the funding. Different experiences were sketched regarding the accountability obligations to certain financiers being overly strict for innovative employees, and respondents fearing that when making one budget available for innovation, it would not be used in line with the goals of achieving EDI within the NFS. Combining this with the notion that a responsibility for encouraging innovation lies with the supervisors and team leaders of the different teams and departments, we propose a combined financing structure for innovation. Based on the answers of the respondents, leaving room for supervisors to financially support decentral projects that require only a small financial investment is seen as an important step towards a more EDI oriented organisation. An important sidenote to this decentral funding structure is that determining the uniqueness and having a clear goal for innovative projects remains vital to the added value of innovative ideas to the organisation. On the other side of this structure stands a centralized budget to accommodate larger expenses, such as extended development and implementation of projects. In line with concerns from respondents about the central managing of such a large budget, we see an important role for the regional innovation counters in making claims to the budget for specific innovation projects. This balance between decentral and central funding for innovative projects is suggested to be of great added value to the proposed innovation ecosystem structure.

### 5.3 Design overview

To incorporate all different supporting elements that can help facilitate EDI to progress further through the innovation process, all design principles and peripheral and structural design aspects are included in a design for the structure of an innovation supporting ecosystem for the NFS. The proposed structure

is not solely based on the input from respondents, but is also based on several key elements which were extracted from the framework of the Netherlands Police, and on notions extracted from existing literature. Especially the different actors and components of the ecosystem from the Netherlands Police, and the importance of connections in an ecosystem were vital inspirations for the proposed ecosystem design. The structure not only incorporates the regional and national character of the NFS, but also highlights the importance of connecting different internal and external stakeholders. All these core components are visually brought together in figure 6, which together with figure 7 can be seen as the final ecosystem design. The presented design allows innovative ideas to be supported better by innovation supporting stakeholders while progressing through the innovation process. As figure 6 shows, the proposed innovation ecosystem consists of several core components. These core components are centred around the duality between the regional and national parts, with the innovation counter and the innovation platform being at the middle of the ecosystem to facilitate support and connectedness in the innovation process. In direct support of this core are the innovation ambassadors in the different regions, to act as network holders in each distinct RSU. Another addition is the innovation database that allows for continuous information sharing on innovative ideas or problems that are in need of a solution, and thus also have a role in facilitating employees and other stakeholders to come into contact with each other. These elements all have the goal of organising a more structured form of support for EDI, and focus on connecting stakeholders on the one hand, and providing practical support to innovators on the other hand. Especially the aspect of connecting stakeholders is highlighted by the importance of using the internal and external networks filled with innovation supporting stakeholders and external partners. The ecosystem has another part that assists in the goal of improving the support of EDI. This aspect is the budgetary support that is proposed to come from both the team level, and is facilitated by team leader budgets, and from the regional/national level, which is controlled by the regional innovation counters. Some important preconditions for this ecosystem are the goal clarity and uniqueness of ideas, and the needed changes in culture and organisational acceptance of EDI. Not only do employees and managers together need to spend a tremendous effort to facilitate a culture that is more receptive and supportive of employees willing to innovate, a change in organisational procedures that move away from relying on the efforts of individual innovators is in place. Only then an ecosystem that allows for innovation to be a team effort can truly thrive.

While not directly mentioned in figure 5, the different kinds of innovation supporting stakeholders play a significant role under the blocks of the internal and external network, as well as under the regional innovation support counter. While on one hand the different innovator roles play a role in actually helping to progress the idea, those with a boundary spanning function provide the connection between the innovator and the support roles. Along with the different innovation supporting stakeholders having roles in different stages of the innovation process, more components with the proposed ecosystem are involved in different stages, and thus have different envisioned effects on the innovator and the progression of the innovative idea. A brief summary of when different actors have a role in the innovation process is given below in figure 6.

