



# Abstract

Title: A Case Study of the platform CLOSER – “It gives more than it takes”

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Innovation is in many organisations the core of the growth and development process. In today's world, many organisations have realised that working in silos is no longer efficient, hence the search for external sources that can complement its internal knowledge base through boundary spanning activities. This is often explained through the concept of open innovation and the recently updated version, open innovation 2.0 (OI2). Especially OI2 focuses on the systemic approach of innovation collaborations and building towards societal wealth. Innovation systems is one of those system approaches towards innovation, and Triple Helix is a form of such a system that involves the triad-partners: academia, public and industry. Commonly, these actors work to create innovative and sustainable solutions. The innovation system must fulfil its eight functions, in order to achieve the overall aim of creating, diffusing and using knowledge. In addition, the role of intermediaries in innovation systems are often discussed. They are essential in designing and managing these networks. However, the literature studies around the definition of intermediaries is scattered and sometimes confusing. The assessment of the intermediary's role and its impact is also not developed. Therefore, the purpose of this study is to investigate the intermediary's role in innovation systems structured like a Triple Helix, through a specific case of CLOSER. To investigate this, a qualitative research strategy was selected and organised by using a narrative literature review with elements of a systemic approach. The qualitative strategy involved semi-structured interviews with partners and managers at the platform and observations of meetings. The collected data from interviews were then analysed in a thematic analysis, using transcripts as the data material and Citavis (a program) as a tool to extract codes and themes to represent the findings of the study.

The findings of the study suggest that CLOSER's role in its innovation system are: *Innovation Process Supporter*, *Facilitator* and *Bridger*. Through these roles, CLOSER Enables Knowledge Development and Diffusion and Creates a Network. The first role, *Innovation Process Supporter*, mainly involves activities that support and stimulate the innovation process. The second role, *Facilitator*, works to create an open, creative and supportive meeting arena to connect the actors involved in the system. The third role, *Bridger*, works to bridge structural holes between potential connections fostering both weak and strong ties. The role also promotes creation of common goals and visions that legitimise the collaborations. Ultimately this role involves solving and avoiding potential conflicts of interest amongst actors.

Furthermore, these results indicate that CLOSER contributes to all eight functions of the innovation system it is intermediating in. However, the extent of that contribution needs further development and therefore this study can be used as a foundation to build an assessment model on.

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# 1. Introduction

In this chapter, a theoretical background will be presented to provide a theoretical scope of the study. This will be followed with a practical background to set up the context the research has been conducted in. A problem discussion and research purpose will also be discussed, leading the study towards the research question that will be studied.

## 1.1. Theoretical Background

Innovation is one of the core concepts in most of today's organisations and firms, especially in the research and development process. In the innovation process many organisations turn to external sources to combine with internal knowledge in order to create opportunities and leverage their innovation efforts. This phenomenon has been described through the open innovation concept that was first presented by Chesbrough (2003). There has been a great shift from working in silos to collaborating regarding innovation (Adner, 2006; Chesbrough, 2003). Enkel, Grassman and Chesbrough (2009) explains that the open innovation concept can be described in three processes. The first process is the outside-in approach and is about expanding the internal knowledgebase with an extension of external sources to boost the organisation's innovativeness. The second process is the inside-out approach and is when an organisation is looking to externalise its knowledgebase to speed up the process of introducing innovation solutions to the market. The third process is the coupled approach which is a combination of the two previously described processes. In this last approach, partners that are complementary and, in some cases, competitors can join forces to collaborate. Relationships between the partners are essential to build on in this process (Enkel et al., 2009).

One way to foster the different approaches of open innovation is to create and engage in an interorganisational innovation network. Innovation systems are an example of this type of networks where actors within an economic system can meet and collaborate, in the search of surplus in value. The aim of an innovation system is ultimately to create, diffuse and use knowledge to further innovativeness of all actors involved. Triple Helix is a form of an innovation system, that focuses on bridging collaborations between three important actors in a society: universities, public institutions, and industries (Etzkowitz and Leydesdorff, 1995). The difference between innovation systems and open innovation is the policy objectives. Open innovation assumes that both external and internal ideas are usable to advance technology. Innovation systems are more focused on the knowledge-infrastructure and -extraction in the network (Leydesdorff & Ivanova, 2016).

Systemic approaches to innovative collaborations, such as innovation systems, are highlighted in the updated version of the open innovation concept. This is referred to as the 2.0 version of open innovation (OI2) and adjusts the original concept by including mega trends such as digitalisation, mass collaboration and sustainability. The systematic approach to innovation and the focus on building towards societal wealth is much more apparent in this version. OI2 is centralised around the idea of shared visions amongst the participants in the system to promote engagement and through that realise the outcomes of the collaborations. According to Chesbrough (2017), the creation and management of these types of innovation systems are vital for its success (Chesbrough, 2017).

The management of innovation systems or networks is fostered by central roles in the system that act as change agents (Roger, 1995) or brokers (Howell, 2006) that intermediate between the participants of that innovation network. The innovation intermediary can be described as organisations that work to enable innovation collaborations that will enhance the innovativeness

of the participants (Dalziel, 2010). The innovation intermediaries can also be said to have a vital role in coordinating interactions between these participants, especially when these organisations are facing challenges in selecting and defining problems and opportunities. The intermediary assists in keeping the participants engaged, bridging connections between different actors and creating spaces where actors are willing to share their knowledge (Chesbrough & Appleyard, 2007).

The role of intermediaries is emphasized in literature about innovation studies, in a wide range of definitions. Following that, some scholars have stated that there is a lack of consensus around the definition of the intermediary role (Klerkx & Leeuwis, 2009; Howell, 2006). The importance of intermediaries in innovation networks coupled with the confusion in regard to its definition, makes for an interesting research topic. The research topic will be studied through the case of an innovation intermediary: the platform CLOSER.

## **1.2. Practical Background – The Platform CLOSER**

The platform CLOSER is a national arena, in Sweden, that aims to develop innovative and sustainable solutions for the freight transport industry, in order to build a sustainable society. Furthermore, CLOSER is a non-profit platform, mainly funded by Vinnova, Västra Götalands Regionen (VGR) and Trafikverket (CLOSER, 2020). It is located at and hosted by Lindholmen's Science Park (LSP), in Gothenburg City. LSP is also a non-profit company with financial control, a clear code of conduct, and acts as a centre for various innovation initiatives, CLOSER being one of those.

New technologies, business models and digitalisation present the need to create and enhance more efficient solutions and opportunities. Thus, a need to leverage innovation efforts and in turn a requirement of collaborations between essential actors is introduced. CLOSER creates conditions for Triple Helix collaborations that will foster knowledge and innovation, by uniting and integrating industry, academia, and public actors within the transport sector (Application for funding, 2018). CLOSER was established to fill the national gap that existed in bridging connections between the Triple Helix actors and to tackle societal issues in the freight industry (Application for funding, 2015). During the collaborations, needs and ideas of different partners are identified, which leads to demonstrations and scaled-up implementations of projects. This way, innovative products and solutions contribute to the transport sector's development and sustainability (CLOSER, 2020).

Key characteristics of the platform CLOSER are (Final Results Report, 2018):

- Open organisation that initiates, support, coordinates and contributes to innovation collaborations between academia, industry, and public institutions.
- Flexible platform that quickly can adapt to different circumstances and market needs.
- Knowledge domain in the field of freight transport efficiency and thus have the competence to act on challenges identified by partners in the society.
- Manager of projects in specific focus areas that have potential to be scaled up.
- Part of the innovation process, which focuses on acquisition, combination, formation and use of existing scientific, technical, industrial knowledge to develop new solutions.

The platform operates in two main parts: Project Arena and Knowledge Hub, see figure 1. The Project Arena is where projects are initiated, coordinated, and managed. The Project Arena consists of a five-part process of developing different projects within one or more of six focus areas that CLOSER works in. First, it starts with the stage of project initiation when external

actors or existing partners are offering new ideas or problems to be developed or solved. Second, the feasibility study (Pre-study) follows, to find out the potential opportunities and possibilities. Third, testing and demonstrations are conducted. Fourth, the evaluation stage is for participants to reflect on the experimentation results and identify lack in resources, infrastructure or capabilities that are hindering the project implementation (see figure 1) (Project description at CLOSER 2.0, 2014).

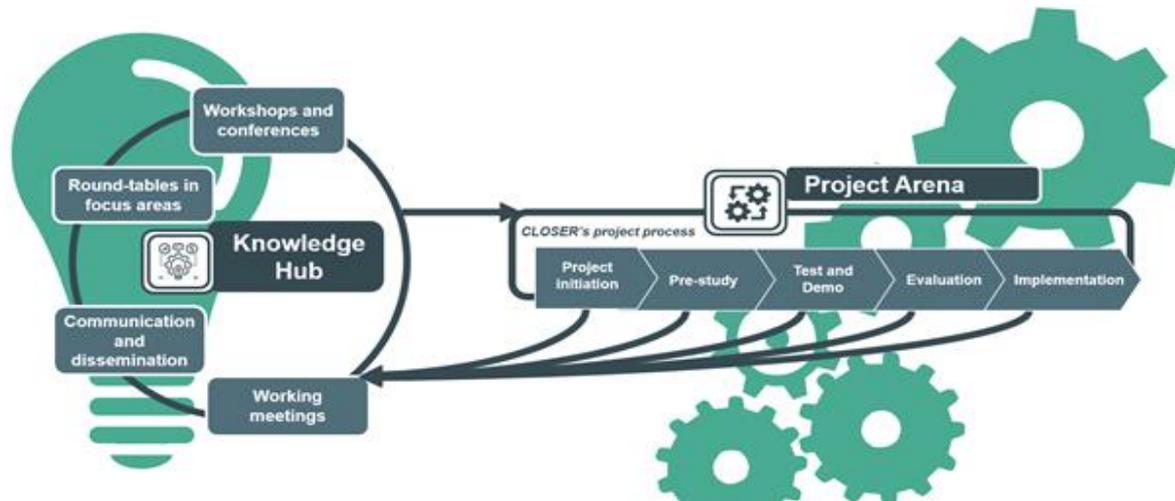


Figure 1: Platform Activities (Presentation slides of the platform, 2019)

The Knowledge Hub is the arena for knowledge sharing and interactive activities between actors in the network of CLOSER. These activities are often organised around specific topics within the six focus areas of the platform. The six focus areas are (see appendix A for detailed descriptions):

- Energy and Supply Logistics
- High Capacity Transport (HCT)
- Digitized and Connected Logistics
- Urban Mobility
- Multimodal solutions
- Horizontal cooperation

The Knowledge Hub activities facilitated and organised by CLOSER, such as meetings, roundtables or workshops, occur in the Project Arena as well and are more of an overarching activity that partners can gain benefits from (Project description at CLOSER 2.0, 2014).

It could be concluded that Knowledge Hub activities and Project Arena processes are complementary to each other. Facilitated meetings and discussions are enabling project development, but the meetings would not be needed if there were no idea to be developed. Thus, these two parts of CLOSER's explain synergies and how the platform operates.

### 1.2.1. The Project DenCity

In order to be more specific in this research, the project DenCity was selected to be the representative of the Project Arena. This project is currently in an implementation and demonstration stage (Test and Demo) (DenCity Application, 2015). Currently, the global transition in terms of more efficient and sustainable solutions is faced. New technologies and

services such as digitalisation, automation, connected solutions and electromobility are changing the transport sector. At the same time, the densification of cities leads to complex challenges related to transport and creates new forms of collaborations. This project is addressing the global and national challenge of urbanization and increasing competition of attractive urban spaces. It includes both passenger and freight transport, and infrastructure solutions within the urban areas (DenCity Application, 2015). The challenge is to develop sustainable solutions for future dense urban areas. It is expected that in the future, cities will be more crowded, and with continuation of the same infrastructures that exist today, a decrease in the quality of citizens' day-to-day life will be apparent.

Accordingly, the main objectives of the project are “to develop innovative solutions for sustainable passenger and freight mobility in dense neighbourhoods, with high standards of attractiveness, accessibility and sustainability” (DenCity Application, 2015). Also, the project includes sustainability, energy efficiency, reduced congestion and noise goals, that are matched with residents' and working people's needs of facilities and delivery services. In order to achieve such goals, a united system should be built through a holistic collaboration, with all involved stakeholders. This way, it is expected to solve the “life puzzle” for people living and working in cities (DenCity Application, 2015).

As mentioned before, meetings are a core activity, in both the Project Arena and Knowledge Hub, because it is usually where information, knowledge-exchange and -creation happen. In the case of DenCity there are meetings set up on different levels concerning different levels of the project: there is a steering committee, work package meeting and consortium meetings. The consortium meetings are where all work packages can meet and exchange experience and knowledge regarding their individual projects. The steering committee meetings happen every quarter and the board of DenCity participates. The meeting aims to update the board on development in each work package through scorecards coloured red, yellow, or green depending on the progress. The work package meeting is where all the work package leaders come together every three weeks to update one another on what has been happening in their respective package, using the same scorecard system.

### **1.3. Problem Discussion**

Innovation systems is a collaborative interorganisational network that can be stated to foster open innovation elements. The network work towards common goals and challenges which acts as a uniting factor for the actors involved (Salmelin, 2013). According to Curley and Salmelin (2018), management and orchestration is vital in the innovation systems. Intermediaries often take on that role of management or coordination in the systems and are in literature sometimes described as change agents or brokers (Roger, 1995; Howell, 2006). Although intermediaries are often discussed in innovation studies, a clear definition of what an intermediary's role is missing. Howell (2006) discusses that the literature is scattered around this role in terms of what activities they perform, what impact it has and if that differs depending on the context it is present in. Thus, it can lead to confusion in efforts of describing what an intermediary is and what role it plays in specifically innovation systems. Furthermore, the assessment of the intermediary role's impact is rarely discussed in literature, which Kanda, Río, Hjelm and Bienkowska (2019) points out in their study.

The reason to specify what the intermediary's role and its contribution in the system it is present in, is needed to understand its performance and to be able to reflect over improvement areas. This is in turn essential to grow and advance as an intermediary. This is the case for the intermediary platform, CLOSER, which is the selected study object in this research. CLOSER

aims to understand its role and contribution to lay a foundation for reflection and material to provide for funders of the platform.

## **1.4. Purpose and Research Question**

In this study, the purpose is to identify what role CLOSER has as an intermediary platform in an innovation system and provide reassurance, feedback and recommendation for CLOSER, on the role of the platform. Thus, a well defined research question is needed to navigate the study to fulfil the purposes. Accordingly, research question can be highlighted:

*What is the role of CLOSER as an intermediary platform in an innovation system?*

The role will be studied in two steps. The first step is to study and identify what activities CLOSER perform in the innovation system it is active in. The second step is to study how the identified activities contribute to the innovation system. The contribution to the system will be examined by recognising and emphasizing the overlaps between CLOSER's activities and the functions that the system is built around. The results will then be useful to further develop a model to measure the impact the intermediary platform has on its system partners.

## **1.5. Delimitations**

The research has been restricted with some limitations regarding the scale and in turn empirical findings. The study is based on a single case study, DenCity, which is only one of many projects carried out at CLOSER. It is important to consider that all projects have unique characteristics, hence no two projects are the same. The uniqueness of each project presents the possibility of the findings from the research not generalisable and applicable to other projects. In addition, not all the involved DenCity people were interviewed, due to time constraints, incompatibility of time schedules and lack of engagement.

Global situation of COVID-19 affected the collection of data. Some planned interviews had to be cancelled, what eliminated the perspectives of some valuable partners that could have contributed in-depth insights on the collaboration. Also, due to this situation, interviews' method was affected, and all interviews were conducted through medium.

## 2. Literature Review

In this chapter, literature around concepts of innovation systems, open innovation and innovation intermediaries will be discussed. The chapter starts around the discussion of innovation networks, including the concepts of innovation, network characteristics and innovation systems. Then, the concept of open innovation is introduced by explaining faced challenges and merge of ecosystems. The third part contains innovation intermediaries and their role within innovation systems. The last part is summarising the whole chapter and providing the theoretical framework.

### 2.1. Innovation Networks

Powell, Koput, & Smith-Doerr (1996) have argued that interorganisational networks could be described as the “locus” of innovation. Networks provide more diversity and opportunities for knowledge exchange which assists the innovation process. These innovation networks have been extensively described by Powell and Grodal (2005), by shedding light on network structures and network contents that build up the network. Hansen (2002) have also described different relationships between actors in the knowledge network.

#### 2.1.1. What Is Innovation?

To uncover innovation networks, innovation needs to be defined. Porter (1990) defined innovation as an improvement of technology and better ways of doing things, he related it with changes in products or processes, new marketing approaches or new distribution methods. It could be highlighted by a quote from Porter (1990, p. 780): “*a new way of doing things [...] that are commercialised*”. Schumpeter (1934) observes that the term innovation is used additionally for a new use or a new combination of existing factors, meaning the use of existing technologies or knowledge in a way that they have not been used before. In Schumpeter’s definition, it is made clear that innovations do not have to be an invention, it just has to be a new combination. There is a clear resemblance in Schumpeter’s and Porter’s definitions, specifically the utilisation of the word new. In another definition, presented by Rogers (1995, p. 11), innovation is “*an idea, practice, or object that is perceived as new by an individual or other unit of adoption*”. This definition also lifts forward the word new, in terms of the recipient’s perception. In this study, the definition will be extended to where innovation is a process that goes beyond the introduction of an innovation and includes the diffusion and utilisation of it.

The theory of innovation diffusion was introduced by Rogers in 1962. Innovation diffusion is a theory that explains how, why and at what rate new ideas and technologies are spread through society (Rogers, 1995). Diffusion defines the spread of innovation and is a “*process by which an innovation is communicated through certain channels over time among the members of a social system*” (Rogers, 1995, p. 5). The concept of innovation diffusion usually refers to the spread of ideas from one society to another. In addition, diffusion is the process by which an innovation is communicated through a certain channel over time among the members within the social system (Rogers, 1995).

#### 2.1.2. Network Characteristics

A central factor in the innovation diffusion process is social systems which is “*a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal*” (Rogers, 1995, p. 23). Each member within the social system is distinguishable from other units,

but in between they are sharing the common objectives (Rogers, 1995). This way, a network is created, and the knowledge spread is facilitated, which increases innovation diffusion rate (Dahl & Pedersen, 2004; Powell & Grodal, 2005). Relationships within the network are based on trust and friendship development, which motives companies to go beyond the formal contracts (Gilsing et al., 2008). Furthermore, the presence or absence of infrastructure influences the diffusion within the social system. Infrastructures enable innovation diffusion and it could be buildings or information systems (Rogers, 1995).

Networks have a central role in the innovation and knowledge diffusion process (Rogers, 1995; Powell & Grodal, 2005). These networks can be built around formal contracts between actors or informally organised relationships. The structure of networks can be described as made up of nodes or ties between actors in the network. Strong ties between actors are an indication of more formal relationships where the foundation is built on contracts and strategic partnerships. Weak ties are organised more informally. According to Powell and Grodal (2005), in interpersonal terms strong ties are ties with a person that you interact with regularly and are based on common interests. Weak ties on the other hand provide a new, diverse, and broad set of perspectives. The intermediary has an apparent role in communication among partners. Intermediaries that are weakly tied to a focal person are likely to pass the non-redundant information. So, intermediaries help to create connections and pass information that bridge two disconnected actors (Hansen, 2002). The concept of strong and weak ties can be compared to the direct and indirect relationships, discussed by Hansen (2002). According to Hansen (2002), there are direct and indirect relations in the knowledge networks. Direct relations provide immediate access to information about opportunities and enables to pass product-specific technical know-how knowledge directly, since information diffusion requires direct contact with an information source. Indirect relation is also beneficial since the information is reached by an intermediary. Intermediaries are passing forward the messages and they are supporting connections in communications (Hansen, 2002).

Indirect relations are not perfect to pass information, because it is diffused through many intermediaries and likely to be distorted. People who are exchanging such information might misunderstand each other, forget details, forget to mention everything they know or filter. It could be done unintentionally or deliberately. Imprecise information wastes time for the project development group, because instead of focusing on few opportunities that are relevant, they check a number of ideas that might be useful (Hansen, 2002). Direct relation is the shortest path enabling teams to know relevant well described opportunities, which involve knowledge regarding it (Hansen, 2002). Accordingly, teams can focus on realisation of project opportunities and contacting relevant people to extract and use their knowledge in further project development. Thus, teams in short-path lengths are able to hear more about relevant opportunities and extract important knowledge (Hansen, 2002).

Direct relations and contacts are especially useful in knowledge transfer and incorporation in other units. More specifically, it is beneficial when knowledge cannot be codified or articulated in writing (Hansen, 2002). Developed direct relations reduce the difficulties to transfer the knowledge due to established habits of working together which helps to reduce time of explaining and understanding each other. Consequently, reduced time is speeding up the project development time and relationship maintenance costs (Hansen, 2002). In addition, the more direct contact business units have, the more chances to transfer non-codified knowledge business units get (Hansen, 2002).

Another way to identify networks, besides the strong/weak ties or direct/indirect relationships, can be through the concepts of bridges and structural holes. The bridges can be described as points of connection across structural holes (Powell & Grodal, 2005). Structural holes are described as potential connections between organisations that are not connected. Identifying

these potentials can leverage innovation. Intermediaries help to fill that gap or bridge over the structural hole, connecting otherwise not connected partners (Burt, 2004). Bridges enable the weak ties. The potential connections or ties that actually are realised represents the density of the network (Ahuja, 2000). Dense networks are built on trust which often results in better collaborations and information diffusions, but it can create inefficient flows of new information. Structural holes instead provide diverse and new information without as much networking required. Depending on the goal of the network the level of density and structural holes can vary (Kohl, Cap, & Raesfeld, 2015).

The structure of networks (strong and weak ties) dictate the network content in terms of what type of information that will be diffused and created. For example, relationships that have had prior interactions will be reflected in the level of trust and cognitive understanding between partners (Powell & Grodal, 2005). The level of trust and cognitive understanding can be described as social capital which exists in relationships between people. Social capital influences knowledge sharing (Chow & Chan, 2008). Strong ties can restrict the variety of information that is diffused, but the diffused information will be more detailed. Weak ties are more unstable, however provide greater non-redundant information. It is clear that both strong (direct) and weak (indirect) ties can be valuable in the innovation process. Although, one could argue that a closer and more stable network has a greater ability in diffusing and sharing tacit knowledge (Powell & Grodal, 2005). However, one could also argue that long-term relationships are prone to face stagnation issues that hinders the positive effects of a close-knit network, which is new information and knowledge transferred among parties (Powell & Grodal, 2005).

It can be stated that strong ties create a high level of trust and mutual understanding, but diminish a novel value in the interaction, which represent a low degree of cognitive distance (Kohl et al., 2015). The higher degree of cognitive distance provides more novel and non-redundant information (Kohl et al., 2015). This can be represented by weak ties. Hence, an intermediate state of cognitive distance is recommended.

### **2.1.3. Innovation Systems**

Generally, systems are a set of components that complement and constrict each other, so a system can work together (Edquist, 1997). In another definition, systems are an arrangement of related pieces in a unity, sharing a mutual goal (Carlsson & Stankiewicz, 1991). Systems consist of components, relationships, and features. The components can be actors, organisations, technological or legislative artifacts. Relationships are the glue that connects the components together. The features of the components are what makes the systems interdependent because the system's characteristics are highly related to each component's characteristic which influences each other.

Innovation systems could be defined as "*organisations and institutions involved in searching and exploring – such as R&D departments, technological institutes and universities*" (Lundvall, 2016, p. 97). In a broader perspective it could be described as "*all parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring*" (Lundvall, 2016, p. 97). According to Freeman (2002), organisations are involved in a wide social economic system where cultural, political, and economic factors enable innovation success due to its clear direction and scaling process. Nelson (1993) explained that innovation systems are the set of national firms which are interacting and determining a country's innovation performance. The definition of innovation systems proposed by Edquist (2005, p. 183) is: "*all important economic, political, social, organisational, institutional and other factors that influence the development, diffusion and the*

*use of innovations.*” The last proposed definition is defining this research concept and matching its purpose; thus, it is chosen to follow this description in further research process.

According to Nelson (1993), innovation systems are defined by four main elements:

- The institutional structures of a country, region, or sector, which are formed by companies, universities, research organisations, routines, networks, financial organisations, and policies that promote and regulate technological change.
- The system of a country, region, or sector. This includes an incentive system of innovation, technology transfer, learning and qualification for business formation.
- The skills and creativity of innovation and economic actors in a country, region, or sector.
- The cultural peculiarities of a country, region or within a sector, which affects innovation acceptance by societies.

Some common features of innovation systems are identified by Moussavi and Kermanshah (2018). One of the features is the concept of knowledge sharing and learning that is the core of an innovation system. A second feature is the holistic and interdisciplinary approach the system takes on by including all elements of the innovation process and extends itself past the boundaries of economics. Another feature, and probably the most basic one of them all, is the notion that innovation systems do not innovate in isolation and that the innovation process is non-linear. This is the consequence of the interactive nature and interdependency between actors (Moussavi & Kermanshah, 2018).

Innovation systems work as a framework to explain the innovation process in a network of different actors in an economic system. Innovation system includes elements that interact in shaping innovation processes and elements that bridges innovation to economic performance (Lundvall, 2007). Innovation is systematic, thus organisations can create innovation only by working in collaborations with other actors, and not by working in silos (Edquist, 2005).

Innovation systems consist of a network of actors who are interacting within a specific infrastructure (Carlsson & Stankiewicz, 1991). Actors within the innovation systems could be divided into three groups. The first group is the production structure, for example companies. The second group is the knowledge infrastructure, organisations such as universities, research institutes or other organisations involved in knowledge development. The third group is the supporting structures, which could be various organisations, partly or fully funded by the public, aiming to support the national or regional economy (Nilsson & Moodysson, 2011). The interactions among them could have technological, commercial, social, and financial aspects, which are aiming to develop new technologies, finance new projects and adapt to regulations (Metcalf & Ramlogan, 2008).

### ***Innovation Systems’ Levels and Structures***

Innovations systems can be divided into different levels of economy. The first level is the national innovation system that consists of a network of different actors within a nation. The system is framed by the nation-specific policies which will determine the system’s ability to fulfil the main aim of creating, diffusing, and utilising innovation (Lancker, Mondelaers, Wauters, & Huylenbroeck, 2016). The national innovation system expands its boundaries to include scientific and technology-focused components like universities, government policies and research institutes (Carlsson, Jacobsson, Holmen, & Rickne, 2002). Some literature argues that globalisation has minimised the importance of the national perspective. Instead, alternative concepts of innovation systems, such as regional, sectoral, and technological have been developed.

The second level is the regional (local) innovation system which is a network of innovative actors and institutions within a specific region that are joined forces to fulfil the main function of an innovation system (Lancker et al., 2016). The dependence on the geographical location of the system is important to recognise, because of the surrounding culture and competition that influence the system (Carlsson et al., 2002).

The third level is the sectoral innovation system and it consists of a network, much like the previously described levels and with the same goal, of various actors. The difference here is that the actors interact in a specific economic or industrial area (Lancker et al., 2016). The sectoral system presents different opportunities dependent on the sector's technological focus, knowledge within the system and its management (Carlsson et al., 2002). On this level, the system is more dynamic as the focus, knowledge and management has a high probability of changing more frequently.

The fourth level is the technological innovation system, again a network of various actors, but this time bound to an area of technology. It is defined as knowledge flows that are focused on knowledge fields including 1) interaction, 2) components such as actors, technology and institutions, and 3) networks. The literature on technological innovation systems considers factors that are unique for a certain knowledge field. This type of system includes different settings and dynamics, it is a network of agents who are interacting under an institutional infrastructure in a specific area (Dahlstrand, Andersson, & Carlsson, 2019). In this type of system, entrepreneurial activities, such as experimentation, are required, otherwise the system would stagnate. Economic activity takes place when technologies are scaled up and commercialised (Bergek, Jacobsson, & Sanden, 2008). Entrepreneurial experimentation is systematic and ensures the creation, selection and scaling up of new technologies and innovations. All actors, such as individuals, organisations, and institutions, should be involved in exploration, creation, discovery, and exploitation of opportunities to make the system effective (Dahlstrand et al., 2019). Thus, the main goal of the technological system is to create, diffuse and utilise technology.

The main difference between the different levels of innovation systems is the underlying focus. There are also many similarities that can help to form a general definition of innovation systems. An innovation system needs to include a complex diverse innovation actor in a collaborative effort that works on creating, diffusing, and utilising innovation shaped by a number of institutions. To sum up, the different concepts can often be viewed as complementary rather than conflicting (Dahlstrand et al., 2019). Also, it is hard to find boundaries, because different levels have the same role actors performing on the same base of innovation system model (Mercan & Goktas, 2011).

In addition, innovation systems can be perceived from different structural perspectives, one of them being the Triple Helix structure. The Triple Helix provides a model of structure and dynamics of the innovation system functioning at various levels discussed before. It provides a finer view and perspective of innovation systems. The Triple Helix concept of university-industry-government relations was initiated by Etzkowitz and Leydesdorff in 1995. It was an extension and shift from dyad of industry-government relationship in the industrial society to triadic relationship between university, industry, and government in knowledge societies. Triple Helix does not presume systems geographically, as national, or regional innovation system levels. It defines involved actors and relationships among them. It is a system for boundary spanning and dynamic transition of knowledge (Ranga & Etzkowitz, 2013). As part of the innovation system concept, this triad collaboration is improving innovation conditions and contributing to knowledge development.

As mentioned before, interactions within the Triple Helix system can be synthesised into the innovation system concept (Carlsson et al., 2002), thus it can be characterised by three main factors: elements of the system, relationships between the system's elements and functions of the system (Ranga & Etzkowitz, 2013):

- Elements: The elements of the model are represented by the institutional and individual actors within the spheres of universities, industry, and academia. Geographical boundaries are looked upon as outdated in this model and therefore the boundaries are more open, and this allows a better circulation of knowledge and ideas.
- Relationships between system components: Collaboration and conflict management is considered vital tools due to the networking-nature of the model. It is directly influencing knowledge sharing, learning and interactions which are the main innovation system features.
- Functions of the system: Activities and functions are the main components that determine the performance of the system. The main functions in the innovations systems are diffusing, utilising, and adopting knowledge and technology. In the Triple Helix model, the function is viewed in a broader perspective – diffusing, utilising, and adopting knowledge and innovation.

The Triple Helix theory emphasizes that the potential of universities for innovation and economic development lies in a synergy with industry and government (Ranga & Etzkowitz, 2013). Traditionally, universities have been perceived as a supportive unit to enhance innovation and development, which provides trained persons, research data and knowledge to industry. However, this view is changed, and universities are becoming involved in the formation of companies based on new technologies created by academia. Intellectual capital is becoming more important as a basis for economic growth. Thus, instead of being solely connected with industry or government, the university is an influential and an equal partner within the Triple Helix.

Furthermore, universities are transforming to another format, the entrepreneurial university, as old and new academic missions are merging (Etzkowitz, 2003). There is an expectation that universities will have a greater role in society as entrepreneurs. The entrepreneurial university keeps the traditional academic roles of social reproduction and certified knowledge and places it in a broader innovation concept. In addition, transformation could also be recognised within the industry. The change from large hierarchical model firms to start-ups leads to the phenomenon of spin-offs from universities (Etzkowitz, 2003). A Triple Helix innovation system is a facilitator of creation and formation of new organisational formats, such as incubators or science parks, which are promoting innovation. Thus, new organisational types are rising from triad interactions of university-industry-government.

### ***Innovation System's Functions***

According to Johnson and Jacobsson (2000, p. 109) system functions could be defined as “*a contribution of a single component or a set of components to a system's performance*”. The main function of an innovation system is to pursue the creation of innovations and all the activities within the innovation system are influencing the development, diffusion and use of innovations (Edquist, 2005). The main function could be named as an outcome of performed sub-functions, which aims to create, diffuse, and utilise the knowledge. The fulfilment of each function is highly dependent on the interaction between the functions (Hekkert & Negro, 2009). Thus, one of the ways to study innovation system performance is through its functionality (Johnson & Jacobsson, 2000).

The dynamics of the general innovation system can be described through the functions or sub-processes. Listed functions are adopted from three articles: Hekkert, Suurs, Negro, Kuhlmann, and Smits (2007), Hekkert and Negro, (2009), and Bergek and others (2008).

- **Function 1 - Entrepreneurial Activities/Experimentation:** Entrepreneurship and creativity are very essential in the innovation process. The role of this role is to seek opportunities of innovation and seize the potential of knowledge development and network into concrete action. It has a high level of uncertainty in terms of technologies, its applications, and markets. The uncertainty factor is a feature of the whole innovation process within the innovation system concept. Reduction of uncertainties is achieved by entrepreneurial experimentation and social learning processes. Without experimentation, whole innovation system would stagnate. The outcome of this function is creating new businesses and firms.
- **Function 2 and 3 - Knowledge Development and Diffusion through Networks:** The knowledge development is directly correlated with learning and R&D. This is the center of the innovation system framework and is based on “learning by searching and learning by doing”. Knowledge is the fundamental resource of innovation systems. The key output of this function is scientific, technological and market knowledge. Thus, for the system to work, R&D and knowledge development are required to be in place. Learning importance could be highlighted by Lundvall (2007, p. 108): *“the most fundamental resource in the modern economy is knowledge and, accordingly, the most important process is learning”*. Also, the networking in the innovation system is in place, mainly for knowledge sharing and information exchange. This function works in favour of “learning by interacting or learning by using”.
- **Function 4 - Guidance of the Search:** This function is performed by attracting external actors to direct the search and investments. In addition, it is related to directing the attention of actors towards the problems and growth opportunities. Thus, the identification of problems and opportunities are guiding the innovation system actors to address it. Moreover, having visualisation and clarification of goals in the work can positively affect the system. This contributes to a certain degree of legitimacy to the development of sustainable technologies and helps navigate the allocation of resources. In this function, expectations can also be included and in certain moments it can change the directions.
- **Function 5 – Market Formation:** Innovation systems identify markets or niches that should be created and stimulated. This way it is identifying business opportunities and stimulating demands. Furthermore, newer technologies or innovations will face difficulties in competing with already existing ones, especially sustainable innovations. Hence, it is important to create protected spaces on the market for the new arrival. One way to do so, is creating temporary niche markets or taking advantage of, for example favourable tax regimes. Market formation process goes through three phases. In the early stage, incumbent markets need to evolve and open up a learning space, where new markets can find the place to form. Secondly, the size of the market is usually very limited, thus the new-born is taken over by bridging markets, which allows increased volumes and number of actors. Finally, the mass markets are created, and markets become mature after decades of initial market formation.
- **Function 6 - Resource Mobilisation:** This function includes building and attracting new resources that are relevant to creation and development of the innovation system.

It could be resources that are vital in the innovation process and drive other functions within the system: financial (venture capital), human (expertise in scientific, technological and entrepreneurship) or complementary assets (network infrastructure). In addition, allocating the resources correctly can determine if a project fails or succeeds.

- **Function 7 - Creation of Legitimacy/Counteract Resistance to Change:** It is building a shared understanding and joint vision. Legitimacy is creating a social acceptance and compliance with relevant institutions. Solutions need to be considered appropriate and desirable by actors to mobilise resources and acquire political strength. Legitimacy also influences expectations of managers and affects their strategic decisions. Legitimacy is formed through conscious actions by various organisations and individuals. However, it takes time and is complicated by competition, which is defending the existing systems and institutional frameworks. Thus, when introducing new innovations, it is important to be mindful of opposing actors to the “creative destruction” the innovation brings. To counteract and mitigate the resistance to change, it is valuable to implement a support or advocacy group that works as a catalyst and helps create legitimacy for the new change. Usually there are three legitimisation strategies to achieve institutional alignment: manipulation of rules, conformance and following the rules of the existing institutional framework, and creation and development of new institutional framework.
- **Function 8 – Development of Positive Externalities:** The systematic viewpoint of innovation and diffusion process suggests that generation of positive external economies is a key in the formation and growth of innovation systems. Positive externalities are developed through entry of new firms and is a central factor in the innovation system creation. New partners could solve some initial uncertainties of technologies and markets and this way strengthen the innovation system functions of direction of search and market formation. Also, they could be the legitimisation factor for the innovation system, because it might strengthen the political power of advocacy coalitions. Consequently, improved legitimacy might positively influence the changes in other four innovations system functions: resource mobilisation, guidance of search, market formation and entrepreneurial experimentation. Moreover, the higher variety and number of actors provides the higher chance for new solutions to emerge and enhance opportunities for all participating organisations and contribute to knowledge development and diffusion and entrepreneurial experimentation. Also, positive interactions lead to diffusion of innovation and the outcomes are collaborations and joint projects. Interactions are the factor which unites all the innovation system functions together. Firms communicate with different parts of the knowledge infrastructures through different media (Lundvall, 2007). For the innovation system performance, it is important that there is an effective interaction between organisations and knowledge infrastructures (Lundvall, 2007). Thus, this function of the innovation system works as a strengthening to other functions and could be perceived as an indicator of system dynamics.

## 2.2. The Concept of Open Innovation

Traditionally, innovations were undertaken within the boundaries of an individual organisation, where they pursued linear and coupling models of a technology push or market pull innovation (Galanakis, 2006). During the years, the innovation concept focus changed to a more integrated

and network model. This is related to Rothwell's "Fifth generation" theory (1994) of evolving generations of innovation models. The theory explains that organisations are faced with the challenge of managing innovative actions that cross organisational boundaries and involve stakeholders as well as competitors. This leads to the innovation process which is distributed across a network of organisations rather than one-unit boundaries (Rothwell, 1994).

Rothwell's theory (1994) leads to the reality of the open innovation phenomena. Nowadays organisations are managing relationships and knowledge exchange of innovation not only within their boundaries, but also across the collaboration networks. This is essential to be effective and stay competitive on the markets (Dooley & O'Sullivan, 2007). Chesbrough (2003), who first coined the concept, points out that open innovation is a strategy where organisations, in combination with internal ideas, commercialise external ideas to leverage innovation efforts. The idea is that an organisation wins if it can "*make the best out of internal and external ideas*" (Chesbrough, 2003, p. 38). The main characteristic of open innovation is that the innovation process does not only take place within the boundaries of the firm, but also is distributed among a large number of actors. Thus, open innovation is described as a boundary spanning activity.

By using the firm's perspective, open innovation can be categorised into three core processes (Enkel et al., 2009). The first process is the outside-in approach which integrates external knowledge sources with an internal knowledge-base to leverage innovation efforts. This process is increasing companies' innovativeness (Laursen & Salter, 2006). Innovation systems and innovation intermediaries have a central role in this process (Dittrich & Duysters, 2007). In the second process there is the inside-out approach and has to do with profits associated with the transfer of internal ideas to the external environment. This approach could be useful for an organisation to speed the introduction of ideas to market (Enkel et al., 2009). The third process is the coupled process, a mix of the first two approaches and it refers to a co-creation process that aims to develop and commercialise innovation in collaborations with complementary partners.

Based on these processes, open innovation can be defined as "*the use of purposive inflows and outflows of knowledge to accelerate internal innovation and to expand the markets for external use of innovation, respectively*" (Chesbrough & Schwartz, 2007, p. 55). Accordingly, open innovation is contributing to the development of knowledge-based economies (Yun et al., 2016). The amount of shared knowledge in the world is increasing together with its circulation speed. Through collaborations companies are utilising not only their but also external knowledge and technologies. The most important factor to make open innovation phenomena work is willingness to provide and share knowledge and technologies to be utilised by others (Yun et al., 2016).

### **2.2.1. Challenges in Open Innovation**

Open innovation is the ability to collaborate with many and use "Wisdom of crowds" (Surowiecki, 2005). This assumes that a large group of people generates and receives more knowledge and ideas than a small group or separate units. The challenge is the management of the collective intelligence and the right structure for the information chaos. A central problem is how ideas and knowledge of many can be aggregated. According to Lakhani and Jeppesen (2007), one of the ways to structure the knowledge is to find solutions to well defined problems or challenges.

Moreover, attracting people from the outside to participate within the innovation process is a challenge for a company. In order to overcome it, a company should be clear and transparent not only about the problem, but also about its resources and own knowledge (Speidel, 2011).

Certain level of transparency is a must regarding what the organisation will not be able to do and that everything that is known is shared. Beyond these factors, partners should share the same declared values to have a common ground for a collaboration (Speidel, 2011).

Firms engaging in open innovation processes are facing challenges of selecting the right problem that could be solved by outsiders and that its solution could be revealed for the outside world. Also, problem formulation is important. Problem formulation should enable experts to recognise the similarities between a problem and already developed technologies (Sieg, Wallin, & Krogh, 2010).

Furthermore, open innovation practices lead companies to an “open strategy” approach and open innovation incentives should be turned into profits (Chesbrough & Appleyard, 2007). It means reaching a balance between value creation and value capture. However, it is a challenge of finding the way to profit from activities carried out in an open environment. Other challenges that are hindering the process of effective open innovation management is attracting a broad group of participants and sustaining their participation over time. Also, setting the tone and expectations of involvement through leadership and agenda formation (Chesbrough & Appleyard, 2007). While engaging into community, the difficulty is to manage and control the community, and the challenge is solving the dilemma of balance between control and growth (Dahlander, Frederiksen, & Rullani, 2008).

Within the open innovation concept, two main principle problems could be highlighted (Calof, Meissner, & Razheva, 2018): 1) ensuring that the right partners and experts are involved and 2) ensuring that involved partners share their knowledge. Involved companies in the open innovation process face issues such as opportunistic behaviour, cultural differences, or foreign laws (Calof et al., 2018). There are also disagreements about intellectual property (IP) in terms of the degree to which IP details are required to be revealed to contribute to the innovation process. Also, there are concerns on how to manage and share the IP that is developed through open innovation collaborations (Calof et al., 2018). However, not everything in the companies should be done with an open innovation mindset. A company’s secret idea can be continuously developed internally, but development of different applications and use of technology may be done in an open innovation mode (Curley, 2015).