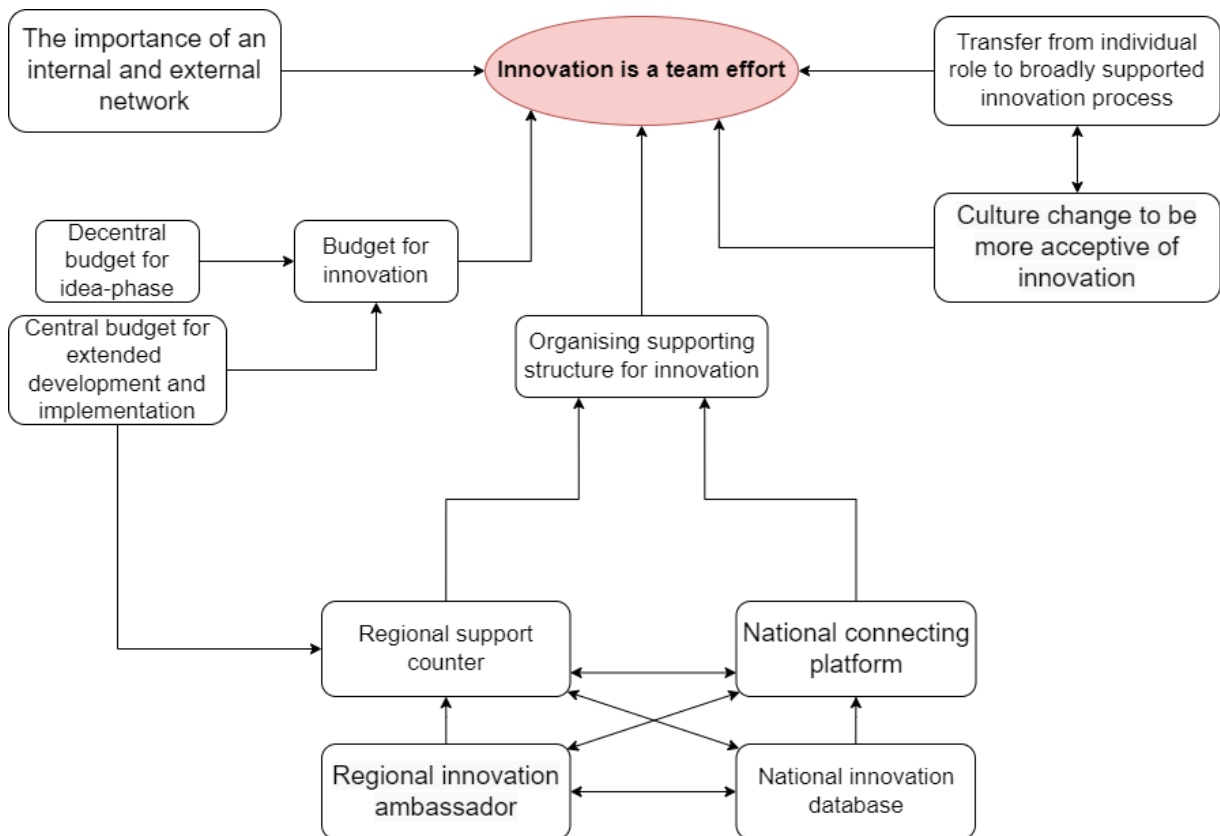


Figure 6. Ecosystem structure

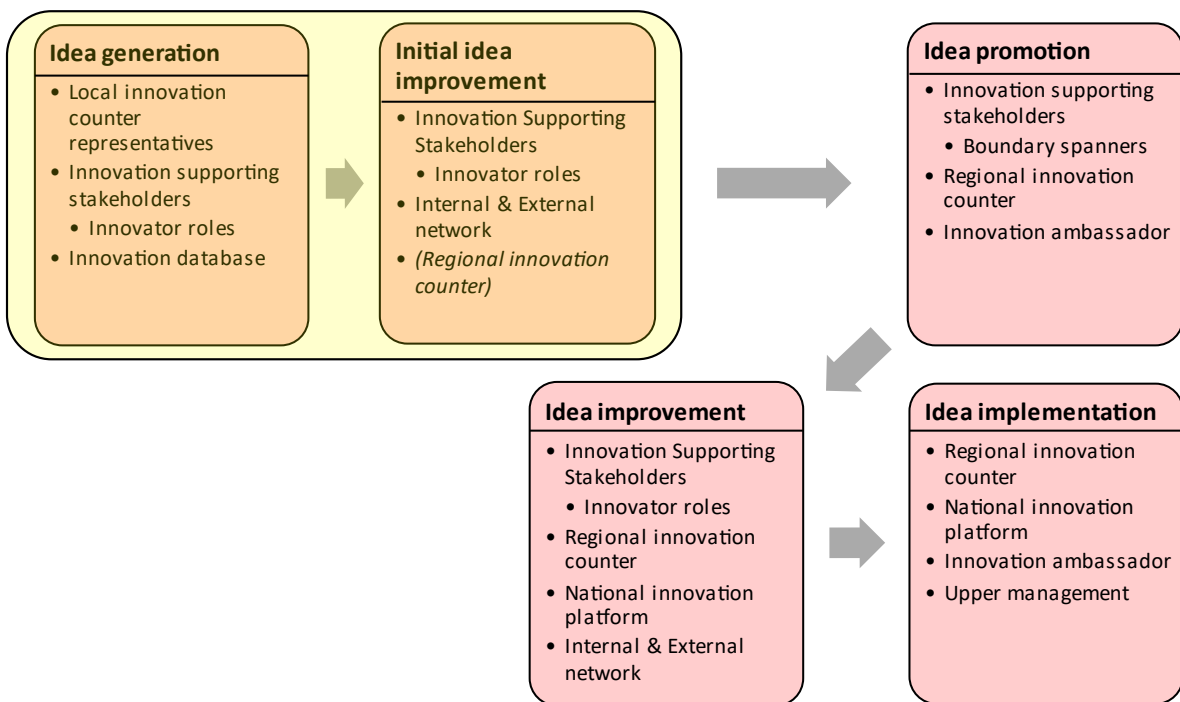


Figure 7. Overview innovation process and actors

The roles of the different actors in the stages of the innovation process can be briefly described as follows:

1. **Idea generation:** In this stage the main driver of innovation are the employees that generate ideas, whom remain important throughout all stages. They are supported by co-workers and supervisors who are in their own internal network, that act as innovation supporting stakeholders and provide support in one of possible innovator roles. Local innovation counter representatives are also in the position to potentially hold an innovator role to provide support. A potential other source for generating or contributing to ideas is the innovation database, that connects initiatives throughout the country.
2. **Initial idea Improvement:** Before progressing with the idea and promoting it throughout the organisation, a substage is passed through in which an initial improvement and polishing of the idea occurs. With a small effort from stakeholders that provide support to ideas, often out of the in- and external networks of the innovative employees themselves. A potential role for the regional innovation counter exists within this phase, depending on the connection to the counter, and which need for support exists.
3. **Idea promotion:** Following after the idea generation comes the phase of promoting the idea throughout the organisation. The goal of these activities is to connect the innovative employee to other stakeholders that can support them, and input for the idea. All the mentioned stakeholders engage in boundary spanning activities, each using their own network and position. The innovation counter and ambassador should be able to span over the regional boundaries, and seek connections that individual boundary spanners might not be able to achieve.
4. **Idea improvement:** After a phase in which connections are made to other stakeholders, an idea is improved upon by working together with those stakeholders who are connected to. These can be innovation supporting stakeholders holding innovator roles, employees that are part of the innovation counter, a connection to the innovation platform, or other stakeholders in an internal and external network that was connected with. Especially a connection to the innovation platform can bring additional network connections with it, as ambassadors gathered in the platform can connect projects to potential supporting internal and external stakeholders in their own network.
5. **Idea implementation:** After improving an idea, the final stage of the innovation process sees a primary involvement of the innovation ambassador, regional counter, and ambassadors gathered in the platform, to enable implementation of the idea. These actors can be of valuable assistance in conferring with (upper) management regarding prolonged support and possible implementation. In the case of the regional counter, together with the innovation ambassador, the role of providing support is mainly focussed on the management of financial means considered to be important.

## 6 Discussion / reflection

### 6.1 Existence of EDI & Innovation supporting stakeholders

A first priority was to establish the occurrence of innovative behaviour within the NFS, and to ensure alignment with the used theoretical framework in the light of overcoming boundaries within an organisation. In line with research from Borins (2002), Bysted and Hansen (2015), and Hartley (2005), we found extensive support in the interviews of the existence of EDI. An additional findings was the identification of the added value of EDI to an organisation. Through the occurrence of EDI within the NFS, innovative ideas that are tailor made for an organisation come to bear, which are carried out by employees that are passionate about their idea and the organisation. Somewhat related to that is that with describing the champion role, Gemünden et al. (2007) point out that individuals might have high personal involvement in an idea. That high personal involvement leads to them being willing to put themselves on the line for the success of the idea. We found support for this notion as well, with respondents possessing all three behavioural characteristics of a champion, stating themselves to be the driving force behind ideas and sharing examples in where their efforts made projects into a success. Another important finding linked to the existence of EDI, is the stance of the organisation regarding employees engaged in forming innovative ideas, and the level of support that is organisationally provided for. We found that within the NFS, the main driver behind innovation are the efforts of individual employees that are passionate about their idea. As dependency on singular employees is not a strong core of strengthening innovation within an organisation, the ecosystem design in the previous chapter has the aim to broaden the support base of EDI within the NFS.