### **2.2.2. Open Innovation 2.0 (OI2)**

Innovation is changing and a new paradigm is merging from the collisions of three mega trends: digitalisation, mass collaboration and sustainability. These three mega trends create conditions and resources, which enables a new kind of innovation. Deep integrated collaborations and exponential technologies are co-creating innovations which deliver financial and societal wealth (Curley, 2015). Thus, the innovation concept has resulted in a 2.0 version of open innovation, often shortened to OI2. The updated version of open innovation can help to drive the development of shared value solutions and the change beyond the scope of what one organisation could achieve on its own. Competition aspect has changed as well and it is no longer just about how good an individual company can perform, rather it is about the strength of the ecosystem the individual company is part of (Curley, 2015).

OI2 is based on integrated collaborations, co-created shared values, cultivated innovation ecosystems, unleashed exponential technologies and its adoption (Curley, 2015). The core of OI2 is the idea of shared vision to which different stakeholders are committed and through collaboration making it become reality. The Triple Helix system structure is changed to the Quadruple Helix system, which contains governments, universities, companies, and citizens. Citizens are not perceived anymore as passive objects, but as active agents contributing to the

whole innovation development process (Salmelin, 2013). Rather than innovation being done for one user, the user participates in the innovation process and is profiting from the outcome. Therefore, such a system is driving the structural change and creating value (Curley, 2015). When all the participants are committing to the transformation of industries, cities or an energy grid then everyone can develop faster, share risks and pool resources together (Curley, 2015).

OI2 is a mash-up process where the public policy makers need to create the framework for interaction (mash-up) to happen. The OI2 approach is an intersection because innovation happens in crossroads of technologies and applications (Salmelin, 2013). All the stakeholders need to find solutions together to speed up the scalability. Only then, new markets will be quickly merged for a new solutions to be scaled-up. “Failing fast and scaling fast” is one of the strongest advantages of OI2, which accelerates the time to market (Salmelin, 2013). Also, the innovation pyramid is turned upside down and instead of having a traditional top-down approach, the crowd has the innovation power. Furthermore, all platforms need to be integrated functionally on a metalevel, have standardised interfaces, compatible functionality, and clear rules in order to be easily usable for business. Only then it is possible to move towards industry and societal commons, which is essential for further development. Designing and managing such innovation platforms and communities is becoming increasingly important for the future of open innovation (Chesbrough, 2017).

In addition, an internal innovation supportive mindset and culture within an organisation is essential for innovation. When companies have an innovation supportive mindset, there is a greater likelihood of a breakthrough innovation. Culture is a key aspect helping a company or society to adopt OI2. According to Curran (2002, p. 1), “*Culture eats strategy for lunch every time*” thus, it is important that culture is open to innovation. Explaining the benefits of adopting any innovation, including open innovation, is always very helpful. People should understand the benefits, and when they do, they are naturally stimulated to adopt it. This way, social communication and relationship building skills are also important in order to establish credibility within the process (Mercedes, Maher, & Murty, 2011). However, there are always two sides and while considering the adoption of something, not only beneficial factors should be understood. In terms of adopting open innovation, intellectual property should be carefully considered (Curley, 2015).

All in all, the OI2 concept creates a different order of innovations where new processes and environments can help to create and manage disruptions, which drives structural changes within societal systems. The kind of outcomes could be characterised by 3Ws: “Wealth, Welfare and Wellbeing” (Ramaswamy & Ozcan, 2014). The possibilities that come from collaboration between governments, universities, companies and citizens are endless. Shared visions may create cities with the best quality of life, countries with the best healthcare, efficient transport systems where nobody is injured (Curley, 2015).

### **2.2.3. Open Innovation Ecosystem (OIE)**

Innovation systems and open innovation concepts could be merged into the recent concept of open innovation ecosystem (OIE) and thus could be perceived as a recent version of innovation system concept. The strength of the impact of new solutions has depended on how innovation creation projects are designed to complement and match to reinforce each other within the systems (Salmelin, 2013). The culture is built to enable interaction between projects and actors within the ecosystems. This is a new kind of courage, which is supported in experimenting and scaling up results into the real world (Curley & Salmelin, 2018). Actors themselves are doing the design of their own projects to match and complement each other to create a sustainable innovation system resulting in economic and societal development.

Cultivating and orchestrating innovation ecosystems are a very important part within the OIE concept. Innovation ecosystems can be created by a shared vision and transformed by reinforcement of the vision by active social network management and orchestration. The innovation capacity is most powerful when it is in the shared vision context (Curley & Salmelin, 2018). The shared vision and values are crucial to success in a multi-stakeholder innovation initiative (Kramer & Porter, 2011). Besides shared values and vision, interaction fluidity is very important, it should be frictionless. Thus, innovation ecosystems are essentially about collisions and connectivity that should be cultivated and orchestrated.

Within such an innovation ecosystem there are various types of actors who are managing and controlling the collaborations. According to Curley and Salmelin (2018), the orchestrators are the ones who lead the value-shaping process. Curators are responsible for consistency and quality of knowledge. Bridgers are the ones who bring the curated contents together and who have broad knowledge and curiosity about ‘everything’, they could be characterised as extroverts, who have courage to link wide range competencies. Another type is system designers, who enable spontaneous interactions to take place (Curley & Salmelin, 2018).

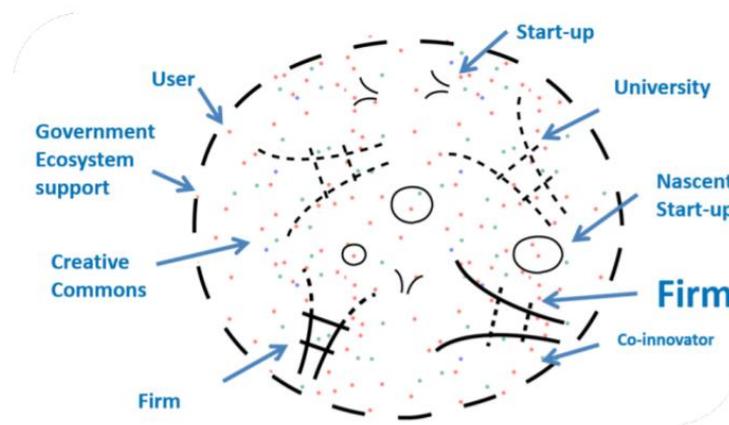


Figure 2: Open Innovation Ecosystem (Salmelin, 2013)

In figure 2, the different colour dots are showing different competencies, which are organised. A firm could be taken as an example of a well organised form of collaboration. However, in terms of OI2 concept and Quadruple Helix, projects could be regrouped based on their expertise and competencies. Research community is providing the seed into the innovation system and the role of the public sector is to cherish the growth of that seed. Thus, public sector is creating an infrastructure and favourable conditions for faster innovation process (figure 2). It is not only providing the funding, but also creating rules within the ecosystem. Rules increase trust and open-mindsets of all the participants in various roles (Salmelin, 2013). In addition, the public sector not only creates links between research and its applications and deployment, but also directly encourages new entrepreneurship (Salmelin, 2013). Furthermore, initiatives and proposed project prizes by the public sector is mobilising more actors to solve the problem and consequently has a very strong impact on the innovation culture (Salmelin, 2013).

Moreover, one participant could have several simultaneous roles, thus it is hard to define roles within Quadruple Helix actors. For example, a citizen could be a professional, who is sharing skills with several problem solvers, but at the same time a citizen can be a problem owner who is looking forward to a solution. Every participant in such ecosystems might have roles which are simultaneously public and private, problem owner or solver and contributor (Salmelin, 2013). Also, everyone participating in the ecosystem has a fair share of created value, because

players can only together create the common ground for innovation development process (Salmelin, 2013).

Grove, the CEO and co-founder of Intel, once said - “*If you can't measure it, you can't manage it*”. Historically it has been hard to measure the innovation performance at both the national and company level. The OI2 approach attempts to take a more holistic approach to innovation measurement. One of the methods is Innovation Union Scorecard (IUS) (Curley, 2015). This instrument provides a chance to measure the relative strength of the different components of the national research and innovation ecosystem and then apply certain interventions to strengthen the ecosystem. It consists of three broad categories of indicators: enablers, firm activities and outputs. Enablers are tracking the basic blocks to enable innovation – finance, human resources, support and research systems. Firm activities are tracking innovation efforts, such as investments, linkages, entrepreneurship level and intellectual assets. Outputs are measuring the collective impact of the innovation efforts, such as increased employment or exports and sales. Another method is a research yield index (RYI) (Curley, 2015), which helps to measure the innovation performance, it values not only the proof of concept, but also takes into consideration strategic impact, enabled revenue, improved reputation or an expanded research ecosystem.

To sum up, OIE attracts competencies, financial resources, and ideas to be tested and prototyped in a real-world setting. It leads to the designed portfolio of activities where sharing of knowledge is a key success factor. Trust, new roles, and experiment-friendly real-world settings are essential to ensure high quality results that would be shared and to be built on for a common future. Such ecosystems, are creating interdependency and making things happen through collective intelligence.

## **2.3. Innovation Intermediaries in Innovation Networks**

The intermediary role in innovation has been discussed in innovation management literature, however the definition of intermediaries is very scattered (Howell, 2006). In this chapter various takes, by innovation scholars, on what an intermediary is and does is discussed in chapter 2.3.

### **2.3.1. Innovation Intermediaries**

The literature is scattered in defining what the intermediary role is, which can lead to confusion in efforts of describing intermediaries (Klerkx & Leeuwis, 2009; Howell, 2006). In some literature, intermediaries are exemplified as retailers, advertising agencies, distributors, management consultants (Bessant & Rush, 1995; Howell, 2006). Bessant and Rush (1995) describes consultancy services as main activities of intermediary through connecting user needs to technological opportunities.

The concept of open innovation has been emphasized in innovation management studies (Hargadon & Sutton, 1997; Howells, 2006; Chesbrough, 2003). As open innovation grows in importance, the intermediary role in the innovation process becomes more highlighted. According to Howell (2006), the interest in intermediaries is also prompted by the development of knowledge-intensive business services (KIBS). Most scholars commonly define intermediaries by the activities they perform in the innovation process, such as *brokering* (Hargadon & Sutton, 1997; Howell, 2006) or *bridging* (Bessant & Rush, 1995; Burt, 2004) the diffusion of knowledge and innovation across structural holes in networks (Burt, 2004; Powell & Grodal, 2005).

In innovation diffusion, change agents are identified as determinants of the diffusion process. Change agents establish the initial need for change and drive the whole diffusion process. This makes change agents another central factor in the innovation diffusion process. Rogers (1995, p.37) defines a change agent as “*an individual who attempts to influence clients’ innovation-decisions in a direction that is deemed desirable by a change agency*”. In addition, change agents usually are the ones who are controlling the communication of innovations and can significantly influence the success of adoption and increase the rate of diffusion (Carey & Mason, 2014). They are usually capable of distinguishing the relevant pieces of information and disseminating it through a network. Change agents specialize in an external information domain and this way enhancing the diffusion within a social system (Tushman, 1977).

According to Dalziel (2010) any organisation, profit or non-profit, with the purpose of enabling innovation can be considered an innovation intermediary. Innovation intermediaries are described as organisations or groups within organisations that work with enabling innovation by enhancing the innovativeness of firms, sectors, regions or nations. Innovativeness is used as a substitute for words such as success, growth, competitiveness, adaption or survival (Dalziel, 2010). Howell (2006, p.720) defines intermediaries as: “*an organisation or body that acts as agent or broker in any aspect of the innovation process between two or more parties*”. This definition is believed to generate a holistic view of what intermediaries are and moving further will be the one used when referring to intermediaries.

Howell (2006, p.720) describes the intermediary roles in four main activities:

1. Providing information about potential collaborators or partners
2. Brokering transactions between two or several parties
3. Mediating or “going in between” bodies or organisation that are already collaborating
4. Assisting in finding advice and funding in support of the innovation outcomes

These four activities were broken down into ten more specific activities, see table 1 (Howell, 2006). The activities offer a holistic view of the total role of intermediaries that aim to translate and diffuse knowledge.

In addition to the activities described by Howell (2006), research has pursued the notion of intermediaries providing a collaborative space (Stewart & Hyysalo, 2008), representing a neutral collaboration space (Lopez-Vega & Vanhaverbeke, 2009). According to Klerkx and Leeuwis, (2009), intermediaries can be described as a third-party that establishes and manages innovation networks. Although intermediaries can be described in various ways, two main activities, or categorisations of activities can be identified. These activities are brokering and networking, specifically around existing knowledge (Agogu e, Ystr om, & Masson, 2013; Elmquist, Ystr om, & Olilla, 2016) and around well defined problems (Agogu e et al., 2013). The brokering activity, similarly, to Howell’s (2006) four main activities, consist of the following activities (Agogu e et al., 2013):

- Providing information
- Brokering a transaction
- Mediating and relationship-building
- Evaluating

The networking activity can be linked to some of the additional “third-party” activities that Klerkx and Leeuwis (2009) and Stewart and Hyysalo (2008) argued for, and these are the following (Agogu e et al., 2013):

- Providing an innovation space for collaboration
- Establishing and managing innovation systems to increase connectivity in the network

The authors (Agogu  et al., 2013) also suggest that the networking and brokering represent the traditional intermediary roles where the focus is on combining already existing knowledge (Hargadon, 1998; Howell, 2006; Elmquist et al., 2016).

*Table 1: Activities of Intermediaries (Howell, 2006)*

Activity	Description of specific activity
1. Foresight and diagnostics	- Forecasting, technology road-mapping, articulation of needs and requirements
2. Scanning and information processing	- Information gathering and identification of potential collaborative partners, selection of collaborative partners
3. Knowledge processing, generation, and combination	- Helping to combine knowledge of two or more partners - Generate in-house research and technical knowledge to combine with partner knowledge
4. Gatekeeping and brokering	- Matchmaking, contractual advice (negotiation)
5. Testing, validation, and training	- Analysis, inspection, prototyping, pilot facilities and scale-up - Joint training in use of new technologies
6. Accreditation and standards	- Formal standards, advice on standards
7. Regulation	- Formal or informal regulation and arbitration
8. Intellectual property rights advice	- Protecting and managing outcomes of collaboration
9. Commercialisation	- Market research (identify market opportunities) and develop business plans - Support in the selling and commercialisation process - Finding potential capital funding and organising funding or offerings
10. Assessment and evaluation	- General assessment of performance and technologies

### ***Innovation Intermediation in Innovation Networks***

In network studies (social network), Burt, (2004) highlights how network bridges are an important source of innovation. Howell (2006) also argues, in reference to activity 3 (see table 1), that innovation intermediaries’s greatest role is to generate and combine knowledge in the innovation system it is active in. Especially in circumstances no organisation can achieve innovation by working in silo (Adner, 2006). Stewart and Hyysalo (2008) claim that in greater societal demands of innovation often require a greater collaboration to identify suitable solutions. These types of demands often call for collaborations between academia, industries, financiers, solution seekers and providers (Agogu  et al., 2013), in a typical Triple Helix fashion (Ranga & Etzkowitz, 2013).

Intermediaries can be classified by their ownership and source of funding. Such classification would include public or private and non-profit or for-profit (Kanda et al., 2019). The challenges of society are often an objective that intermediaries located in the public sector work to tackle. For example, literature discusses intermediaries that support resource limited SMEs, driven by the public incentives and usually funded by public institutions. These intermediaries are often strategically positioned in areas where universities, research centres or SMEs are located, science parks are an example of such locations (Lee, Park, Yoon, & Park, 2010). Intermediaries

with a greater public funding tend to be non-profit organisations. The objectives uncovered by the intermediary are dependent on its setup in terms of institutional structure such as being public or private and for-profit or non-profit (Klerkx & Leeuwis, 2009). In the same study (Klerkx & Leeuwis, 2009), the authors argue that publicly funded intermediaries have a higher credibility in being impartial in their role.

Organisational creation of new knowledge is according to Nonaka (1994) key to innovation practices. It is even more essential in collaborations, with various actors and expertise, concerning societal issues, Elmquist and others (2013) identify intermediaries that enable joint knowledge creation as an open innovation arena. The coined concept of the open innovation arena works towards filling in an overlooked gap of intermediaries enabling knowledge creation, not only knowledge diffusion as most literature focuses on. The open innovation arena has an agenda to be a key stakeholder in a specific field of expertise and act as a complementary to the traditional intermediary, that goes beyond the intermediary activities and focuses on enabling joint knowledge creation in peer collaborations. Elmquist and others (2013) make a point that in the concept of open innovation arena, none of the partners are more pronounced than others. Managers of the open innovation arena have the task of supporting the creation of knowledge by fostering and emphasizing the shared visions and identity of the collective. Hence, it is more than providing a physical space for knowledge creation, it is also nurturing the relationships in that space. In agreement with Elmquist and others (2013), Agogu e and others (2013) also add the importance of a supportive, creative and open management and leadership to the discussion.

Nonaka and others (2000), much like Agogu e and others (2013), argue that leaders should create creative “chaos”. It is an important part of the interaction between the organisations and their external environments. The intention behind creating such a chaos is to motivate members to look beyond existing boundaries. According to Ekvall (1999), creativity is required in order for innovation to be achieved. Creativity helps to generate ideas, create liveliness and stimulate challenges. The environment in which the innovation takes place, has to encourage trust and openness. The environment also has to be supportive of one another’s ideas. The atmosphere should promote freedom, playfulness and openness (Ekvall, 1999).

In multilateral collaborations where the intermediary is more active in a complex innovation process, often in the front end of innovation, collective exploration is necessary. Agogu e and others (2013) propose that these intermediaries act as architects for collective exploration in the process of joint creation of knowledge. This expanded activity is necessary to support collaboration partners to go beyond their existing knowledge-base. In a further effort to understand intermediaries in complex and highly uncertain contexts, the degree of the “unknown” can be referred to (Agogu e et al., 2017). Agogu e and others (2017) explain that a low degree of the “unknown” occurs in collaborations where there is a clear common goal for all actors, even for conflicting stakeholders. These situations are more related to incremental innovations. In contrast, a high degree of the “unknown” suggests that the context of the collaboration is ill defined and unclear.

The authors also identify four core activities, inspired by previous contributions to literature (Howell, 2006; Klerkx & Leeuwis, 2009) that all types of intermediaries, no matter context and degree of the “unknown”, fulfil. These core activities are (Agogu e et al., 2017, p.21):

- Connecting actors
- Involving, committing and (resource) mobilising actors
- Solving, avoiding or mitigating potential conflicts of interests
- Actively stimulating the innovation process and innovation outcomes

### 2.3.2. Knowledge Diffusion and Creation

Knowledge can be described as information in a context; hence it is context specific. This also means that knowledge is dynamic. Knowledge can be divided into two types of knowledge: tacit and explicit. Tacit knowledge has an abstract aspect to it. It is engrained know-how that can be found in experiences, routines, values and emotions. This type of knowledge is very difficult to communicate to others. Hence, tacit knowledge is best transferred to others by activities that support “learning-by-interaction” and “learning-by-doing”. Explicit knowledge is more concrete and can be codified and easily shared with others (Nonaka et al., 2000). Tacit and explicit knowledge should be considered to be complementary to each other (Nonaka, 1994).

Knowledge creation is a continuous process. Nonaka and others (2000) propose a three-step knowledge creation process consisting of the following concepts:

- Knowledge conversion through the *SECI* model
- A physical context (*Ba*)
- Knowledge assets

The first step is the *SECI* model which was first introduced by Nonaka (1994) and includes four modes of knowledge conversion. Nonaka and others (2000) argue that knowledge is created through conversion between tacit and explicit knowledge in four interactive knowledge conversion modes:

1. Socialisation: tacit knowledge to tacit knowledge
2. Externalisation: tacit knowledge to explicit knowledge
3. Combination: explicit knowledge to explicit knowledge
4. Internalisation: explicit knowledge to tacit knowledge

The first mode, socialisation, is mainly about creating knowledge through sharing experiences. Experiences can for example be exchanged through informal meetings, observations and interacting with customers. The socialisation mode facilitates an arena for sharing. The second mode, externalisation, converts tacit knowledge into explicit knowledge, in effort to conceptualise the knowledge. The third mode, combination, is the process of combining various sources of explicit knowledge into a knowledge system. New knowledge can be developed by categorising knowledge gathered through documents, meetings and communication etc. The fourth mode, internalisation, is translating explicit knowledge to tacit knowledge and can further be described as “learning by doing”. The extracted experiences from the mode one, two and three, become very valuable when it is internalised by individuals and adds to their tacit knowledge (Nonaka et al., 2000).

The second step of the knowledge creation process is according to Nonaka and others (2000), the context to where the knowledge creation and *SECI* modes take place. A shared physical space also called *Ba* in Japanese, whether it is an office, virtual or mental space, is needed. Social, cultural and historical contexts are also important. The physical space offers a dynamic interaction space, which is a core concept in joint creation of knowledge. Managing the knowledge creation process in the traditional sense of managing and governing information flows, is not applicable. Leadership can take place in the sense of providing the space and foster conditions that enable the creation process. The management can promote creation of knowledge by arranging meeting arenas or composing common goals. Beyond the establishment of a physical context, managers also need to feed into the *SECI* modes continuously (Nonaka et al., 2000).

The third and final step is the knowledge assets, the base for the knowledge creation process, which are the inputs, outputs and controlling factors in the process. For example, trust in the organisation can be perceived as an output of the process (Nonaka et al., 2000).

Knowledge assets can be categorised into four parts:

1. Experimental Knowledge Assets

Tacit knowledge is diffused and shared through mutual experiences. Trust, care and energy are some of the important factors in this category. This type of knowledge assets is difficult to assess or evaluate because they are tacit, but they also make it difficult for other organisations to imitate.

2. Conceptual Knowledge Assets

Explicit knowledge is diffused and shared through visual images and language. This knowledge asset is explicit and concrete which makes it easier to understand. However, the difficulties for this asset present itself in understanding the external environment's perspective on these assets.

3. Routine Knowledge Assets

Tacit knowledge is engrained in the practices through organisational routines, culture and day-to-day tasks. Examples are the organisational culture and day-to-day practices.

4. Systemic Knowledge Assets

A systematised packaging of explicit knowledge in databases, documents and licenses. Examples of these types of assets is intellectual property rights.

The value in knowledge assets, is just that, they should be assets. Therefore, the knowledge assets should be developed internally. The knowledge assets are shared with the members gathered in the provided physical context where tacit and explicit knowledge is diffused and created in the steps of the SECI model (Nonaka et al., 2000). However, it is important to remember that these assets are dynamic, so to keep competitive advantage, the organisation must keep up with their dynamic (Nonaka et al., 2000).

Regarding knowledge creation, the recipients of that knowledge should not be passive in the processes (Powell et al., 1996). Knowledge cannot just be created; it also has to be absorbed. Powell and others (1996) argue, in relation to absorption capacity, that the existing knowledge-base in an organisation dictates what the organisation can learn from the new found knowledge (Powell et al., 1996). Burt (2004) discusses how collaboration networks that bridge structural holes have a faster learning rate, which in turn has a positive effect on the innovation capacity of the organisation. The absorption capacity can be stimulated through different learning experiences gained through for example, networking interactions. A lack of absorptive capacity for the recipient of new knowledge can create a knowledge barrier for the diffusion process (Szulanski, 1996). Another knowledge barrier dependent on the knowledge recipient is the reluctancy to accept knowledge derived from external sources. Lack of retention capacity of the knowledge, a determining factor in how well an organisation institutionalise knowledge, is also an example of a knowledge barrier in the knowledge diffusion process. The knowledge source could also be reluctant to share knowledge in fear of losing its superiority position or because of a lack of trust in that source of knowledge, this is another example of a knowledge barrier (Szulanski, 1996).

### 2.3.3. System Function and Intermediary Activities

In the discussion in chapter 2.1 (Innovation Systems) and 2.3 (Innovation Intermediaries), in agreement with the discussions of Kanda and others (2019) and Nilsson and Sia-Ljungström (2013), there is an overlap between innovation system functions and general intermediary activities to consider. According to Kanda and others (2013), literature has faced issues in demonstrating the intermediary's impact in the innovation system. To fully understand the potential contribution of intermediaries to the system, a linkage between system functions and intermediary activities can be done (Kanda et al., 2019; Nilsson & Sia-Ljungström, 2013). Nilsson and Sia-Ljungström (2013) argue that there are significant similarities between the two bodies of literature to highlight. The focus on generation and diffusion of knowledge being the biggest one. In the same vein, the authors argue that there also is a great difference, for example: intermediaries' role is often viewed from a linear perspective due to the supportive role in the innovation process while innovation systems have a very systemic approach. However, combining the two approaches can act as a first step towards an assessment of the intermediary's system-level potential contribution (Kanda et al., 2019).

## 2.4. Theoretical Framework

Innovation systems are defined as *“all important economic, political, social, organisational, institutional and other factors that influence the development, diffusion and the use of innovations”* by Edquist (2005, p.183). Innovation systems revolve around innovation processes in a network that involve different actors in an economic system (Lundvall, 2007). The Triple Helix is a type of innovation system that provides a finer view of the network, structured in a triad collaboration between industry, academia and governmental institutions. The triad works towards knowledge development and leveraging innovation conditions. The Triple Helix structure is described by the actors and the relationship between them. The Triple Helix innovation system can be seen in incubators and platforms at science parks.

Innovation systems can also be described by the following features identified by Moussavi and Kermanshah (2018):

- Knowledge sharing and learning
- Holistic and interdisciplinary approach
- Work beyond silos in a interactive and interdependent environment

The overall purpose of innovation systems is to generate, diffuse and use knowledge. In general, the innovation system carries out eight different functions to achieve this purpose (Hekkert & Negro, 2009; Bergek et al., 2008):

1. Entrepreneurial activities/Experimentation
2. Knowledge Development
3. Knowledge Diffusion through Networks
4. Guidance of the Search
5. Market Formation
6. Resource Mobilisation
7. Creation of Legitimacy/Counteract Resistance to Change
8. Development of Positive Externalities

There is an apparent relationship between the concept of open innovation and innovation systems. Open innovation is the strategy of working beyond organisational boundaries to welcome external ideas into the internal organisation for the purpose of leveraging innovation

efforts (Chesbrough, 2003). The idea is that an organisation wins if it *can* “*make the best out of internal and external ideas*” (Chesbrough, 2003, p. 38). The open innovation concept can be described as a boundary spanning activity. Open innovation can be divided into three core processes (Enkel et al., 2009):

- Outside-in process: External sources combined with internal ideas to leverage innovation efforts.
- Inside-out process: Internal ideas transferred to the external environment.
- Coupled approach: Mix of the outside-in and inside-out processes to co-create to develop and commercialise innovation in collaborations with complementary partners.

This notion lays the foundation to create more integrated network models, one of them being innovation systems. The innovation system can be perceived to take on all three approaches of open innovation and even the ideas in OI2. The updated version of open innovation (OI2) also covers the fact that the competition aspect is changing in today’s environment, as the focus now is on the strength of the ecosystem the individual organisation is a part of, rather than the performance of each individual organisation (Curley, 2015). “Failing fast and scaling fast” is one of the strongest advantages of OI2, which accelerates the time to market (Salmelin, 2013).

In addition, innovation systems and open innovation have been merged together into a newer and updated version of the innovation system, called open innovation ecosystem (OIE). This system can be created by shared visions and transformed by supporting the vision by active social network management and arrangement. Shared visions are essential in the success of multi-stakeholder innovation systems (Kramer & Porter, 2011). The innovation capacity is most powerful when it is in the shared vision context (Curley & Salmelin, 2018). Among the participants in such ecosystems, whether it is public or private and a problem owner or solver, the created value should be shared justly (Salmelin, 2013).

Rogers (1962), argued that the change agent has an important determinant role in the innovation diffusion process as they are skilled in recognising where there is a need to change. The change agent can also be called an innovation intermediary. There is a lack of consensus around the definition of innovation intermediaries in literature (Klerkx & Leeuwis, 2009; Howell, 2006). However, most scholars define intermediaries by the activities they perform in the innovation process. Commonly, these activities are described as *brokering* (Hargadon & Sutton, 1997; Howell, 2006) or *bridging* (Bessant & Rush, 1995; Burt, 2004) the diffusion of knowledge and innovation across structural holes in networks (Burt, 2004; Powell & Grodal, 2005). In an effort to further specify the intermediary role, Howell (2006, p.720) describes it in four main activities.

1. Providing information about potential collaborators or partners
2. Brokering transactions between two or several parties
3. Mediating or “going in between” bodies or organisation that are already collaborating
4. Assisting in finding advice and funding in support for the innovation outcomes

The activities offer a holistic view of the total role of intermediaries that aim to translate and diffuse knowledge. In addition to the activities described by Howell (2006), research has pursued the notion of intermediaries providing a collaborative space (Stewart & Hyysalo, 2008), representing a neutral collaboration space (Lopez-Vega & Vanhaverbeke, 2009). Furthermore, Elmquist and others (2013) identify an intermediary that enables knowledge creation as an open innovation arena. The open innovation arena has an agenda to be a key stakeholder in a specific field of expertise and act as a complementary to the traditional intermediary, that goes beyond the intermediary activities and focuses on enabling joint

knowledge creation in peer collaborations. The knowledge creation process is discussed by Nonaka and others (2000) through three concepts:

- Knowledge conversion through the SECI model
- A physical context (Ba)
- Knowledge assets

All intermediary activities described above can be summarised through the four core activities of intermediaries highlighted by Agogué and others (2017). The first activity is connecting actors. The second activity is to involve, commit and mobilise resources. The third activity is to solve, avoid and mitigate potential conflicts of interests. The final, and fourth activity is stated to actively stimulate the innovation process and innovation outcomes.

In exploring the intermediary's role in innovation, an overlap between its activities and innovation system functions can be detected. This overlap can, according to Kanda and others (2019), be utilised to demonstrate the potential system-level contribution of intermediaries. The matching of activities and system function could then be perceived as a first step in analysing this contribution.

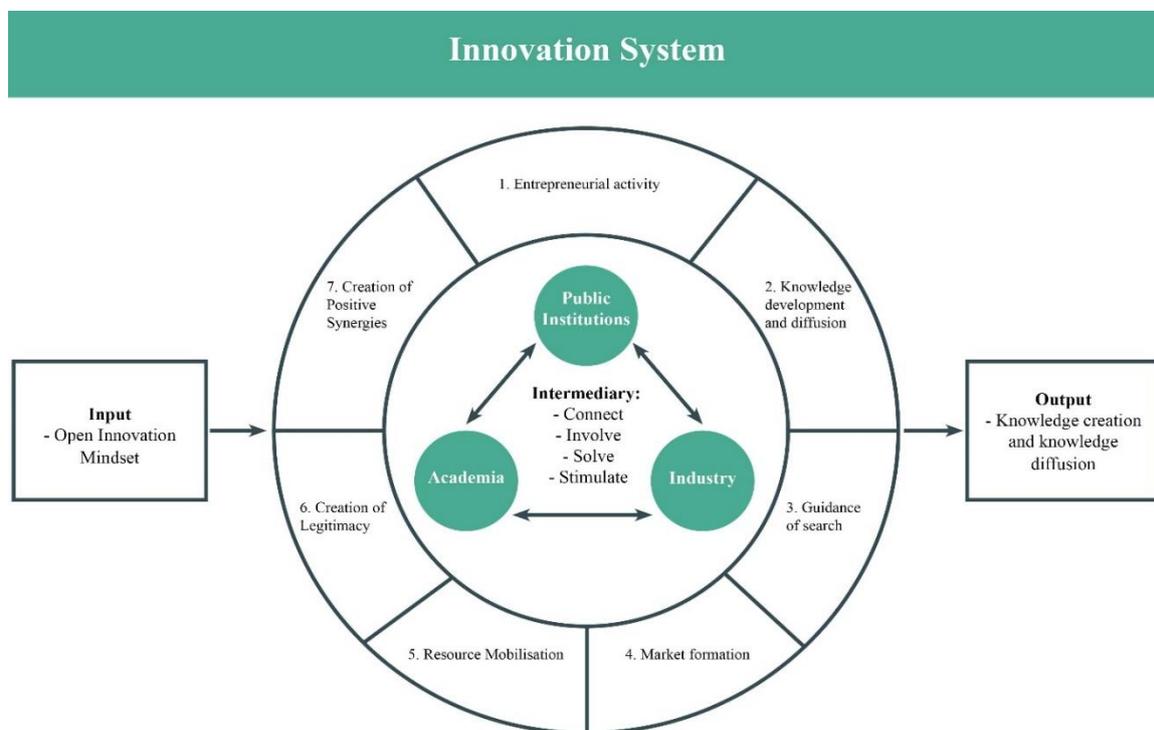


Figure 3: Theoretical Framework

In summary, the theoretical framework presented in figure 3, presents how the concepts of innovation systems, innovation intermediaries and open innovation are linked together. Innovation networks such as innovation systems, are created to foster the open innovation concept where organisations can come together in an innovation collaboration to internalise and externalise information and knowledge, which will in turn be used to leverage innovation outcomes. Hence, the input into the innovation system is the open innovation mindset. In the network, the intermediary has a central role as an assistant and supporter in activities to fulfil

the aim of generating, diffusing, and using knowledge. The intermediary role can be uncovered through the activities of connecting, involving, committing and mobilising, solving and avoiding conflicts of interests and stimulating the innovation process. In a Triple Helix system, a triad collaboration between industry, academia, and public institutions, these activities are fulfilled. The output of the system is knowledge development and diffusion. These activities can in turn be analysed through the system's function in a primary stage assessment of the intermediary contribution to the overall system.

### 3. Methodology

This chapter presents the methodology behind the conducted research. First, the research strategy and research design will be introduced. Second, the practise of data collection and data analysis will be presented to discuss how the gathered data is examined. The chapter will be closed with a discussion around the research quality.

#### 3.1. Research Strategy

This research follows an abductive approach, due to the exploratory research method needed to analyse the case of the platform CLOSER (Malhotra, 2017). The focus of this study is to provide qualitative feedback for the organisation regarding its role in an innovation system. This way, research will contribute to the existing theories and understanding around innovation systems and innovation intermediaries. It is not attempted to test existing theories and hypotheses or to develop new theoretical concepts, but to explore in depth one case through the collection of opinions and insights. This study attempts to provide conclusions with support of theoretical concepts that would explain the existing case and study objective.

Abductive reasoning involves attempts to identify the details that would make the phenomena less complicated and clearer (Bell, Bryman, & Harley, 2019). According to Weick (2005, p. 433), abductive strategy “*refers to reasoning that forms and evaluates hypotheses in order to make sense of puzzling facts*”. Abductive reasoning is a process of deriving explanations for poorly defined concepts (Magnani, 2001). In this research, the objective, the platform CLOSER’s role, is blurry and hard to be explained easily. Also, concepts such as novel type of intermediaries are not well developed yet. Thus, understanding around the platform CLOSER is built through collecting “puzzles” together.

Selected abductive approach is usually used to overcome the limitations related to deductive and inductive approaches (Bell et al., 2019). Deductive approach relies heavily on strict theories and hypothesis testing. The issue regarding the deductive approach is that it is not clear how to select the theory that should be tested (Malhotra, 2017). The limitation of inductive approach is that amount of empirical data that needs to be gathered to build theories is uncertain (Bell et al., 2019). Deduction states that something must be, induction approach proves that it operates and abduction approach suggests that something may be (Locke, Golden-Biddle, & Feldman, 2008). Abductive approach is selected, because it is hard to rely on testing theories that are fragmented and build new ones on a limited amount of empirical data. Thus, this research is done based on discovery and understanding.

Furthermore, the abductive approach goes hand in hand with qualitative study methods (Awuzie & McDemott, 2017). The qualitative approach is selected because the study attempts to capture and reflect on the dynamic environment. The qualitative approach provides a chance to perform a deeper investigation of the case and this is essential to explore this research area and be flexible in theoretical explanations when studying objective (Bell et al., 2019). A quantitative method is not suitable, because it analyses more objects in a less profound way. The purpose of this research is to define abstract concepts in real-life settings, such as innovation systems and innovation intermediaries. Thus, an abductive approach and qualitative method is the most appropriate to identify the role of the platform CLOSER in the innovation system.

To sum up, the abductive approach does not rely heavily on theories, unlike deductive approach nor on aiming to build theories, unlike inductive approach (Bell et al., 2019). In order to fulfil the research purpose, existing theories and concepts will guide, but not drive the research.

Concepts will be gathered in order to get the general insights and formulate research topics. Theory will be used to analyse the collected data, to support the conclusions and to explain the role of the platform CLOSER. This way, study quality is increased, because authors become more familiar with the research area and important topics to be included, before gathering and analysing data.

## **3.2. Research Design**

In general research design provides a framework for data collection and analysis. The execution of a research method and the analysis of the subsequent data are guided by research design (Gray, 2019). In each design several different methods could be used to process data. There are five archetypical research designs: case study, experimental, cross sectional, longitudinal and comparative (Bell et al., 2019). Decision of the research design depends on the research question and purpose. A typical case study design has been selected as the best suited approach for the study because it provides a detailed and in-depth take on the case of CLOSER (Yin, 2012). This approach is appropriate, as the goal is to uncover the role of the platform and therefore should be investigated in a thorough manner.

Conducted interviews and observations, as qualitative data, should be analysed in detail in order to get an outcome of great insights and valuable results. Also, the case study design allows to identify the specific features and uniqueness of such an organisation. The case of the platform CLOSER is unique because of this organisation's operating model, where public sector, industry players and academia emerge to drive the development of freight transport. Therefore, the platform's role is not fully clear and needs to be crystalised by an in-depth explorative study approach.

In order to support the choice of the typical case study design, the rejection of other designs should be explained. Experimental design is not suitable, because in this research is no variable of interest to be manipulated and analysed. Cross-sectional design might be found suitable, because different stakeholders will be interviewed, but it will not be done at one point in time. Longitudinal design might fit in terms of one subject observation, but it is not suitable, because this research is not aiming to observe changes over time. Comparative design is used for two or more cases, when there is a need for comparison. Since this study considers only one case, comparative design is not suitable (Gray, 2019).

## **3.3. Data Collection**

The literature review method and selected specific primary data collection techniques are presented below in order to fulfil the research purpose. The objective of this research is the platform CLOSER in the innovation system; thus, the primary data collection is based on the perspectives of the platform's partners and project and communication managers at the platform. Few meetings and conferences were observed to enrich researchers' understanding of the platform. Thus, qualitative interviews and observation methods were applied in this research.

### **3.3.1. Narrative literature review**

Literature review is necessary for researchers to understand what is already known around the interest area and what is missing and unknown. Theoretical concepts will be used to formulate research topics, build a theoretical framework, prepare interview guides, generate, and support

results and insights. The abductive approach allows us to use existing theories and concepts as a guide (Malhotra, 2017).

There are narrative and systematic methods to conduct the literature review (Bell et al., 2019). For this study, the narrative review is selected. The reason for this choice is that researchers need to get the initial impression of the topic area, understand general concepts and contribute with new insights. The general research purpose is to enrich human discourse by generating understanding, and not review the literature to find out what the research can add to the existing knowledge about the subject (Juntunen & Lehenkari, 2019) .

As mentioned before, the research strategy is abductive, which is neither inductive nor deductive, but a combination of both. The study attempts neither to test theories, nor to build them. A systematic review method requires setting all the main theoretical and conceptual definitions prior to the study (Xiao & Watson, 2019). That would be problematic, because an abductive approach theory is aimed to support the outcome and results. The research needs flexibility in order to enable the dialogue between theoretical and empirical data. Since this is a qualitative approach, the strict inclusion and exclusion criteria also could limit the study (Holstein & Gubrium, 2016). Narrative review is suitable because the research topic requires a more flexible approach and less strict exclusion and inclusion criteria, since the aim is to produce an exploratory in-depth case study and explain the research objective through theoretical concepts. Therefore, less strict inclusion and exclusion have been implemented in this study as well. The narrative approach is less focused and more wide range (Holstein & Gubrium, 2016). Thus, the data collection should be based on literature within the field of innovation systems and innovation intermediaries, which are widely broad concepts to be overviewed.

However, the gap between narrative and systematic reviews is narrowed (Bell et al., 2019). Systematic review is in general more transparent, replicable, and aiming to minimise research biases, which increases the research quality. Thus, by using mainly a narrative approach, some systematic process methods are used. Keywords, broad inclusion and exclusion criteria are identified (table 3) as systematic approach elements used in the narrative approach. It is needed in order to devote research time for the best quality studies. During the literature search and review approach the electronic database of Gothenburg University Library and Google Scholar were used to find relevant material.

***Keywords:*** *Innovation Intermediaries, Innovation systems, Open Innovation, Knowledge development and sharing*

Quality appraisal criteria was applied to ensure the collected literature trustworthiness. One of the applied literature quality appraisal criteria was “Peer-review”. This is a mechanism to control the quality of research. It is the instrument to define the quality and to ensure trustworthiness of scientific journals (Green & Johnson, 2006). Another quality criteria was the high number of citations, which indicates the value, recognition, interest of the research community and importance of the published results (Griffith, Cavusgil, & Xu, 2008). A third applied criteria was relevancy for research question and sources were selected based on its relevance in order to keep research focused (Green & Johnson, 2006). For this purpose, general exclusion and inclusion criteria were used (table 2).

Table 2: Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Innovation concept is analysed within the organisation, network, system perspective	Innovation concept is analysed from user and customer perspective
Innovation intermediaries within the innovation systems and networks	Innovation intermediaries within the marketing strategies
Open innovation in networks	Innovation as linear approach

### 3.3.2. Qualitative Interviews

The aim of conducting interviews was to get the insights from managers at the platform, and three different types of partners: academia, public authorities, and business/industry units. Conducted interviews were semi-structured because it allows for exploration, clarification, control and flexibility when collecting data (Bell et al., 2019). The semi-structured approach was necessary to guide the conversations into certain topics, using an interview guide (see appendix B). The interview guide consisted of questions related to specific theories about innovation intermediaries, innovation systems and knowledge development. The questions were revised in the process of the abductive approach that involves an iterative process between collecting theory concepts and data. Beyond the control, semi-structured interviews were selected due to the flexibility it provides (Bell et al., 2019). Flexibility is vital when dealing with interviewees from different organisational backgrounds and positions in their own organisations. Thus, semi-structured interviews are selected as the main data collection method because it provides a trade-off between structure and flexibility, which is needed to have in-depth conversations to extract valuable insights for further analysis (Bell et al., 2019).