As theory also suggests that a precondition for innovation is being connected with and supported by other stakeholders, we delved deeper into the kinds of innovation supporting stakeholders. Support was found for the existence and functions of the different innovator and promotor roles, described by Gemünden et al. (2007) and Hauschildt and Kirchmann (2001), combined with the notion that each different promotor is meant for overcoming a specific barrier. The fact that different innovator roles and promotors overcome different barriers returned as a core characteristic of the NFS in the interviews. Whereas team leaders are for example able to overcome internal organisational boundaries, another co-worker of an employee with an innovative idea might be schooled and capable to assist with the physical construction of a product, or the graphical design of something. This also aligns with the outcome of research by Drion (2021) into boundary spanners within public sector organisations. Where the results of Drion (2021) confirm a need for all four boundary spanning roles, we define that further as that each stage in the innovation process presents a specific boundary that needs to be spanned. Especially in the case of the four boundary spanner roles, we see that each role is relevant in a different stage of the innovation process. Whereas the *Entrepreneur* is more needed in the idea generation and promotion stages, the *Messenger* is mainly at home in support of the idea promotion stage, the *Reticulist* is of more use in the idea improvement stage, and at last the *Facilitator* is great at spanning the boundaries in the idea improvement and idea implementation stages. In light of the goal of an ecosystem aiming to connect those that hold these different roles within an organisation, albeit through a boundary spanner, connecting all different stakeholders is interwoven in the fibres of the ecosystem (Flocco et al., 2022; Granstrand & Holgersson, 2020; Leifer, 2001; Rabelo & Bernus, 2015). By implementing several instruments to connect stakeholders within the organisation, we aimed to design the innovation ecosystem to be aligned with the aforementioned concepts of different innovator roles and boundary spanners. By enabling those with innovative ideas to connect to stakeholders with different skillsets through different ecosystem components, they are able to act as their own boundary spanners while still achieving the result of interconnectedness between stakeholders.

When combining these theories with the innovation ecosystem design, it becomes clear that innovation supporting stakeholders play a very important role in innovation. We found that they not only support innovative employees in different kind of ways, corresponding with the aforementioned promotor roles, but also the connecting of innovative employees with not only those supporting stakeholders, but also with external parties that can support them. These two functions assist in innovative ideas progressing through the four discernible stages of the innovation process.

## 6.2 Comparison NFS and the Netherlands Police

As the ecosystem design of the Netherlands Police served as an important comparison for the design of the NFS innovation ecosystem, some important remarks are to be made in the comparison between the two. Especially as certain design choices might need extra explanation, or were not clear in the chapter containing the eventual ecosystem design. The four stages of the innovation process that the Police uses as a base for its EDI are fairly aligned with the proposed innovation process for the NFS. However, the entire process at the Police is significantly more focused on enforcing a fixed order for progressing through the process, and ensuring a thorough (pre-)selection of ideas before they continue through to a next stage. The theme of focussing on selection persists throughout several other components of the Police innovation ecosystem. For example, both the innovation funnel, and in the subsequent phase, the innovation council both have the sole purpose of weeding out innovation ideas that might be deemed to be less successful than others. This conflicts with the nature of the innovation process that is proposed for the NFS, as the design for the NFS allows for more innovative projects to be supported as opposed to the Police that has a stricter policy on which projects pass through the innovation funnel. Parts of the Police innovation ecosystem that align more with the ecosystem proposal for the NFS are the innovation broker and the portfolio holder. The innovation broker within the Netherlands Police has an equal function to the innovation ambassador within the proposed ecosystem, namely that of connecting a variety of stakeholders inside and outside of the organisation. However, the broker does this on a broader geographical level (several combined regions into districts) than the ambassador, which only has a responsibility for a specific RSU. The innovation portfolio holder and the suggested local representatives of the innovation counter hold a very similar role, both being a stepping stone to the innovation supporting infrastructure and actors. An additional element of the innovation ecosystem that was found at the Police is the presence of so-called Q-lab's, as locations for assistance with practical idea improvement. No support was found for the necessity of forming such labs for the ecosystem of the NFS in the interviews, and the organisational shift in focus from trying to be a manufacturing stakeholder to a problem-holder stakeholder defeats the purpose of having such a physical innovation lab. An element that was added in our proposition that was not present in the ecosystem of the Police, is that of an innovation platform. This platform allows for a connection between different ambassadors/brokers, and thus different regions/districts. While some contact between these two parties might exist in an informal manner, the added value of a platform is that regular contact between the actors is formalised, and thus ensured. Another difference between the proposed ecosystem and the ecosystem that is present within the Police is the addition of a national innovation database, which allows a continuous sharing of innovative projects and problems in need of a solution on a national level. The Police has this role filled by the innovation brokers, but by implementing a database that is accessible for the entire organisation, innovation becomes a much more tangible concept for all levels of the organisation.