The interviewees were selected from two sets of groups. The first group being partners, within the chosen case project, DenCity. The reasoning behind choosing a case project to focus on, was to select a representative case for the Project Arena. To select the specific case of DenCity out of all projects conducted at CLOSER, all running projects were studied first. Internal documents and reports also served as complementary information to choose selection criteria that guided the choice of the case project. To obtain a sense of un-biases, selection criteria were used to identify suitable projects for the report and then a random selection of one of these projects was done. The selection criteria are the following:

- Projects need to have been conducted over a period of at least 3 years. This means that the projects will have been a part of CLOSER's organisation early on and enough time to have gone through CLOSER's core activities.
- Projects need to be considered on a national level, since CLOSER was established for this reason.
- Projects where events, conferences, meetings, and workshops contain the highest number of hours spent per year.
- Projects with the highest number of the main partners involved, who are investing the most into CLOSER.
- In an internal document, mentioned as a successful example. This is important because this assures that the project has gone through the vital part of the collaboration process.
- The most overlapping with other projects within horizontal collaborations.

Five projects were identified as suitable, according to the selection criteria. After a random (blind) selection between the five projects, the chosen project was DenCity. About 26 partners

participate in DenCity’s three different stages of the project. Because of the exploratory nature of the research and dependency on partner’s perspectives, the aim was to interview 50% of the participants, which led to 13 respondents. The sampling of the interviewees happened in a combination of snow-ball sampling and (Bell et al., 2019) and random sampling (Robinson, 2013). The simple random sampling is when the individuals to interview are selected and are given an equal chance by randomly picking them, of course with some frames to the selection. The frames were constructed by the DenCity project and the Triple Helix sectors. Everyone within the project was categorised in academia, industry and public sectors. The individuals were provided a number and then randomly selected to match the aimed percentage. The snowball sampling is a method where existing subjects suggest other subjects, they find suitable to interview (Bell et al., 2019). This method was used to complement the interviewees that was cancelled later on in the process due to time constraints.

Table 3 provides a list of interviewed partners, their names are coded in terms of which sector that fits the most (I - Industry partners, A - Academia partners, P - Public authority partners). Table 3 visualise the number of interviews that was conducted with each of the three sectors. It should be pointed out that the number of interviews for each sector is proportionate to the number of partners that has been active in the DenCity project from each sector. The project DenCity involves more partners from industry than from other sectors, thus, the amount of industry respondents is the highest. The length of each interview was dependent on how much time interviewees could devote and reflects the amount of information each respondent had to share. All the interviews were conducted online, due to reasons explained below.

Table 3: Interviews with partners

Respondent	Medium	Date	Length (mins)
I1	Skype	3/13/2020	35
I2	Phone Call/Skype	3/16/2020	25
I3	Phone Call/Skype	3/23/2020	20
I4	Skype	3/16/2020	35
I5	Teams	4/1/2020	57
I6	Skype	3/30/2020	21
I7	Skype	4/3/2020	42
A1	Phone Call/Email	3/20/2020	12
A2	Teams	3/24/2020	40
A3	Skype	3/31/2020	51
P1	Skype	3/23/2020	43
P2	Skype	3/25/2020	60
P3	Skype	3/17/2020	35

The second group of interviewees was the project managers that work internally at CLOSER. They were interviewed to better understand the activities in the Knowledge Hub and to get a holistic view of the platform, through the perspective of other projects beyond DenCity that the respondents were involved in. These interviewees, similarly, to the selection of partners to interview, were selected in a random sampling approach. The aimed percentage was also 50%, but the achieved number of semi-structured interviews landed at the number seven. This represents approximately 40% of managers working at CLOSER (table 4). It should be mentioned that the collected empirical data from interviews with managers was supplemented by their backgrounds’ information received from publicly accessible managers’ Linked-In profiles. The interviews were conducted, using online mediums as well.

Table 4: Interviews with managers at the platform

Respondent	Medium	Date	Length (mins)
In1	Teams	4/2/2020	60
In2	Google Hangout	3/26/2020	57
In3	Teams	4/1/2020	41
In4	Phone	3/16/2020	23
In5	Teams	4/1/2020	28
In6	Skype	3/31/2020	47
In7	Teams	4/2/2020	37

Because of the constraints presented by the pandemic situation in the world during the data collection stage, all interviews had to be conducted using an internet medium to avoid physical meetings. The used internet medium was Skype, Teams, Google Hangout and phone calls, which is a practical solution for the faced situation but also for geographically dispersed interviewees, the latter was the case for a few of the respondents. Face to face meetings can provide the benefit of a more advanced take on the conversation based on tone, expression and body language, this is helpful in delivering a message without talking over each other (Holt, 2010). In phone calls and online mediums the face-to face elements are taken away which can cause uncertainty and inability to pick up visible signals and body language (Bell et al., 2019). To avoid these disadvantages, an email explaining the purpose of the interviews were sent out, anonymity was provided, with permission the interviews were recorded, and transcripts were later sent out to the respondents.

The recordings and transcripts worked as measurements for quality and transparency purposes. The transcripts were then sent to each respondent for validation. Bell and others (2019) suggest listening back to the recordings one or two times in order to improve the researcher's understanding and memory of the content which aids in the process of analysing the data and provides necessary follow-up questions that can clarify any question marks. In this case, the recording was listened to once, by one of the researchers, while writing the transcripts and the other researcher had to approve before sending out the transcripts for validation. Also, to avoid respondents from being too restricted in their responses and affecting the real perspectives, anonymity was provided (Bell et al., 2019).

### 3.3.3. Observations

Observations of three meetings and two conference meetings were used as a complement to the interviews and building researchers' understanding around the platform's role. Researchers participated in the selected meetings between the platform CLOSER and their partners as complete and overt observers (Gray, 2019). In these meetings researchers presented themselves and informed all the participants the reason for the researchers' presence. The sampling of the meetings was selected through a purposive sampling, which means that the selection of meetings to observe are made on a subjective basis to assist the purpose of the research (Bell et al., 2019). The purpose of the observation was to understand the culture, communication and interaction amongst the partners and also managers. Meetings that were observed are: the quarterly DenCity project steering committee meeting, a monthly project work-package leaders meeting and a "Monday meeting" that occurs every Monday for the platform's managers. Also, two webinar conferences were observed: urban mobility round table and CLOSER's annual meeting.

Based on the involvement degree and detachment from members of the platform CLOSER, researchers selected a complete observer role. Researchers were not able to interact with people during the meetings because the researchers should not be considered during discussions. Thus, some risks of failing to understand the situation could occur. One more issue could be related to participants being reluctant to disclose some information, knowing that there are observers present (Gray, 2019). Another challenge or issue that could occur in the observations of the meetings is the “Hawthorne effect”. It means that the awareness of being observed might influence the participants behaviour (McCarney et al., 2007). A last potential challenge is the information overload, from the perspective of the researcher.

### 3.4. Data Analysis

A characteristic of qualitative research is the huge amount of data that is collected through interview transcripts. To wave through this database the thematic analysis approach, combined with a few elements of the grounded theory will be utilised, as the methods are closely related. However, as the grounded theory approach is not suitable for unexperienced researchers, these elements have been condensed to a few (Bell et al., 2019).

Thematic analysis (TA) is an analysis method that focuses on interpreting patterns, also referred to as themes, in the collected data. TA can be viewed as a tool, technique or method with loose commitment to theory as opposed to a methodology with a theoretical base (Braun & Clarke, 2017). There are six steps to the thematic approach. In the first stage, researchers should get familiarised with the data collection. This is done by listening to the interview recordings and writing transcripts. In the second stage, initial codes which are the building blocks to identify themes, should be identified. In this step, researchers used the coding “Citavi” program to codify the transcripts. The third stage includes the search for themes by comparing codes to each other and categorising the codes into potential themes, the program “Citavi” served this purpose. The fourth and fifth stage involves reviewing and renaming the themes to be better coupled with relevant theory, in a finalising process. The themes present a framework that organises the collected data in a way that allows identification of key data (Braun & Clarke, 2017). The last and sixth stage is to produce the presentation of the data collection. The advantages of TA are mainly the flexibility it provides in terms of theoretical commitment, research question and data collection method (Braun & Clarke, 2017).

One of the risks of the TA is that coding could lead to loss of fragmentations of data, losing a part of the story. To conquer this risk, the coding process was divided into three stages of coding. In each stage important pieces of the interviews were extracted. Another risk is the subjective interpretation during the coding (Bell et al., 2019). This risk was mitigated by letting both reserachers code and approve each others codes. The coding of the transcripts was conducted through the “Citavi” program that offers support in categorising the data by choosing quotes to extract and place under suitable categories. The specific topics in the interview guide (see appendix B) served as categories in this coding process. Figure 4 represents the empirical findings extracted from the conducted interviews. The codes derived from the three-stage process can be seen in figure 4. These codes were then grouped together in different 1<sup>st</sup> order themes: *Innovation Process Supporter*, *Facilitator* and *Bridger*. These themes represent the roles of CLOSER. These roles were then merged into the 2<sup>nd</sup> order themes of *Enabling Knowledge Development and Diffusion* and *Network Creation*, which are the main identified effects of the performed activities in the roles. In addition, these 2<sup>nd</sup> order themes are the building blocks to the aggregated dimension of innovation systems. The themes will be further explained and supported by direct quotes from respondents and their expressed experiences in Chapter 4 of empirical findings.

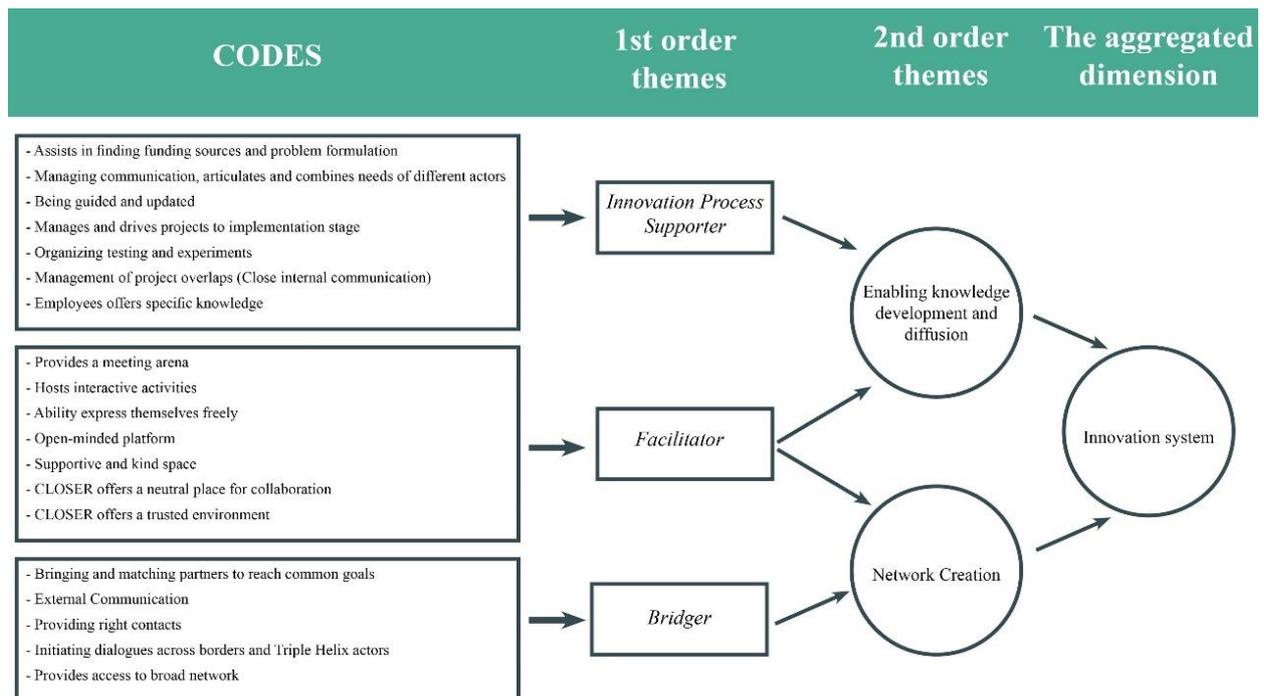


Figure 4: Coding tree

### 3.5. Research Quality

For the abductive case study design and qualitative empirical data method, the most suitable criteria for research quality is credibility, transferability, dependability and conformability. Thus, according to these criteria the research is overviewed.

#### *Credibility*

This quality criteria defines the trustworthiness of the research. It entails if research is carried out according to good practice and if research findings were submitted to the members that were studied (Bell et al., 2019). In this research, transcripts of conducted interviews were sent out for all respondents for validation. Seven out of the 13 interviewed partners and five out of seven interviewed managers at the platform responded back with the validation.

#### *Transferability*

This criteria determines if findings could be applied in other contexts (Bell et al., 2019). This research entails the group of individuals who are sharing the same characteristics within the unique unit. Interviewed managers and partners are sharing common goals and the platform CLOSER itself is a unique intermediary in terms of its structure and projects' focus areas (appendix A). Also, since it is a single case study, findings implications could be limited. Thus, this study's findings do not represent a generalised view about similar intermediaries or units as CLOSER.

#### *Dependability*

This research quality criteria defines trustworthiness (Bell et al., 2019). It involves the auditing approach which ensures that all interview records, transcripts and email conversations are kept

during all research phases in an accessible manner. During the thesis writing all the data were precisely saved on several digital formats. Thus, the access to it is available upon request.

### *Confirmability*

This criteria is concerning if researchers' values affect the research findings and refers to the degree to which the results could be confirmed by others. A Qualitative research assumes that each researcher brings a unique perspective to the study. Thus, during the thesis writing process, students were critically reviewing each other's insights and ideas to avoid findings that are based on potential research biases and make findings based on participants' interviews and empirical data.

## 4. Empirical Findings

The chapter about empirical findings concentrates on structuring and presenting extracted findings from the data collection process, particularly from interviews. Chapter 4.1 – 4.3 discusses the 1<sup>st</sup> order themes, derived from codes, as it reflects the identified roles of CLOSER. In figure 5, the codes and 1<sup>st</sup> order themes are displayed. Chapter 4.4 focuses on challenges that are faced by the respondents in the collaborations they participate in.

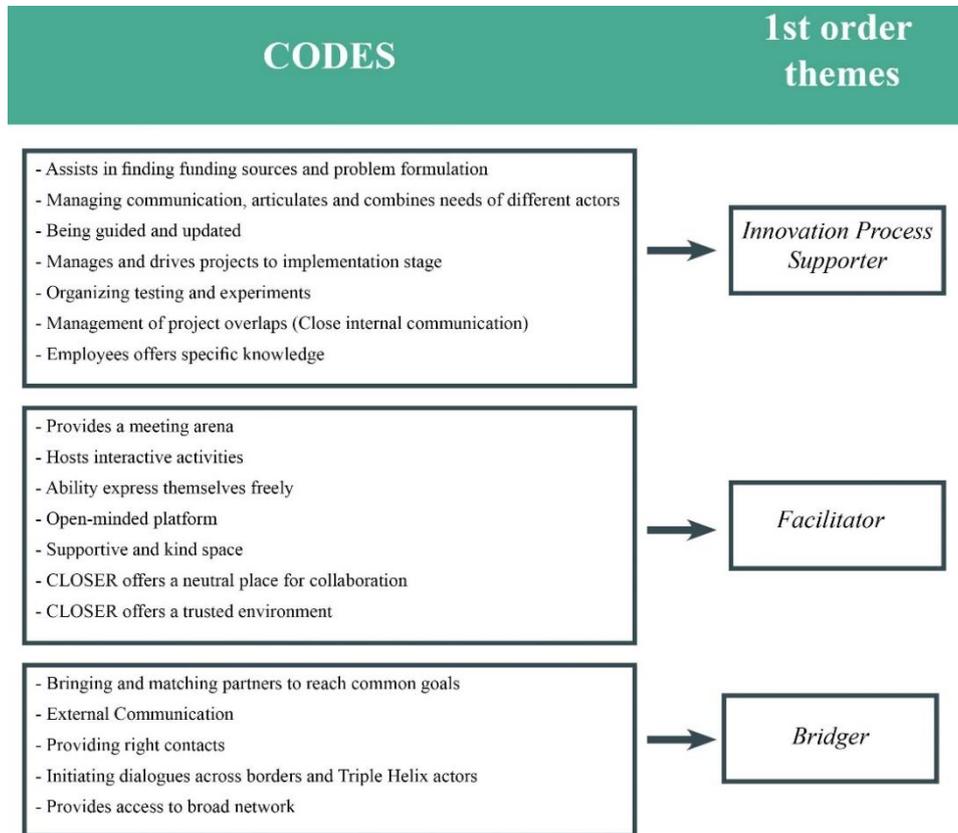


Figure 5: Codes and 1st order themes

### 4.1. Innovation Process Supporter

The first 1<sup>st</sup> order theme is the role as an *Innovation Process Supporter*. The Innovation Process Supporter can through the codes, derived from the interviews, be explained as a supporter to different stages of an innovation process and manager of projects, see figure 5. The innovation project stages go from helping to find funding to assisting the project implementation stage.

During interviews, stakeholders mentioned that even though there is a good promising idea for a project, applications to get funding and keep the project running are the hardest tasks. Also, formulation of an exact problem and sub-goals is an important part of the process that CLOSER is very good at. Through this, CLOSER is stimulating and encouraging new projects initiations. Respondents said that:

*“It is a challenge to go from discussions about what should be done - to get a project up and running with funding and the right interested parties.” – Respondent I7*

*“It is very good that somebody helps to set up the things related to budget or planning in order to reach the common goal.” - Respondent I4*

*“[...] a place that brings parties together and facilitates collaborations and new projects stimulation [...]” – Respondent I1*

In addition, the role of *Innovation Process Supporter* is leading the process till the projects are tested and implemented. Through project management, CLOSER is able to manage and control the processes which makes them leaders in reaching goals and objectives. Respondents from the public institution sector mentioned that one of the motivating factors of being involved in collaborations at the platform is that it helps speed up the process of implementing solutions and helps overcome faced technological barriers. It was mentioned several times by respondents that *“CLOSER makes it happen”*. Without an actor like CLOSER, the process of reaching ambitious goals would be very slow and complicated. Thus, CLOSER speeds the process of achieving innovation goals. Respondent I7 explained motivation of being involved at the platform:

*“We wanted to move with the fastest speed when it comes to development and innovation, when it comes to more energy efficient transportation”- Respondent I7*

Also, involved partners are getting an opportunity to do tests and experiments of projects' solutions, which was mentioned as activities, that partners are learning and gaining unique knowledge from the most. Ability to learn was mentioned by stakeholders from all three sectors: public, academia and industry. However, it was also mentioned that participation in collaborations provides a chance to learn, but it is up to each partner how much they want to learn. During interviews it was asked what gains partners are receiving from collaborations at CLOSER, it was answered that:

*“Both learning more and need of place to test things to accomplish the development”- Respondent I3*

*“I suppose that the knowledge I gained working within the HCT group, I could not get anywhere else. I have learnt a lot from that group”- Respondent I7*

Furthermore, within the platform, different projects are overlapping in terms of their contexts and purpose. It is very important to be able to recognise and identify those overlaps. One industry response mentioned that the overlapping of projects is seen as both a challenge and a strength of CLOSER:

*“[...] overlap and blurry boundaries are the strength of CLOSER, to have the overlapping projects.”- Respondent I5.*

Also, the interviewees highlighted CLOSER as a communication hub, particularly in its project managing role. Thus, this role includes the management of communication between partners as well. It is important to recognise and manage overlaps between different projects to fully utilise knowledge resources. In the management of communication between partners, articulating, and combining partners' different needs and provides updated information of what is happening in other projects. Communication skills are by respondents emphasized as very important when coordinating and managing projects. Scorecards used to illustrate the status of different stages in the work packages and further used in steering committee, are described as a communicative tool that elevates that communication skill. Beyond this tool, CLOSER makes sure to have a strategy for how and when to communicate during the projects. Partners appreciate the newsletters that are informing what is happening in not only a specific project, but also in other project areas. Thus, communicator role within the network is important to manage projects efficiently. Most of the partners mentioned that communication content is very useful and relevant, it could be supported by Respondent I3:

*“The content of the communication that is spread is always relevant”*

However, a few respondents also mentioned that relevant information is communicated, confusion around work role identities sometimes occur.

Some industry partners mentioned that through CLOSER’s communication they are being guided not only in the project, but also in their own organisation. Respondents from all three sectors mentioned that it is very important to be updated regarding ongoing situations on the market and get information of what is recently happening in other industries and sectors. The updated information which is received by partners helps to make decisions in their organisation. It could be highlighted by:

*“[...] We end up for the better result by participating in such projects [...] Great ideas will always have a guiding role in product development.”- Respondent I6.*

*“This is one of the main reasons being a member. Gaining knowledge of what is happening out there in the short term is very important” – Respondent I2*

*“I think the participation at CLOSER is a very good orientee [...]and that is why we are part of it” – Respondent P1*

*“[...] to know more about new cases that we can apply money for and also to be updated and knowledge update of what is happening in the logistic area.”- Respondent A2*

To reduce the overlapping, different project managers are working and closely communicating with each other. This way, they bring perspectives and expertise from other projects. Through such close communication, managers are complementing each other’s knowledge and are able to recognise overlaps between projects. This leads to full utilisation of existing knowledge and collected experiences.