## 6.3 Theoretical implications

Our study brings with it a selection of theoretical contributions. While it has contributions to different fields of literature, the largest theoretical contribution of our research lies in the drafting of the

structure of an innovation ecosystem, accompanied by a description of the necessary design principles and basic necessities for a functioning ecosystem.

1. This main contribution immediately translates to a significant addition to the existing literature on innovation ecosystems. While in the first place general insights are generated regarding ecosystem design, more tangible insights can be taken away from this study for the ecosystem literature surrounding KIPSOs, as the innovation ecosystem is designed around the NFS which has a specific organisational structure. The core of this contribution lies in the design of the ecosystem that was made, along with the surrounding design principles and considerations.  
An important part of this implication is however that organisations structured like the NFS, with an independent local/regional component, and an overarching national component, could also have the proposed ecosystem be applied to their organisation. Examples of such organisations are similar KIPSOs or public/private organisations with local or regional departments and connecting national structures, but also large multinational organisations in which the locations in different countries have a similar role to the RSUs, and the international headquarters fulfils the overarching role. The goal of ecosystem implementation with these organisations should be that of promoting local EDI, and sharing as well as cooperating with that innovation on a broader level.
2. Another addition to theory is the notion of how the innovation process looks like in an innovation ecosystem. While many sources exist that all present a slight variation on the innovation process, we combine multiple of those sources, and infuse it with our findings. The resulting innovation process of 5 steps, as seen in figure 7, can be regarded as a basis for innovation within an ecosystem with the design as proposed.
3. A body of literature that is also supplemented is that of EDI, especially in an ecosystem context. Whereas we described earlier that we found support for the existence of EDI within the NFS, our findings make a contribution to theory by linking EDI to the functioning of an innovation ecosystem in a KIPSO. The notion of EDI existing within KIPSOs is not a new one, but by making the link to innovation ecosystems and highlighting the importance of connecting stakeholders and supporting innovating employees, existing literature is expanded upon.
4. Another field of literature that is expanded upon is that of innovation supporting stakeholders, and their role in an innovation ecosystem. While it is already known that a lot of different innovator roles exist, we further highlight the importance of different roles, and connections between these stakeholders in the innovation process. However, what we add to existing literature is that an ecosystem can only function when all different innovation supporting stakeholders, from innovator roles to boundary spanners, are connected and enabled to collaborate with each other. Existing literature often stresses the need for collaborating in a diverse selection of actors
5. Finally, our findings contribute to the value of providing clarity of the supporting structure for innovation, and clarity of the goal for innovation. Especially the latter was found to be able to help with clearly guiding EDI within organisations, as it provides a guideline to employees how they are able to progress throughout the innovation process. By having this guideline, and having an ecosystem that supports those employees that want to contribute to their organisation, those employees are better supported in the first stages of the innovation process, with a connectedness to stakeholders that can help them further develop their innovative project.

#### 6.4 Practical implications and recommendations

The main practical implications of our study are aimed at the NFS, due to the innovation ecosystem being design around its characteristics. However, as described above in the theoretical implications section, the practical implications can be translated to similarly structured and operating organisations in the public and private domain.



First of all, the results of this research present an insight into the current stance of EDI and the support for it within the NFS. Additionally, the proposed ecosystem and preconditions provide handles for NFS upper management to give attention to the parts of the organisation that can best be adapted to allow for better EDI support and ecosystem formation. All of these elements require an effort from different parts of the organisation, of which collaboration is necessary to ensure proper functioning of the ecosystem. On one hand, the RSUs are expected to make the largest effort in organising the lower levels of the support structure, and ensuring contact with the employees. On the other hand, rigorous steps need to be taken on the national level, as any effort on the part of individual RSUs is hollow if no overarching connection between the RSUs is made. Additionally, innovation can only go so far without arrangements being made around funding. A collaboration is needed between the national level and the RSUs to make those arrangements. Especially the NIPV, as umbrella organisation for the NFS, can play a large role in these changes due to its prime position.