During stakeholder interviews, it was mentioned that CLOSER owns intelligence and knowledge that is spread through the network and that is also facilitating the project development process. According to Respondent I4:

*“[...] they (managers at CLOSER) have a lot of internal expertise and knowledge by themselves, so they are sharing it through the network, and it is great.”- Respondent I4*

Table 5: Educational Background of managers at the platform (Interviews and Profiles in Linked-In)

Background	In1	In2	In3	In4	In5	In6	In7	Info from LinkedIn
Marketing and Communication								
Logistics and Digital Tools								
Civil Engineering								
Electrical Engineering								
Sustainability								
Economics and Manufacturing Technologies								
Supply Chain Management								
Environment Science								
Chemistry								
Energy and Environment Engineering								

From seven interviews with managers working at CLOSER and receiving information from publicly shared information on LinkedIn (table 5), it is detected that the managers at CLOSER come from a diverse set of educational backgrounds that all matches with CLOSER’s six focus

areas, see appendix B. It is seen that backgrounds and focus areas are matching; thus, the management of projects is perceived to be efficient. This way, the project manager is aware of the specific project content, able to indicate and understand problems, find the relevant partners, and thus facilitate the rest of the project management process.

## 4.2. Facilitator

The second 1<sup>st</sup> order theme is the role of Facilitator. The role includes the establishment and management of stages in the innovation process, both in the Project Arena and Knowledge Hub. In this role, a meeting arena (physically and virtually) is provided. The arena is fostered by an open, supportive, neutral, and trusted culture, see figure 5.

The meeting arena provided by CLOSER is described by respondents as a space for partners to meet and discuss freely. Workshops, meetings, roundtables, and seminars are mentioned as examples of discussion forums where perspectives from different partners are exchanged. In addition, it was mentioned that through discussions partners are learning. These ideas could be supported by Respondent I5 statement:

*“The good thing about meetings is that we are getting a lot of perspectives in one place, everyone brings their own perspective on the question. Then You are getting a much broader picture of the problem to be solved. [...] Within our separate roles we can understand each other and understand the difficulties in order to achieve goals.” - Respondent I5*

Roundtables was mentioned by several respondents as a valuable and informative networking activity that provides an opportunity to share, inspire and learn amongst partners that are interested in similar topics, within the focus areas. Inspiration, knowledge, and contacts are expressed as key extractions from these discussions. In addition, one of the managers at the platform mentioned that it is very important to manage roundtables that are held around a specific topic and to make sure that discussions are not too broad. It could be underlined by the following statements:

*“[...] The roundtables are very interesting and valuable. It has helped us very much. Inspiration, knowledge and contacts can be extracted from these types of forums.” – Respondent I5*

*“I think they make discussions easier to manage between different parts, by being a facilitator.” - Respondent I4*

Many respondents, in fact most respondents, perceive CLOSER to be a place that is very open-minded and a space where everybody can have open discussions. Respondents highlighted that CLOSER has an open, supportive, kind and creative climate, which enables partners to freely express themselves, to solve problems together through knowledge sharing. No respondents experienced conflicts. With an open climate CLOSER is inspiring partners to also implement similar elements within their own organisations. However, managers at the platform mentioned that it has taken years to reach this level of open climate. People were mentioning that the open and trusted climate, created by CLOSER, is very important for the success of projects, because through being open they are able to share knowledge and learn from each other. However, sensitive data is protected. It was mentioned that data and knowledge sharing is a key requisite for being involved in the collaborative efforts. CLOSER’s openness could be highlighted by the following responses:

*“We should work more with an open-minded culture, to allow ourselves to take the time to collaborate more within the company and between business areas. We should learn openness from CLOSER and how they work together and think more holistically.” – Respondent I6*

*“[...] I feel that everyone is open and helpful in the projects and this is a cultural thing, that you want to help each other by spreading information and appreciating the work and results.” - Respondent I4*

During interviews it was asked if gained knowledge from collaboration is spread outside the platform and how it is applied in partners' organisations. Some respondents explained that this knowledge is not internalised, because ideas have not reached an implementation and scaling-up stage yet. Others highlighted that it is essential to transfer and distribute the information within their organisations and this is one of the motives of being involved. Information is usually distributed in the form of verbal or written summary. It is important to highlight that industry partners said that gained knowledge is shared within their organisations and used for developments, later it is coming back to the platform CLOSER. The importance of information and knowledge spread was underlined by Respondent I2:

*“Forwarding that information internally is essential, in order to make internal people familiar with what is happening outside in terms of transport electrification [...] It provides knowledge that is valuable to be distributed internally. [...] Being a part of the network is a good way to spread knowledge gained from the platform collaboration which is then distributed internally to develop internal projects.”- Respondent I2*

CLOSER serves as a neutral hub suited for project collaborations that aim to increase freight transport efficiency with the purpose to contribute sustainable solutions that can be implemented in society. Being neutral is another factor that attracts partners to collaborate. Neutrality means not having a share in the final created value and not being politically involved. CLOSER is a non-profit organisation, funded by public institutions, that works towards the common good in society and has no owned gains in the project, this is an important point highlighted by several managers at the platform. According to Respondent In7,

*“[...] there is a need for a neutral partner who does not actually gain a lot out of the results.”  
- Respondent In7*

It was stated that collaborations between competitors very seldom happen in Sweden, but due to CLOSER having a neutral role with the purpose to benefit society, these types of collaborations can be set up. The neutrality of the platform is also seen as a driving force for creating ideas, gathering partnerships, and managing projects. The strength of the platform is that it wants the best for society. One of the partners mentioned that it is evident that organisations are more comfortable with sharing data when a neutral party, such as CLOSER, is present. However, one respondent from industry mentioned that neutrality is not always the best idea, because there is a need to make an impact on the political agenda, but the respondent also understands the underlying factors for being neutral and that their political agendas can be served by other, more politically involved, platforms.

Furthermore, stakeholders mentioned that CLOSER is a trusted partner and its great reputation is attracting them and motivating them to be involved within the network. Partners mentioned that due to the existing high level of trust, they can have quite open discussions with competitors in terms of faced challenges. It could be highlighted by the following statements:

*“However, I feel that we can have quite open discussions about our challenges, also together with our competitors.”- Respondent I7*

*“The most beneficial for us is the aspect of the great network and respect that society has for CLOSER. I think they have serious reputation of making things happen.”- Respondent P1*

### **4.3. Bridger**

The third 1<sup>st</sup> order theme is the role of *Bridger* which is described through activities that link, bridge and connect partners around common goals. This information is merged from codes and forms the third 1<sup>st</sup> order theme (figure 5). In this role, actors can match the right partners together and initiate dialogues across the different sectors’ borders. Through these activities, partners are getting access to the network and making new contacts.

During interviews it was asked about the motivation to enter the collaboration at the platform, many actors explained that relevant project topics and a network of engaged partners to reach common goals were the main reasons to join the platform. The importance of being able to work together with other partners on the same goals and reaching it collectively was mentioned several times. Many respondents highlighted that projects and challenges cannot be solved by one actor and that it requires involvement of several partners. There is especially a need of those who have the highest power within industries. Respondent I7 highlighted:

*“So, we know that we are stronger if we are working together, [...] we think that it will move much faster if we can do it together.[...]We find partnership interesting because we learn a lot and we believe that together we can reach more than doing things on our own.”-*

Respondent I7

Thus, CLOSER’s role of bringing people from different sectors enables collective work, that provides a chance to be more effective than working in silos. Thus, *Bridger* role is creating a network, where partners are focused on the same common goals. This could be supported by the statement below:

*“CLOSER is a very good organisation for networking.”- Respondent P3*

In addition, respondents mentioned that the platform provides right contacts and is matching right partners together to solve challenges. Some partners mentioned that they were matched with the right partners and without CLOSER’s help it would be difficult to achieve by themselves. Others said that they would manage to find partners, but the process would take longer. It was also stated that the bridging of connections can happen by either the external organisation being introduced to CLOSER through references or by CLOSER reaching out to the organisation. In addition, it was mentioned that CLOSER has a great base of contacts from different industries and therefore can involve the right partners in the collaborations. The ability to provide the right partners was underlined by the quotes below:

*“So that it is not only for things to happen, but also to develop things and use the specific skills, where CLOSER is a very good network at finding the right partners [...] If we try to find external help to make it happen, we will not have abilities to find the right contacts, so there is a big role of CLOSER. [...] To find the right people, good network is required.”-*

Respondent P1

*“[...] CLOSER helps to present those opportunities in linking with the suitable partners.”-*

Respondent I3

*“We would probably manage to find those partners by ourselves, but it is great to have a common project and common goals to work on. We would probably manage, but with CLOSER the process is going further faster.” – Respondent I4*

Furthermore, platform CLOSER is combining partners from different sectors, such as academia, business industry and public authorities (Triple Helix), to achieve goals and tackle wide challenges faced in societies. The platform provides a chance to work not only with partners within the same sectors, but also across the borders of different sectors. Accordingly, the Triple Helix collaboration network system is created. Partners were highlighting that it is very important to be involved in collaborations with partners from different sectors, because it is a way to handle challenges and make things happen. The quote from the interview with Respondent I5 underlines this:

*“Within our separate roles we can understand each other and understand the difficulties to achieve goals. [...] In CLOSER, we are finding the way to collaborate and reach our goals collectively.” - Respondent I5*

Industry partners mentioned that from academia they are getting a chance to “investigate the future” and to know what research is done. During interviews, industry partners mentioned that they are getting advice about relevant business models. In addition, it is important for industry to meet public authorities to have a constructive dialog of what the industry needs are and what kind of regulations that are coming up. Industry partners mentioned that it is important to be in a group of people who have the same opinion to convince authorities. Respondent P3 mentioned that:

*“DenCity is a very good example where a lot of companies and academia are collaborating. The collaboration from these two partners creates a change in the society which is the main goal.”- Respondent P3*

Academia partners mentioned that it is very important to understand the business perspective and what research is needed. Also, it was highlighted that it is very important to be involved, not only to extract knowledge, but also to utilise and spread already existing internal knowledge. Developed research ideas by academia can be tested and implemented together with industry partners, making research utilised. Moreover, academia partners mentioned that they are getting a chance to be involved in the network and help to solve common issues. It could be highlighted by Respondent A2:

*“It is a platform and a media that we can use to talk to industry”- Respondent A2*

Public authorities mentioned that they are also getting a chance to work with business industry and academia and those dialogues are very important. Respondent P1 mentioned that the public sector is perceived as a problem maker or making things difficult, when they are expressing their needs which is sometimes not aligning with business perspectives. This network provides a chance to find a common ground to work on.

Moreover, during interviews, respondents from all three sectors mentioned that the platform is providing access to a broad network and ability to make new contacts. Industry partners mentioned that contacts were made during the collaboration and will be used in the future, even though projects are over. Received contacts were not only from the same sector, but also from different sectors. In addition, academia and public respondents mentioned that they are also bringing their own contact and introducing partners into the network. This way several contact bases are merged. It could be underlined by these statements:

*“[...] valuable relationships that will be used beyond DenCity.” - Respondent I1*

*“They have a strong network and we also have a strong network.” - Respondent A3*

In the interviews the public visualisation and display of the successful project outcomes by CLOSER, is valued by the interviewees. This statement is coded as external communication. This fact was especially mentioned by public institutions and partners from industry. Also, the value of external communication is extended in terms of it being a tool to inform society about the progress and ongoing changes. This was mentioned by public institution partner, Respondent P1:

*“They have done a great job. That is a very important thing in projects like this, that you make people see what is happening. You are informing people and society of what is happening, because this is not what we are doing by ourselves.”- Respondent P1*

It was said that CLOSER is spreading the information through the community and making ideas and projects more visible. Respondents from academia and industry described external communication, in terms of public display of collaborations, as a valuable way of marketing and bringing attention to the projects their organisations are involved in. From the standpoint of a manager at the platform, social media and external communication assists in disseminating the concrete results of conducted projects and attracts more actors to get involved in the platform.

To sum up, CLOSER is an actor who stimulates new ideas and leads the project’s development process. Through precise management, owned knowledge and competence, and communication within the network CLOSER manages projects efficiently and speeds up the development process. In addition, the platform provides a meeting arena where partners are getting holistic perspectives and understanding partners from different sectors. Also, partners are being updated and information is guiding them in their organisations. Inspiration, knowledge, and contacts are extracted from meetings and discussions. Tests and experimentations provide a deep learning experience. Moreover, such an open and supportive climate and trusted environment is enabling knowledge sharing within the network. Thus, the skill of organising networks and combining needs from different sectors serves for effective handling of society challenges. All the empirical findings could be summarised by the quote from the Respondent I7 interview:

*“CLOSER gives more than it takes.”- Respondent P1*

#### **4.4. Faced challenges**

In this section, challenges faced by the participants interviewed are emphasized. The challenges are derived from the interviews and do not fit a specific 1<sup>st</sup> order theme; hence the challenges are presented in a separate section. The challenges are organised in three categories:

- Investment Risks and Outcome Uncertainties
- Communication and Information Sharing
- Encouraging SMEs to Participate

##### **Investment Risks and Outcome Uncertainties**

- The dependency on each other in a project was mentioned as a risk, especially when funding partners decide to leave the collaboration prematurely. This can delay and prolong the project process as partners that can contribute to funding the project has to be replaced. The high dependability on huge industry partners is recognised as a risk by

some of the respondents, as they also are a huge motivational factor to participating in many projects. This can be illustrated by Respondent I1.

*“Internally, there is a huge motivational factor found in the fact that many bigger organisations are involved” – Respondent I1*

- The amount of time that partners are able to invest was mentioned as a limitation factor in their participation. The reason behind this is often time constraints as they have to run their own operations in their internal organisations. Thus, a limited amount of time naturally slows down the project development process.
- It was mentioned several times that the challenge is to go from testing and experimentation to a wide scalability of solutions. Thus, to achieve it, ideas, pilot studies should be financially realistic, adaptable to business models or perceiving new business models, identifying the real need of solution and who would be affected. Also, the scalability aspect should be considered from the first project development stages. Underlying political issues and regulations are reasons why projects are hard to scale up. Regulations take time to be solved and changed, thus it is hindering solutions' scalability process. Respondent I7, mentioned that it would be wished to be able to have an influence on political agenda, but it is understandable why CLOSER is not stepping into such actions. Ability to do that would increase the chance to improve the innovation speed and project scalability. It is supported by Respondent I7 statement:

*“[...] not trying to have an Agenda against politicians, and sometimes that could be frustrating, because we want things to move faster in certain areas and CLOSER is not taking that part.[...] some political non-decisions are slowing it (process) down.”*

- Respondent I7

The scalability of the solutions is affected by how the value of the project outcomes is captured. In some projects the main investors, who are creating the value, are not the ones who are actually capturing it. In societal challenges it is important to identify partners who are actually getting value and to make them want to invest into it. Otherwise, there is no one who wants to invest and thus the project is not scaled up. In this factor the ability to negotiate and find a common ground is very important. Unscalable projects become expensive, due to lack of economies of scale, thus partners are losing interests, which is supported by Respondent A3:

*“You always have the economics of scale, if this solution does not scale it will become very expensive for the use and it will become not interesting for large distributors to conduct” - Respondent A3.*

- Some respondents mentioned that they do not perceive direct financial gains in projects development and gains are more intangible. However, it is believed that something useful and profitable will be developed through close collaboration and in the long run profits will be generated. This factor also leads to the project prioritisation in partners organisations. If there are no direct gains, then participation at CLOSER is not in high priority. This could be illustrated by the responses of Respondent I6 and I5:

*“It could be a problem to prioritise, we have many projects that we run internally, and it is not connected to DenCity. When it comes to prioritisation that might be the problem, since the DenCity project is not connected with any commercial benefits, not upfront at least.” – Respondent I6*

*“[...] it is creating gains for the future, even though we don't see the benefits and real value today. Those gains are more intangible today then.”- Respondent I5*

## **Communication and Information Sharing**

- In the interviews it was discovered that overlapping between projects occur, more often due to communication issues amongst participants in different projects. The communication between people working in the same project is effective but across the boundaries of projects the communication becomes more complicated. However, communication in between meetings are helping to manage this overlap at CLOSER as seen from response of In6:

*“[...] the problem is that you don't really have time and are not prioritising discussing these things. Focus areas are very closely related and there is an overlap between them. I have a feeling that sometimes we are doing the same things [...]”-*

*Respondent In6*

- According to Respondent I4, data sharing can present a case of knowledge sharing barriers, especially as some partners are not too keen on sharing data details. Another industry partner, Respondent I7, mentioned that they are sharing information that is relevant for the further project development, which is related to the business model. However, at the same time facing the lack of information provided from other partners. But that is an understandable factor that business critical information cannot be shared. Thus, knowledge and data sharing require a certain level of partners' transparency.

The respondent from the academia sector mentioned that data privacy is an issue. Research papers need to be published, but industry partners want to keep their patents. The respondent highlighted that having such a platform for communication and networking is very important, because it is encouraging actors to use their competencies. However, the data sharing aspect is hindering the process of knowledge sharing.

## **Encouraging SMEs to Participate**

- The contribution from different partners is not equal in many instances, and it would be expected to get more input from the biggest companies involved in the projects. Respondent A3 mentioned that it is very important to keep SMEs involved, because their commitment is higher. A manager from CLOSER mentioned that it is a challenge to keep different types of partners engaged in discussions, even though they are involved in projects, which could be seen from In3 response:

*“[...] the most challenging was to engage partners in discussions – and still is. Some are always interested to take part, but we want to make sure that we have a balance between different types of actors and that could be very challenging.”- Respondent*

*In3*

- In the interviews, the challenge of convincing smaller players on the market to participate can sometimes be challenging. The issue lies in their potential contributions to the collaboration to promote transport efficiency in comparison to their lack of experience in working in collaboration projects with others. It is also a challenge for smaller companies because they have to work with larger companies with more

resources and owned R&D functions that they cannot compete with. There is a need to convince smaller players to join collaborations and find a suitable level where they also are contributing. It is important to have them on board due to two reasons: 1) gather forces of all actors and push policies or governmental decisions and 2) have all actors work together towards a joint goal to improve overall efficiency of transport and logistics sector. It was discussed that more engagement could be received through bilateral communication approach, as it is highlighted by Respondent In2:

*“We have been talking about doing more bilateral discussions with each partner because what we can see is that the main members, the bigger companies are louder. The smaller members might have difficulties in reaching out and being as active as they maybe would like. This could be due to the personalities of the specific members but by having these bilateral discussions we can see the specific challenges, problems and issues we and the partners would like to raise”- Respondent In2*

## 5. Analysis

In this chapter, empirical findings will be analysed from a theoretical perspective, utilising the presented literature review in chapter 2 to answer the research question. This analysis is conducted through the themes discussed in empirical findings, see figure 6.

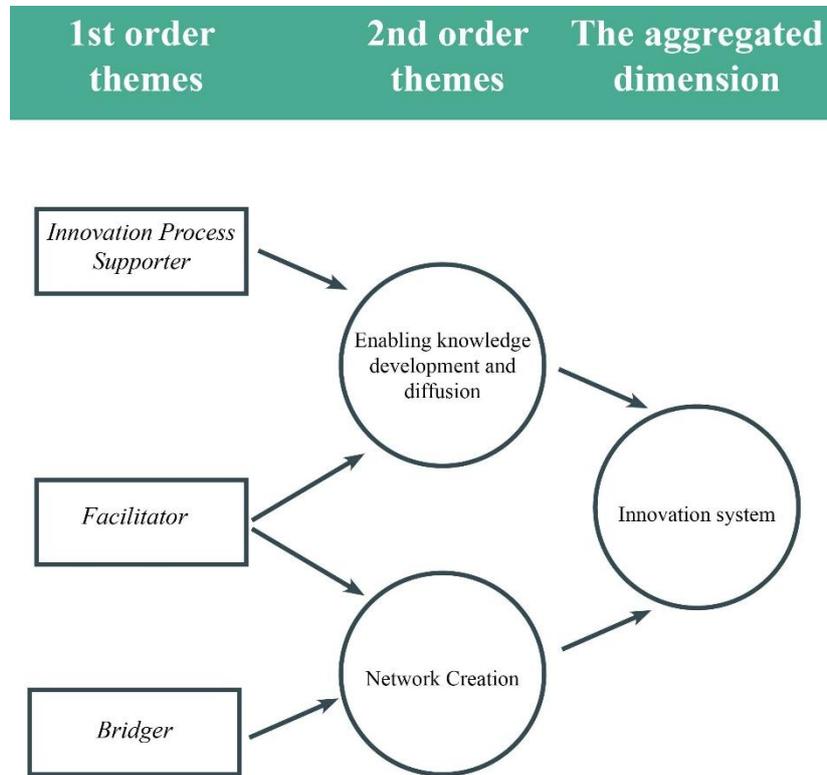


Figure 6: Themes

### 5.1. Enabling Knowledge Development and Diffusion

The aim of an innovation system is to develop, diffuse and use knowledge. The intermediary has a greater influence in this which will be analysed in section 5.1.1. and 5.1.2.