Another practical implication of our research is that organisations are shown that innovation is not something that just happens, but is a collection of process steps in which each step is guided by a variety of ecosystem actors and requires an amount of effort in support and structure. This is also demonstrated in figure 7, and highlights the interconnectedness in the web of stakeholders that the NFS is to ensure before it is to properly benefit from EDI.

Following the practical implications, a number of core recommendations on how to broadly achieve the described result are also given. These recommendations can be divided into a short-term part, and a part that is more medium to long-term, as some parts require more prolonged efforts from the organisation to make a change. First an overview of the short-term changes that the NFS can make in starting the formation of an innovation ecosystem.

1. The most sensible start the NFS can make is for each RSU to attract and/or appoint an innovation ambassador that satisfies all personal characteristics that were mentioned in section 5.2, as to ensure someone in the organisation has supporting and encouraging innovation as their primary focus.
2. Intertwined with each RSU having an innovation ambassador is each ambassador organising a group of employees around him/her that is able to serve as support counter. Important aspects here are the abilities of the counter employees to provide initial support, in for example administrative tasks.
3. On the short to medium term follows the unifying of all independent innovation ambassadors into a national platform. This to allow for a nationwide ecosystem that connects projects and stakeholders, through a network of ambassadors, to parties that might provide valuable support to those projects.
4. Another aspect on the short to medium term spectrum is the arranging of a structure for funding innovation projects. In the ecosystem design we propose this entails the arranging of a central budget that is managed by the regional counters and ambassadors. As this asks a lot of changes in comparison to how the NFS is structured now, the execution of this plan requires some additional attention.
5. A project that is executable on the shorter term, in line with current efforts from the NIPV, is the formation of an innovation database. As this database allows nationwide insight in active innovation projects and innovative ideas, and thus allows for an all important connection to the work floor, the implementation and active use of such a database might be a significant step in the direction of achieving a culture focused more towards innovation.
6. This serves as a good link to a more longer term recommendation for the NFS. A significant finding in our study was that of a need for cultural change within the NFS. In order to tie the support for

innovation to the organisational character, a shift in culture and perception towards innovation and towards innovative efforts from other parts of the NFS is necessary. How this is best achieved remains unclear, and is an interesting topic for further research.

## 6.5 Limitations

The research we conducted has several limitations that need to be applied to its results. These limitations pertain mostly to the sample of respondents, as the sample is limited to projects that were executed several years back. Nevertheless, the attempt to include more recent projects in the sample did somewhat negate these negative effects. Additionally, relative to the size of the NFS, the presented sample can be seen as small. However, due the organisation knowing so many smaller and larger innovative projects, it is impossible to interview a sample that is representative of all different experiences with innovation. Through the manner of selecting projects for our sample, we ended up with a skewed mix of some smaller and mainly larger projects, while also representing various RSUs that were included in the projects. Therefore, by spreading the chosen projects over multiple years, sufficient efforts were made to be able to draw up conclusions from the interviews in the sample. Furthermore, the expert interview selection could also be expanded upon, as there are many more individuals within the organisation that are enthusiastic for innovation, or have a role that deals with innovation. Such an expansion of the number of interviews could have provided more insight in the balance between incremental and radical innovations within the NFS, or to investigate if substantial differences in innovation drive exist between volunteer and professional firefighters. Sadly however, it was not feasible to include all these individuals as respondents into this research in a meaningful way.

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## 8 Appendices

### Appendix 1: Interview questions in-depth interviews

#### **Interview questions – Innovation ecosystem**

- 1) Can you introduce yourself? Who are you, what do you do within the NFS, how long have you been employed by the NFS?
- 2) What is your experience with innovation within the NFS?

#### **Innovation project**

- 3) Can you explain what the project is about?
- 4) Why are you involved with the project?
  - a. Who is the initiator of the project?
- 5) How was the project founded?/What was the cause for the project?
- 6) Could you explain the lifecycle of the project?
  - a. Was the project eventually implemented? Why yes/no? And how?
    - i. *How is the result of the project used right now?*
- 7) What were critical points in the project?
  - a. *Where (a lack of) support was decisive in the life cycle (e.g. Financing, connection to stakeholders, etc.)*
- 8) What were success factors for the project?
- 9) Which parties were involved with the project?
- 10) How did that collaboration go?
  - a. How could that collaboration be more effective?

#### **Support**

- 11) What kind of support did you receive in the process? Either from co-workers and external stakeholders.
- 12) What kind of support could you have used additionally?
- 13) How should that support have been organised to be as effective as possible?
- 14) How do you experience the general stance regarding innovation on the work floor?

#### **Ecosystem design**

- 15) How should an innovation ecosystem look like, according to your opinion?
  - a. Think of: Structure, location, facilities, support, etc
- 16) What would you expect of such an ecosystem be?



## Appendix 2: Interview structure expert interviews.

### **Interview questions – Innovation ecosystem**

- 1) Can you introduce yourself? Who are you, what do you do within the NFS, how long have you been employed by the NFS?
- 2) What is your experience with innovation within the NFS?

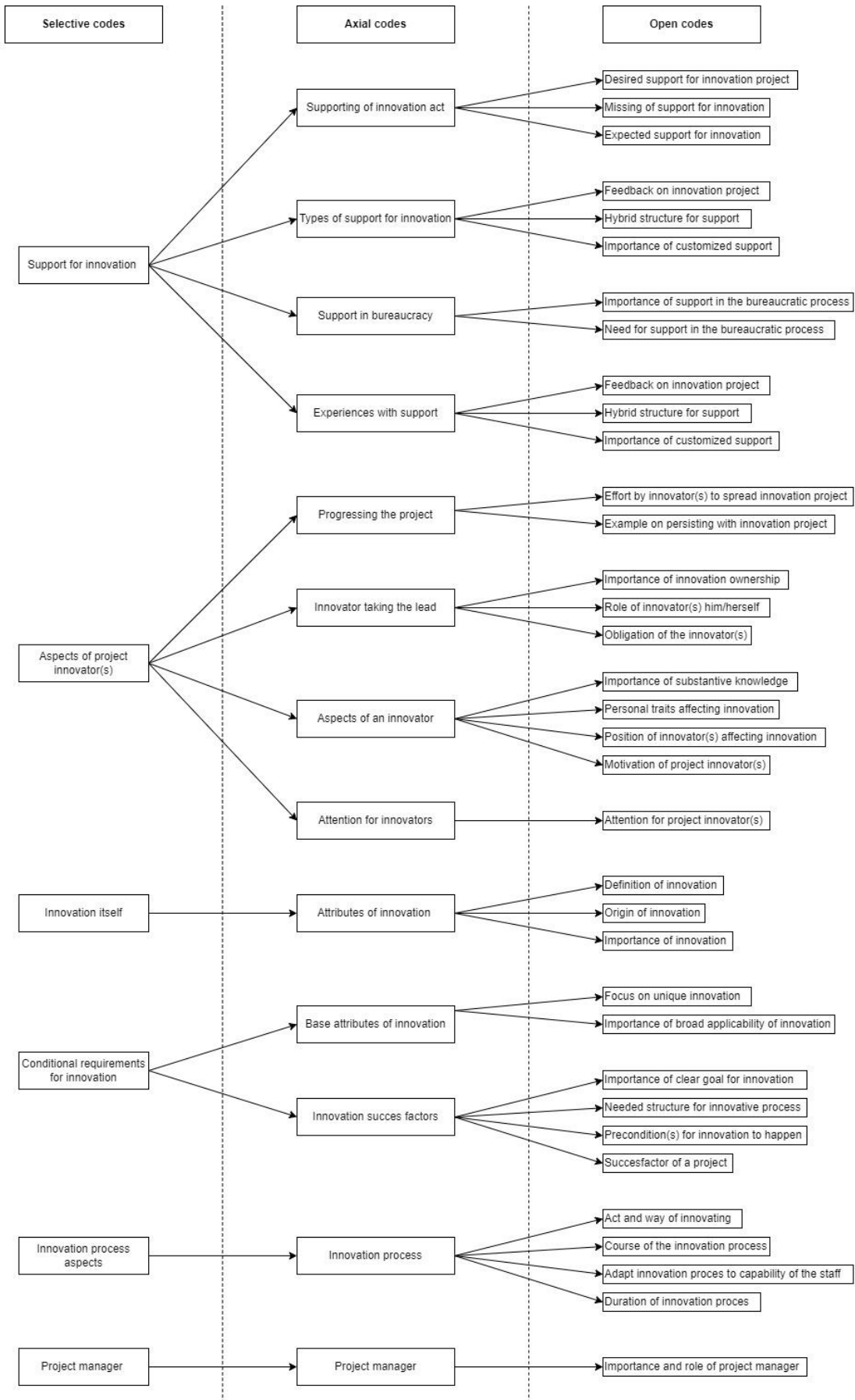
### **Innovation within the NFS**

- 1) How do you envision the innovation process?
  - a. And how should this process look like/be implemented within the organisation?
- 2) How is the support for innovation currently organised?
- 3) How **should** this support look like in the future?
- 4) How do you envision facilitating the development of innovation within the NFS?
- 5) What is your opinion on the gap between national and regional policy regarding innovation?