#### 5.1.1. Innovation Process Supporter

The themes included in the 1<sup>st</sup> order theme, *Innovation Processes Supporter*, presented in empirical findings can be compared with the intermediary activities discussed by Howell (2006), see figure 6. The shared activities between CLOSER and Howell (2006) is mostly concerned with supporting or stimulating the innovation process (Agogu e et al., 2017). The empirical findings suggest that CLOSER is perceived as a platform that initiates the innovation process by shedding light and articulating needs and societal demands. Sieg and others (2010) recognised problem formulation and selection of the right problems as a challenge in open innovation context. It can be noted that CLOSER helps mitigating this issue and this way stimulates the open innovation phenomena. Lakhani and Jeppesen (2007) argued that a way to structure knowledge flows is to have well defined problems and challenges. Apart from being good at articulating needs and problems, CLOSER is able to manage challenges in the projects. For example, in DenCity, the project status is uncovered through the red-yellow-green

scorecard system which helps to navigate through problems and challenges. According to Agogué and others (2017), this would suggest a low degree of the “unknown”.

Furthermore, CLOSER is perceived to be a supporter of the innovation process by assisting in project applications, funding, project implementation and scale-up. As an *Innovation Process Supporter*, CLOSER assists in identifying testing opportunities which are in the empirical findings pointed out as factors that speed up the implementation stage and help in overcoming technological challenges. This drives the projects to implementation and commercialisation. However, it was also discovered in the empirical findings that the cross-over from testing to wide scalability can be challenging. Underlying reasons for this issue can have to do with political policies and regulations that do not support the project outcome that is wished to be scaled. This is according to many respondents of the interviews, an important aspect to consider during the beginning stages of projects. In the concept of OI2 the “Failing fast and Scaling fast” the phenomena was emphasized as a strong advantage of OI2 (Salmelin, 2013). Although CLOSER is perceived to assist the speed up of the testing, implementation and commercialisation stage, a selected number of interviewees highlighted that CLOSER fails to fulfil the extended advantage of OI2 “Failing fast and Scaling fast”, mainly because the platform does not partake in political agendas.

The economic growth can only take place when the new technologies are commercialised and scaled up (Dahlstrand et al., 2019). These findings advocate an alignment with the following intermediary activities of Howell (2006):

- *Foresight and diagnostics*
- *Scanning and information processing*
- *Testing, validating and training*
- *Commercialisation*

It could also be suggested that, to fulfil the activities above, CLOSER has to process, generate and combine knowledge from different actors, including its own knowledge base. Hence, CLOSER is also fulfilling the activity of *knowledge processing, generation and combination* presented by Howell (2006).

It should also be acknowledged that these activities are conducted by an intermediary (CLOSER) in a Triple Helix innovation system, found in a specific field of expertise, freight transport industry. This means that the context of where CLOSER operates differ from the general notion of the intermediary Howell (2006) refers to. It presents a level of complexity in CLOSER's role when dealing with a multitude network consisting of complementary and sometimes competitive partners, like the coupled approach to open innovation described by Enkel and others (2009). This leads to the conclusion of CLOSER being an *open innovation arena*. Elmquist and others (2013) coined the term and defines it as an open innovation actor or an intermediary that goes beyond traditional intermediation. The open innovation arena is considered to be a key stakeholder in a specific field of expertise and focuses on knowledge diffusion and enabling joint knowledge creation in peer collaborations.

The empirical findings revealed that CLOSER as an intermediary in an innovation system speeds the project development process through its supporting activities, and with that has a central role in leveraging the innovation efforts in the collaboration. According to Enkel and others (2013), Laursen and Salter (2006), the outside-in approach to open innovation is where organisations turn to external sources to boost their innovation process outcomes and increase the companies' innovativeness. Through this approach partners are able to extract knowledge and information that then can be transferred into their own organisation; hence they are able to internalise gained knowledge. Moreover, during the collaboration, partners are sharing their knowledge with others. This indicates the second open innovation process of inside-out, where

internal ideas from partners' organisations are transferred to the external environment (Enkel et al., 2009). Furthermore, the third coupled process, which refers to a co-creation process that aims to develop and commercialise innovation in collaborations with complementary partners (Enkel et al., 2009), could be identified. This could be recognised by understanding the uniting collaboration factor of achieving common goals together. Therefore, it could be said that CLOSER enables all three open innovation processes and is speeding the process of handling societal challenges. According to Dittrich and Duysters (2007), innovation systems and intermediaries have a central role in an open innovation process.

Communication skills are essential in the role of coordinating and managing projects. The communication is not only valuable for the stakeholders, but it is also important in the following three factors, which were uncovered in the empirical findings:

- Updates about what is happening in the market and the external environment
- Updates and knowledge diffusion in the project they are involved in
- Understand and manage project overlaps

The importance of the communication skill for intermediaries is coherent with the concepts of direct and indirect ties discussed by Hansen (2002). According to Hansen (2002) direct relationships or strong ties (Powell & Grodal, 2005) results in quicker information transfer about opportunities and transactions of tacit knowledge is easier. Benefits of indirect relationships or weak ties can be found in the diverse and non-redundant information that is diffused. However, imprecise information wastes time in the project development as it tends to confuse the focus due to the wide set of information presented (Hansen, 2002). Direct relation is the shortest path enabling teams to know relevant well described opportunities. This means, as it was uncovered in the empirical findings, that relevant content is diffused and shared in short path relationships. However, as it was also discovered in the empirical findings, the short path relationships are mainly found within the project's partners (both partners and managers at the platform) work in. There can sometimes be a confusion about work identities or lack of updates on what is going on in other projects or work packages (DenCity), due to weaker ties. This makes knowledge transfer across work packages less easy.

To minimise overlaps in projects, although it at times can be perceived as a strength of CLOSER, projects are divided into different focus areas that helps to put limits around projects. The project managers at CLOSER all have internal expertise which helps in navigating through the boundaries of the projects. The six focus areas can also help in managing the "Wisdom of crowds" or collective intelligence that Surowiecki (2005) discussed. Furthermore, the project managers work in pairs in each project, additionally each person works in a different pair in a second project which helps in broadening their perspective and sharing of project-updates. The internal expertise, educational background of each project manager and experiences make them competent to conduct innovation process supporting activities, thus contributing to the knowledge diffusion in the network. This is coherent with Lundvall (2007) who argues that the link between innovation systems and knowledge and learning is embodied by agents and their knowledge.

### **5.1.2. Facilitator**

The 1<sup>st</sup> theme *Facilitator*, see figure 6, can be discussed in terms of *Enabling Knowledge Development and Diffusion* and *Network Creation* (2<sup>nd</sup> order themes) as the activities contribute to both aspects. In this section, the discussion will focus on how *Facilitator* activities contribute to knowledge development and diffusion.

CLOSER provides a meeting arena and hosts interactive events where all partners and actors in the field of expertise (freight transport) can come together to discuss societal issues. The

meeting arena is established and managed to increase connectivity (Klerkx & Leeuwis, 2009) and function as an innovation space (Stewart & Hyysalo, 2008) where partners discuss, inspire and share knowledge, this can be called the networking or connecting activity (Agogu   et al., 2013; Agogu   et al., 2017). Other researchers highlighted the provision of a collaborative space, which is neutral, one of the intermediaries' features (Lopez-Vega & Vanhaverbeke, 2009). The meeting arena can be stated to be the Ba (Nonaka et al., 2000) in the knowledge creation process. The Ba is a physical context and space for partners in a network to interact in, however, this context can go beyond a physical space, it can also be virtual or mental. At CLOSER the Ba is mainly seen through the activities in projects (Project Arena), workshops, seminars and roundtables (Knowledge Hub). The roundtables specifically are a forum for informative networking, sharing, inspiring and learning.

These activities mentioned above can be described as parts of the socialising mode (SECI) (Nonaka et al., 2000). CLOSER, as a neutral and non-profit platform that has no gains in the outcome of the innovation process, is pointed out as a vital building block of the trusted environment the platform has built. This is coherent with Klerkx and Leeuwis (2009) statement about publicly funded intermediaries having a higher credibility in being impartial in their role as an intermediary. This trust is essential in the socialising mode as it allows for relationships to be formed. It is valued by partners seeking collaborations where strong ties are required (Powell & Grodal, 2005). According to the SECI model, the externalisation mode is where organisations can share and transfer their knowledge to another party. The projects performed at CLOSER can be viewed as a vessel for the externalisation mode where partners can come to the platform and articulate their knowledge. In the same vein, as different types of knowledge are combined in the projects and its outcome of solutions, publications and reports, the combination mode is achieved. Finally, the internalisation can happen through the experiences and knowledge developed at CLOSER, both tacit and explicit. As discussed previously, this internalised knowledge is transferred to their own organisation. When discussing internalisation, absorption capacity should be highlighted. The absorption capacity influences the innovation capacity, because it is a determinant of how well an organisation absorbs newfound knowledge. In these networking interactions, the absorption capacity can also be stimulated. Especially innovation systems, that bridges structural holes are considered to have a fast learning rate (Burt, 2004).

An open culture or climate is essential for innovation to take place, in the creative climate factors such as trust are important according to Ekvall (1999). Beyond the supporting activities of the innovation process, intermediaries, in e.g. the public sector should create rules in the ecosystem. One of these rules should be to only invite open-minded participants (Salmelin, 2013). Elmquist and others (2013) and Agogu   and others (2013) discussed the importance of a supportive, creative, and open management and leadership within the open innovation arena. According to Nonaka and others (2000), it is the leaders' or managers' responsibility to create a "creative chaos" where members can feel motivated, which is achieved by CLOSER. Openness, supportiveness, and creativity were also detected in the empirical findings as the enabler of open discussions that take place in the interactive activities in the project development process.

## **5.2. Network Creation**

A platform and connection provided by intermediaries is needed according to Stewart and Hyysalo (2008). Hence, to create such a network the intermediary should provide a space for networking and bridge connections between actors.

### 5.2.1. Facilitator

In continuation with the *Facilitator* role (see figure 6) and how it enables network creation, the boundary spanning activity (open innovation) is discussed (Chesbrough, 2003). CLOSER, through its meeting arena, gathers partners from various sectors to work together in a Triple Helix collaboration. In this space, actors can step out of their own organisation to meet others. The space is represented by the creative, trusted, supportive and open climate as discussed previously, all to support the open innovation mindset and processes in the innovation system. The neutral role of CLOSER makes it a trusted partner with a great reputation that also allows the platform to manage collaborations between competitors, which seldom occur in Sweden. In such an open meeting arena, partners are making contacts and creating new relationships which leads to the existing network growth. Thus, by providing a meeting arena and creating an innovative atmosphere CLOSER is a *Facilitator*, who hosts network creation activities.

### 5.2.2. Bridger

The 1<sup>st</sup> theme *Bridger* (see figure 6) can be linked to CLOSER's ability to bring competitors together in a collaboration and is an indication on how the competition landscape is changing. The competition aspects have progressed into understanding that working in silos is not as effective in trying to achieve innovation, it is rather about the strengths of the ecosystem the organisation is a part of (Curley, 2015). This is driving the further merge of ecosystems, where intermediaries have a central role in managing it. As it was identified earlier, the neutrality of CLOSER is attractive. Another attractive factor that was identified in the empirical findings is the skill of connecting partners to the right partners that CLOSER possess together with the offer of a broad network. Connecting and matching partners to the right contact is the main challenge highlighted by Calof and others (2018), which CLOSER manages to do. Finding the right contact means to match and recognise opportunistic behaviour, cultural differences, or foreign laws (Calof et al., 2018). In the empirical findings it is discovered that the introduction to CLOSER sometimes happens through a reference by already existing partners. CLOSER is in this way used to invite others into the platform, this indicates that CLOSER bridges across structural holes (Burt, 2004). When discussing the bridging of connection, there should be a distinction between seeking for partners to collaborate with and partners to establish contact with. CLOSER enables both to happen. Establishing the right contact or bridging over structural holes that forms weak ties could be a first step in creating a network. Building a collaborative relationship or stronger ties could then be understood as a second step in the network creation process.

This attractiveness helps to create and grow the network. However, in acquiring such a broad network there are challenges of continuing attraction of actors constantly and also sustaining the partnerships over time, which is also one of the open innovation challenges (Chesbrough & Appleyard, 2007). Besides this, partners that are involved in the platform discussed another attractive aspect, which is the public display of successful projects they have been involved in. This helps getting their organisation's name out there, tied to innovative solutions that in turn can help bring attention and attract potential stakeholders to their individual organisation. In the empirical findings, this fact was especially mentioned by public institutions and partners from industry.

However, the bridging over structural holes has to take some precautions. The most vital one is to mobilise the partners around common goals. Especially, since CLOSER works with partners from academia, industry and public institutions, it is safe to state that there are connections in the network that would not have been formed without the collaboration at CLOSER. However, the different actors come together to work towards societal demands. The activities of bridging

connections can be seen as involving, committing or mobilising (Agogu  et al., 2017). Bringing parties together around common goals can work towards solving or avoiding conflicts of interests (Agogu  et al., 2017).

The innovation capacity is said to be most powerful in a context where there is a clear, shared vision (Curley & Salmelin, 2018). Innovation (eco)systems are about collisions and connectivity that needs to be orchestrated. The most vital part of open innovation is the willingness to provide and share knowledge with others (Yun et al., 2016). The willingness to share knowledge can in the empirical findings detected to the common goals and shared interest contribute to society's wealth.

The higher level of shared views or mutual understanding can be understood has stronger ties among the actors in the network. In contrast, the lower level of shared views or mutual understanding will result in weaker ties. The more potential connections are bridged, the denser the network. As discussed by Powell and Grodal (2005), there are both benefits and downfalls of strong respective weak ties. Stronger ties and more dense networks represent high levels of trust and low cognitive distance, which makes the network stable but sometimes too static – this can hinder the creative and open climate that needs to be in place for innovation to happen. Weaker ties and less dense networks result in a higher level of novel and non-redundant information flow (Kohl et al., 2015). The author suggests an intermediate state of cognitive distance, although it can be adjusted to the goal of the network. At CLOSER there are many things that speak for the legitimacy of the platform, the trusted environment and mutual understandings being two of them. Due to the stability and legitimacy of the network CLOSER has created and the dynamic characteristics, a balance an intermediate state of cognitive distance could be suggested.

### **5.3. Innovation System Functions Matched with CLOSER's role**

In chapter 5.1 and 5.2 the discussion circled around the identified activities performed by CLOSER which together defines the role CLOSER has in its network, see figure 6. In this section the gap between the 2<sup>nd</sup> order themes and the aggregated dimension (figure 6) is explained. Through literature studies and the empirical findings, a clear indication of the overlaps between innovation system functions (Hekkert & Negro, 2009; Bergek et al., 2008) and the intermediary role can be acknowledged (Kanda et al., 2019; Nilsson & Sia-Ljungstr m, 2013).

As stated in the literature review, there is a lack of consensus around the definition of an intermediary (Klerkx & Leeuwis, 2009; Howell, 2006). However, there are some common traits of the intermediary in most contexts which has been highlighted in the literature review. These common traits have also been utilised to uncover how commonly claimed intermediary activities contribute to the innovation system, see appendix C. The comparison of the theoretical match between innovation system functions and the intermediary role with CLOSER's match is interesting. The match presented in appendix C will be discussed function by function.

**Function 1.** The **entrepreneurial activity** is set up to reduce the uncertainty level by providing a “learning by doing” and “learning by using” mentality. These mentalities are uncovered in entrepreneurial activities such as testing and experimentation of ideas and solutions (Howell, 2006). The empirical findings, as previously discussed, present opportunities and possibilities to test solutions, this can be seen in the final stages of the project DenCity. Also, CLOSER is selecting ideas and formulating problems and challenges that should be solved, what works as a gatekeeper. Accordingly, CLOSER as an *Innovation Process Supporter* fulfils this function.

Training is also considered to be a part of the intermediaries' activities (Howell, 2006); however, it has not been identified as part of CLOSER's role. Training could be implemented as an offer by organising training sessions for organisations that wish to develop their knowledge and understanding of certain project areas or technologies. This would foster the learning process.

**Function 2 and 3.** The core of the innovation system is to generate, diffuse and use knowledge (Moussavi & Kermanshah, 2018). This is also uncovered in functions of **knowledge development and diffusion** of the system as activities that promote “learning by doing” and “learning by searching”. From a theoretical standpoint, these functions are matched with the intermediary activities such as: scanning and information processing, communication, accreditation, and standards and assessing and evaluating (Howell, 2006). The intermediary role of knowledge generation, combination and diffusion is an obvious match with the function. In CLOSER's case the articulation of needs, specifically how to contribute to societal demands, is an important part in understanding which projects to create. The testing stage and aid in the commercialisation stage helps the partners to “learn by doing” and realise project outcomes. The communication between CLOSER and its partners, and even among the partners were in empirical findings discovered as a vital part of the knowledge development and diffusion process. Furthermore, establishing and maintaining a meeting arena that is creative, neutral and open works in the favour of supporting the knowledge development and diffusion process. In comparison with the theoretical match, CLOSER is not perceived to provide accreditation and standard. Standards could be viewed as a method to transfer and diffuse explicit knowledge. The assessment and evaluation activity can be identified in the project arena process. However, there have been concerns regarding the assessment of CLOSER's total performance in the innovation system. In the empirical findings, respondents also voiced that, although the environment is trusted and open, there are limits in how willing organisations, specifically industries are to share sensitive data. Besides the two mismatches described above, most of CLOSER's activities align with knowledge development and diffusion in the innovation system. Besides the two mismatches described above, all roles of CLOSER's, *Innovation Process Supporter, Facilitator and Bridger*, align with knowledge development and diffusion in the innovation system.

**Function 4.** The **guidance of the search** is the function related to highlighting needs and opportunities for growth which is helpful in addressing project objectives that can be realised. Moreover, having visualisation and clarification of goals in the work can positively affect the system. Intermediaries are fulfilling this function by strategy development, foresight and diagnostics and brokering (Howell, 2006). As stated before, CLOSER is skilled in articulating needs and formulating problems, which in turn creates common goals for partners to collaborate on. This way, CLOSER matches the right partners and performs brokering activities (Howell, 2006). In the guiding of search function, communication and updates on what is happening in the external environment is helpful in the partners' internal decision-making processes. The communication skill is perceived to be efficient in the empirical findings. So, CLOSER is not only guiding participating actors within the projects through precise problem formulation, but also has a guiding function beyond the platform borders. This innovation system function is fulfilled by CLOSER being an *Innovation Process Supporter* and *Bridger*.

**Function 5.** The **market formation function** can be described to be the activity that identifies markets, or niche markets, that could be stimulated. Initially, CLOSER provides a meeting arena that acts as a space with conditions, such as trust and openness, for development of ideas and solutions that are aimed to be realised on the market. CLOSER's assistance in the development of new business models, implementation stage and commercialisation stage, should be highlighted as contributions to this function. Thus, CLOSER's role of *Innovation*

*Process Supporter* and *Facilitator* is fulfilling this function. Yet, the discussion about CLOSER not fulfilling the full potential of supporting the commercialisation stage due to not working towards political agendas, at least not intentionally, should be emphasized.

**Function 6.** The **resource mobilisation** function is about activities that involve and mobilises resources to create and elevate the innovation system. The resources are mainly financial, human and complementary assets (e.g. the network infrastructure). Financial sources, for example projects, are managed by CLOSER in each project through gathering and providing funds. The human resources are the different partners or stakeholders. The bridging roles between different parties have a great influence in this function as this activity creates the complementary asset, a network infrastructure. Therefore, CLOSER is fulfilling this function by being an *Innovation Process Supporter* and *Facilitator*. The resource mobilisation function should also be discussed in terms of how CLOSER through its communication skills for example, manages project overlaps to make sure that the resources are delegated properly and not used inefficiently. Nevertheless, the project overlaps are also discussed as a strength rather than an issue by some respondents in the empirical findings. It is perceived to be important to fully utilise the existing resources (knowledge) to speed up the innovation process.

**Function 7. Legitimation** is another innovation system function that is built on shared visions and goals between partners in the collaboration. It is about creating social acceptance, which works as an incentive for actors to mobilise their resources. This function is useful in counteracting resistance of change. CLOSER being a publicly funded, neutral and national arena that works towards efficiency and sustainability. The neutrality, for example, helps build up the trust as indicated in the empirical findings, which in turn creates social capital (Chow & Chan, 2008) and this boosts the organisational knowledge sharing. The legitimation can then be said to have an influence on the resource mobilisation activity, because a trusted platform will have an easier time to match-make as this is perceived to be an attractive trait. Gathering actors around common goals and shared values helps to gatekeep the network. This way, CLOSER acts as a *Facilitator* and *Bridger*. However, CLOSER being publicly funded can hinder takes on political agendas which might minimise the catalyst role for the platform. In the theoretical match between intermediary roles and innovation system functions, the activity of IP rights protection is emphasized. In the empirical findings there was also no indication of CLOSER supporting the process of IP rights protection. This can be concluded to be due to CLOSER's neutral position as a national arena, which means that the platform has no stake in the outcome of the solutions.

**Function 8. Creating positive synergies** is about generation of positive external economies, which is a key in the formation and growth of innovation systems. It is developed through entry of new firms and is a central factor in innovation system creation. New partners are helping to resolve the unknown and other challenges with a diverse set of perspectives. In the empirical findings it was stated that SMEs can experience difficulties in keeping up with the larger organisations due to scarce resources, funds, and time. CLOSER has recognised this issue and is considering introducing more bilateral discussions with all partners to really understand where CLOSER can step in to support the partners. Moreover, CLOSER is an open, creative, and neutral collaborative platform that attracts new partners, and adds to the density of the network. Therefore, it could be stated that CLOSER's role of *Bridger* fulfils this innovation system function.