### **Ecosystem design**

- 1) How should an innovation ecosystem look like, according to your opinion?
  - a. Think of: Structure, location, facilities, support, etc
- 2) What would you expect of such an ecosystem be?

## Appendix 3: Full codebook





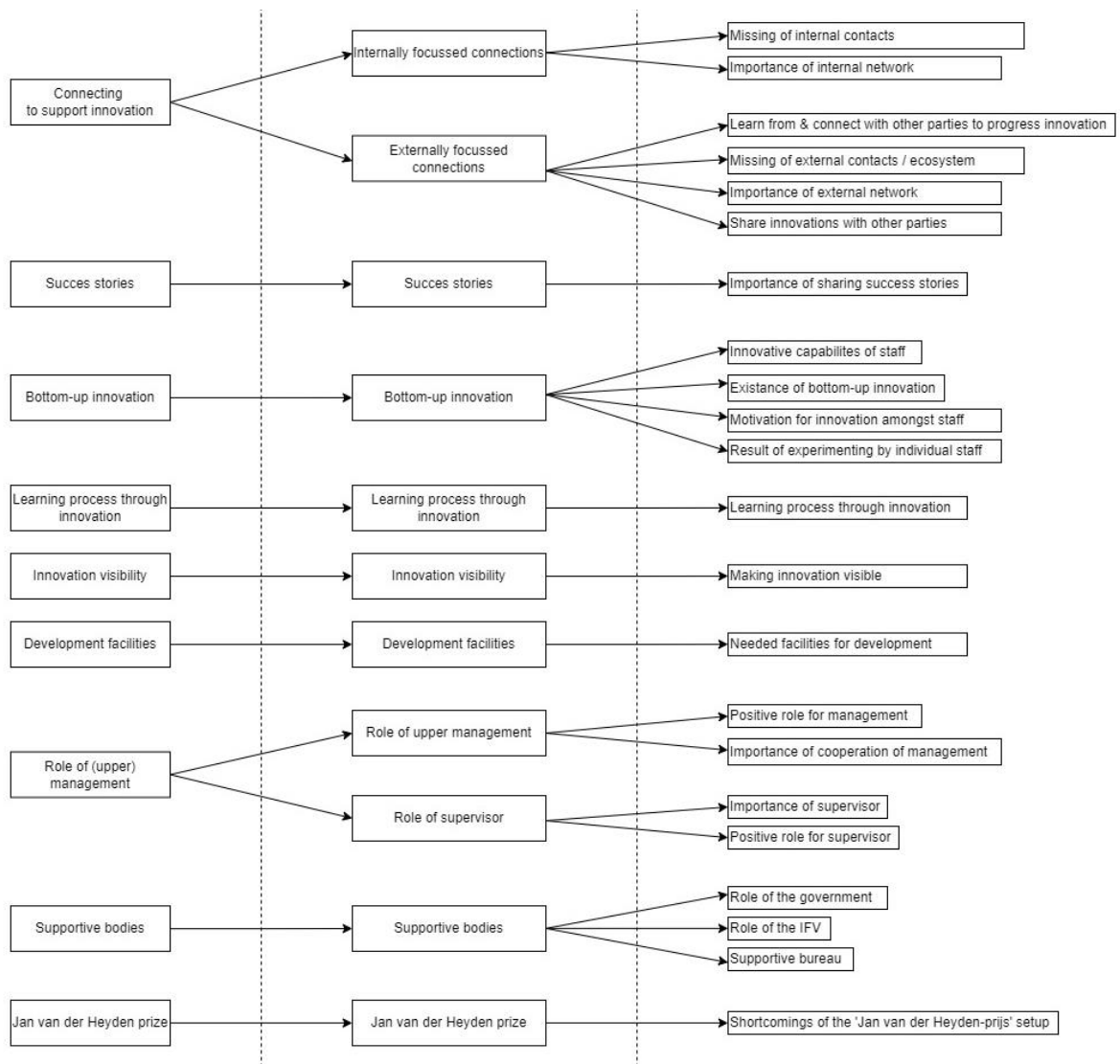


Figure 8. Codebook all extracted codes