Following the analysis how the commonly (in theory) claimed intermediary activities match the innovation system functions, there is an interest in identifying how CLOSER contributes to the different functions in the innovation system, see appendix C. From first glance, it can be

noted that CLOSER contributes to all functions in the innovation system. This could support that CLOSER has greater influence on the innovation system and would also support the previous statement about CLOSER being an open innovation arena, partially due to its position as a key stakeholder in the specific field of expertise. The match (appendix C) also indicates that all three overarching activities, *Innovation Process Supporter*, *Facilitator* and *Bridger* (1<sup>st</sup> order themes), are parts in the influence CLOSER has. Furthermore, the match between CLOSER's role and the innovation system functions only can confirm that CLOSER is contributing and partaking in all the innovation system functions. There is no assessment of the contribution's extent, this could rather be used as an evaluation foundation.

## 5.4. Summary of Analysis

A summary of the analysis can be given through a conceptual framework (figure 7) which was derived from the theoretical framework (figure 3) presented in the literature review and the conducted analysis in chapter 5.

The innovation system is created to foster the open innovation and boundaries spanning activities, which is mainly about combining external and internal ideas to leverage innovation efforts in the individual organisation. It is about understanding that innovation requires interorganisational collaborations (Chesbrough, 2003). The open innovation concept can be approached through three different processes: outside-in approach, inside-out approach and coupled approach (Enkel et al., 2009). In the empirical findings it was identified that CLOSER, as an intermediary, assists in fulfilling all three processes, which is an indication that the open innovation process is adopted in the platform and network. According to the conceptual framework (figure 7), the two sides arrow between the innovation system circle and input represents the interrelatedness of open innovation and innovation system. The open innovation mindset is vital for the innovation system to operate, but at the same time by operating, the innovation system is also fostering open innovation processes. Beyond this, CLOSER is found to be an intermediary in a Triple Helix structured innovation system, which works towards societal issues. Therefore, societal challenges are considered to be an input (figure 7) to the system as it brings the triad actors of academia, public institutions and industry together (Ranga & Etzkowitz, 2013). The two side arrows indicate interrelatedness between the societal challenges and the innovation system. It could be concluded, by the argument presented above, that open innovation and societal challenges act as an input or fuel for the innovation system.

In the theoretical framework the intermediary activities were summarised into four core activities: connect, involve, solve and stimulate (Agogu  et al., 2017) (figure 3). The four activities could be linked to the identified roles of CLOSER (figure 7). These identified roles are *Innovation Process Supporter*, *Facilitator* and *Bridger* within the Triple Helix innovation system. In figure 7, the triangle in the circle represents the Triple Helix innovation system structure and the sides of the triangle represent the identified roles of the platform. Figure 7 reflects that the platform CLOSER is in the centre of the innovation system and is a vital part in gathering partners together.

Furthermore, it was found that the platform contributes to all eight functions of the innovation system through the three identified roles. In figure 7, the two side arrows in the innovation system circle represent the alignment of the role and specific function of the innovation system that is fulfilled by the platform intermediary. It should be mentioned that one innovation system function could be fulfilled by more than one role, thus the same function can be connected to several roles. For example, innovation system function 2, knowledge development and diffusion, is matched with all three roles. It indicates that all the activities performed by the platform are contributing to this innovation system function.

Moreover, in an innovation system the overall aim is to generate, diffuse and use knowledge to leverage innovation outcomes (Moussavi & Kermanshah, 2018). The conducted analysis showed that the outcome of the collaboration is matched with the overall aim of innovation systems. It was detected that the effects of the platform roles are Enabling Knowledge Development and Diffusion and Network Creation. In figure 7, these facts are highlighted as the outputs of the innovation system. The two side arrows between the innovation system circle and output represents the two-way impact. The platform within the innovation system is *Enabling Knowledge Development and Diffusion* and *Network Creation*, thus these two outputs would not be generated and stimulated without innovation system collaborations and intermediaries in it (figure 7).

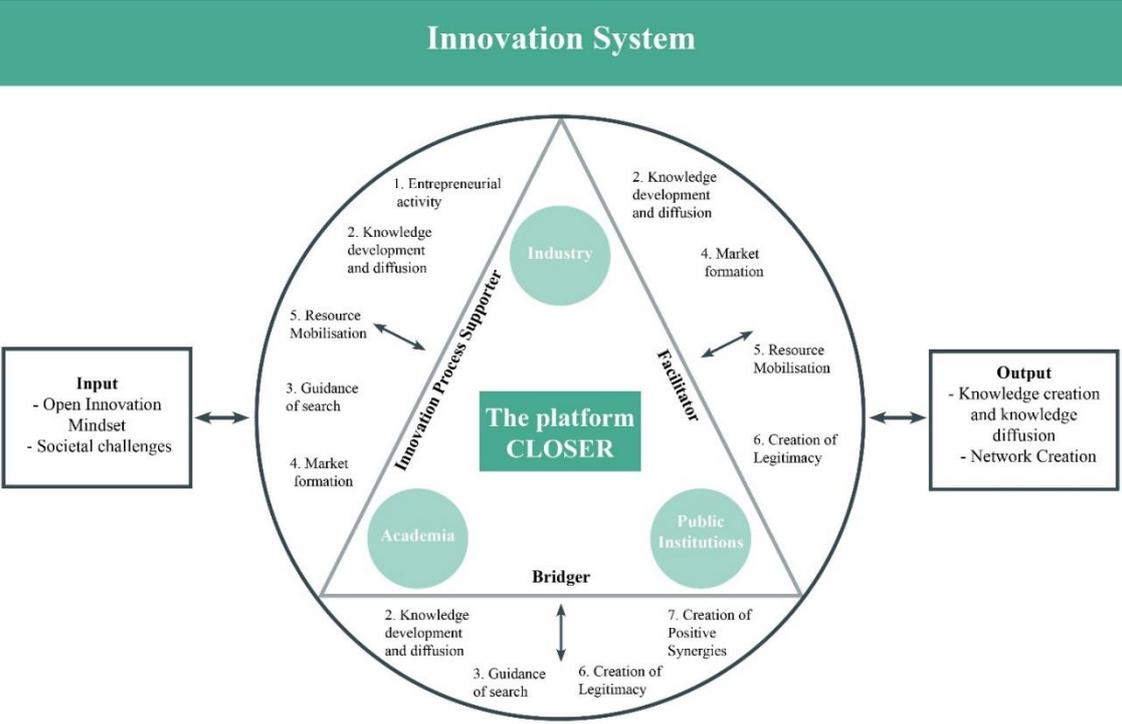


Figure 7: A Conceptual Framework

## 6. Conclusions and Recommendations

In this chapter the research question will be answered by discussing the identified roles and its alignment with innovation system functions. In the second part the practical implications and recommendations for the platform CLOSER are provided. Theoretical implications and future research suggestions are provided in the last section of the chapter.

### 6.1. Revisiting the Research Question

As mentioned before, to fulfil the research purpose of investigating intermediaries' role within an innovation system, the contribution of the intermediary to the innovation system functions were examined. It supports the existing literature of intermediary's definition. This purpose is achieved by answering the research question, which is:

*What is the role of CLOSER as an intermediary platform in an innovation system?*

The empirical findings coupled with literature resulted in three main roles that CLOSER performs. The three main roles are: *Innovation Process Supporter*, *Facilitator* and *Bridger*.

The role of *Innovation Process Supporter* includes assisting or supporting activities of the innovation process stages that is said to stimulate the innovation process. By formulating the problems and articulating societal needs, CLOSER is shedding light and guiding the development process. Assisting in funding and project management speeding up the innovation process and reducing common uncertainties. Moreover, CLOSER is mitigating the challenges faced within open innovation, encouraging phenomena development and structuring knowledge flows within the innovation system.

Moreover, CLOSER has a central role within the innovation system and speeds the project development process through its supporting activities. It was identified that through communication CLOSER, is updating partners not only regarding the specific project, but also regarding other projects and external markets. Later, this internalised knowledge is transferred to the partners' organisations. This way, CLOSER is not only contributing to the knowledge diffusion within the network, but also influencing the innovation decision making in partners' organisations.

The role of CLOSER is more complex than an ordinary intermediary, because it is dealing with a multitude network consisting of complementary and sometimes competitive partners, like the coupled approach to open innovation described by Enkel and others (2009). This leads to the conclusion of CLOSER being an open innovation arena, which goes beyond traditional intermediation. The open innovation arena is considered to be a key stakeholder in a specific field of expertise (freight transport industry) and focuses on knowledge diffusion and enabling joint knowledge creation in peer collaborations.

*Facilitator* includes all activities that revolve around establishing and maintaining a creative, trusted and open network infrastructure that welcomes open discussions. By being neutral and trusted, CLOSER enables the creation of relationships within the network. CLOSER offers a meeting arena, which serves for knowledge diffusion and network creation. This way, it is undoubtedly increasing the connectivity within the network. Consequently, these networking interactions are stimulating partners' absorption capacity and learning capabilities (Burt, 2004). Thus, this role is increasing connectivity in the network and stimulating learning.

The last main CLOSER's role, *Bridger*, includes activities that mobilise and connect different parties together and setting up common goals for the partners that interact. It can be said to bridge parties across structural holes, within the Triple Helix innovation system. It decreases

the structural holes in the network and creates strong ties. The stronger the ties the denser the network which forms a close-knit network that consists of a low degree of a cognitive distance and higher level of trust (Burt, 2004). Thus, CLOSER is directly contributing to a denser network creation.

CLOSER's ability to bring competitors together in a collaboration is an indication on how the competition landscape is changing. The competition aspects have progressed into understanding that working in silos is not as effective in trying to achieve innovation, it is rather about the strengths of the ecosystem the organisation is a part of (Curley, 2015). Due to this factor, it is expected that the importance of such platforms will increase and that it has a great potential to grow.

Moreover, CLOSER's roles were analysed and matched with the innovation system functions to identify how the platform as an intermediary contributes to the system. The contribution can be identified by detecting the overlap between CLOSER's role and the innovation system functions. Either one or both of the 2<sup>nd</sup> order themes which are Enabling Knowledge Development and Diffusion, and Network Creation can be detected in all functions. The following points will conclude the match with the eight innovation system functions:

1. Entrepreneurial Activity: CLOSER provides testing opportunities, which enhances the learning process. However, training was not discovered.
2. Knowledge Development and Diffusion: CLOSER is performing foresight and diagnostics, scanning and information processing, supporting testing and commercialisation. Also providing a creative, open and neutral meeting arena to enable this innovation system function. However, within the commercialisation and scale up process are pointed out as possible challenges that partner's faced, specifically industrial partners. Beyond, the evaluation stage in the project arena, an assessment and evaluation of the overall performance of CLOSER should be implemented. The data-sharing can be challenging at times and act as a barrier for knowledge diffusion.
3. Guidance of the Search: CLOSER articulates societal needs, provides updates about the external environment, and guides partners not only in projects but also in their own organisations during innovation decision-making.
4. Market Formation: CLOSER supports the implementation and commercialisation stage by assisting in developing business models. The platform creates conditions for seed to germinate. However, the support in the commercialisation stage can be hindered by a "non-political-agenda" mindset.
5. Resource Mobilisation: CLOSER is mobilising financial and human capital and network infrastructure. In this function, the management of project overlaps is considered. Project overlaps are perceived as both a challenge and strength for many of the respondents in the empirical findings.
6. Legitimation: This function is fostered by the neutrality of CLOSER and broad network. It is also nurtured by mobilising partners around common goals and creating social acceptance. Creation of legitimacy could however be hindered by being neutral, as the platform does not work towards political agendas.
7. Creating Positive Synergies: CLOSER is an open, creative, and neutral collaborative platform that attracts new partners, and adds to the density of the network. CLOSER is attracting new partners and stimulating the growth of the innovation system. However, the challenge of keeping everyone engaged was mentioned.

All in all, CLOSER's role within the innovation system was investigated. It could be stated that CLOSER, through its roles of *Innovation Process Supporter*, *Facilitator* and *Bridger* fulfils the innovation system functions. These activities help to fulfil the overall aim of innovation systems

to generate, diffuse and use knowledge. Overall, the appreciation of the existence of platform CLOSER could be summarised by the statement of Respondent I7:

“CLOSER gives more than it takes.”

## 6.2. Practical Implications and Recommendations

The first part of the study purpose was to identify the role of CLOSER from the perspective of the partners in the innovation network. The second part of the study purpose is to provide clarity, feedback, and recommendations for CLOSER, on the role the platform has in its network and how to lay a foundation for assessment of its impact on the network.

The role of such a platform has great potential in the future because the competition landscape is changing. In terms of growing willingness to participate in networks, it is expected that organisations in the future will be competing on the participation in the best ecosystems. Consequently, intermediary's and open arena's role will be even more important in the future. Therefore, it is very important to indicate the key areas that the platform should build their competences in, to strengthen the future position in innovation system.

It is believed that the main functions and core themes that CLOSER focuses on and should continue with are *Enabling Knowledge Development and Diffusion* and *Network Creation*. These are the two core factors for an innovation system to function and exist. Thus, it is important to focus on it to strengthen the platform's position in the innovation system in the near future. In the investigation of CLOSER's contribution to innovation system functions, the following points were identified as improvement areas:

### **In terms of Knowledge Development and Diffusion activities:**

- To fulfil the lack of training offer, CLOSER could organise training sessions revolving topics covered in the different projects, workshops and seminars. This would generate and contribute to creating an environment that fosters a faster learning rate and could help elevate the knowledge absorption capacity of the partners.
- Project overlaps have been detected as both a challenge and strength. To reach a balance between these perceptions, the overlaps should be managed to fully utilise existing knowledge resources, without exhausting the resources, which will help speed up the innovation process.
- There is also some conflicting perception about the support in the commercialisation stage. The concerns about the non-political-agenda objective of CLOSER can be considered as a hindrance. However, the neutral position of CLOSER is understood and in most aspects appreciated.
- Eliminate knowledge sharing barriers such as reluctance to share data or at least provide a standardised solution for sharing to increase willingness to share. Sometimes partners refuse to share even though they do not know what will be asked for yet.

### **In terms of Network Creation:**

- Entry of new firms is a central factor in innovation system creation. It is important to attract new partners in order to feed the network with new insights.

- In the empirical findings it was discovered that, in some cases, SMEs can struggle with feeling confident to take up more space due to lack of resources. A suggestion to implement more bilateral discussions where challenges, concerns and visions can be uncovered without distractions, were highlighted. The study's results support this suggestion.

The neutrality feature has two side effects. It provides a chance to collaborate for many different partners, from different industries. However, the creation of legitimacy is hindered, due to lack of advocacy in front of political parties that have power to influence change. Otherwise CLOSER works as a catalyst of the innovation system.

In the concept of OI2 the “Failing fast and Scaling fast” phenomena was emphasized as a strong advantage of OI2 (Salmelin, 2013). Although CLOSER is perceived to assist the speed up of the testing, implementation and commercialisation stage, a selected number of interviewees highlighted that CLOSER failed to fulfil the extended advantage of OI2, mainly because the platform does not partake in political agendas. Due to this factor projects’ scalability is challenging and takes longer.

### **6.3. Theoretical Implications and Future Research**

This case study contributes to the currently scattered literature surrounding the intermediary role (Klerkx & Leeuwis, 2009; Howell, 2006) Firstly, the intermediary role in this case has been studied through a non-profit, publicly funded national arena within the field of freight transport. The study indicates that the intermediary in an innovation system, specifically in a Triple Helix system, performs a combination of activities previously discussed by scholars within the topic of innovation intermediaries. Secondly, the study contributes support to the scarce set of literature on how the intermediary role impact can be evaluated. Previous literature has suggested a first step towards an assessment method of the intermediary role’s impact in the innovation system, by considering the overlap between intermediary activities and innovation system functions. This method has been implemented to understand the case’s contribution to its innovation system functions.

This research project could be a base for further research of measuring innovation intermediary’s performance. It was identified that CLOSER’s roles and activities are complimenting the innovation system functions and supporting the system’s development. As a compliment to this study’s qualitative approach, a quantitative approach could be conducted to realise a measurement of the performance of CLOSER in the identified matches between intermediary roles and system functions. A longitudinal study would not only guide the platform in its performance but also enrich present research with how to measure the intermediary performance.

Moreover, the longitudinal study about CLOSER’s influence on the national or international innovation performance would be relevant. As it was understood, the platform has developed very quickly and is still expanding. We believe that a longitudinal study in terms of the platform’s development could provide great insights and knowledge for the research community not only about innovation management, but also about actors and why they are so demanded not only on a regional, but also national and international level.

Furthermore, a comparative study could be done by comparing different platforms with a similar structure and activities. It would be useful to understand motivational factors of why partners are selecting one or another platform. Is it only a matter of handled project topics and societal development challenges, or reasons are hiding beyond the built relationships, contacts or created culture and atmosphere? Such research would not only advise platforms of how to

attract partners, but also it would contribute to the open innovation research, which is not clear in terms of what exactly inspires it – internal needs or pressure from the external environment?

In addition, this platform could become an object for researchers who are interested in an innovation project development and its scalability. During interviews it was mentioned that the biggest challenge is to scale up projects and widely adapt its solutions. Thus, further research could be done in terms of faced project challenges and focus could be on factors that are hindering the scalability process. Results could not only help to overcome the identified problems, but also prosper the research topics of challenges in innovation ecosystems.

Lastly, it was indicated that knowledge management is key to utilise the full potential of existing knowledge. Project managers and their communication at CLOSER could become an object for further research because projects are overlapping within the platform. Thus, knowledge management and close communication between employees is essential for efficient knowledge utilisation within the platform. Research study might indicate some potential improvement and enrich research topics such as communication and knowledge management within open innovation systems.

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# Appendix A

## Description of focus areas at the platform CLOSER (CLOSER, 2020):

- Energy and Supply Logistics. Projects under this topic are focused on increased energy efficiency and sustainable energy supply solutions for the freight transport industry and system, which are not the same as solutions for passenger cars and public transport. Thus, collaboration of Swedish government agencies, major automotive, energy and transportation companies is needed. CLOSER is engaged in driving the initiative and coordinating the collaboration. (CLOSER, 2020).
- High Capacity Transport (HCT). It is known that the greater usage of HCT vehicles, would increase not only the energy efficiency and infrastructural capacity, but also would cut CO2 emissions. CLOSER is responsible for running this program, which contains 11 work-packages, and at the same time responsible for the International Cooperation work package, where an international collaborative group was set up. (CLOSER, 2020).
- Digitized and Connected Logistics. Innovative digital technology brings new opportunities to increase efficiencies in the logistics and transport systems. Digital technologies can provide greater transparency, quality and sustainability, what would change the trading patterns and customer demands. CLOSER is driving several projects and this way creating a platform for strategic cooperation. (CLOSER, 2020).
- Urban Mobility. This focus area is broad and includes innovative and sustainable solutions for urban freight and passenger transport. To achieve goals, cooperation among business, academia, government and policy makers is essential. CLOSER is organising four Round Tables during a year, when the opportunity for dialog, knowledge and experience exchanges is created for partners. (CLOSER, 2020).
- Multimodal solutions. Better coordination and interaction among different modes of transportation is required in order to increase transport-efficiency. It is focused on increased transport efficiency for all types of transportation, connection with terminals and transfer between different transports. CLOSER provides a chance to do testing and share knowledge about new innovative solutions. (CLOSER, 2020).
- Horizontal cooperation. The aim of this focus is to achieve more efficient use of resources through more efficient sharing of resources among the same level players in the supply chain. Thus, it is important to focus on how organisations can collaborate to a greater degree. (CLOSER, 2020).

# Appendix B

## Interview guide

### Introduction

- Introducing ourselves and the research purpose
- Asking a permission for recording and if there are any questions

### Interview Questions

1. Could you describe your work and role within your organisation?
2. Could you take us back to the beginning of the company's introduction to CLOSER and what are the drivers that made you want to work with CLOSER?
3. What kind of benefits your organisation is getting out of Triple Helix collaborations?
  - a) Academia
  - b) Public authorities/governmental institutions
  - c) Business partners
4. What does your company bring into the collaboration?
5. What are the challenges faced in the collaboration?
6. What kind of knowledge is shared and exchanged? Is it a specific technique or is it a tacit knowledge?
7. Are there any specific activities at which knowledge sharing and information exchange happens?
8. The knowledge that is gained from the network, is it shared in your internal organisation?
9. Have you formed relationships with parties in the network that will be useful beyond the collaboration of CLOSER?
10. Communication. How do You communicate with a CLOSER? How effective is it?
11. How would you define CLOSER culture? Is there anything adaptable to your organisation's culture?
12. What do you think determines that one actor is enabling the processes and making things happen, while others are just stuck?

### Thank You for Your time!

- Could we send You the summary of our interview and maybe You could validate it?
- Would You be interested in the final report and results?

# Appendix C

## Matches between intermediary role and innovation system functions

Innovation Function	Intermediary Role in Theory	CLOSER's Role	Description
1. Entrepreneurial activity	Testing, validation, and training. Creating a place for learning by doing and using	Provides opportunities and possibilities for testing. Protecting Innovation space by gatekeeping and brokering	<i>Innovation Process Supporter</i>
2. Knowledge development and diffusion	Scanning and information processing, knowledge processing, generating and combining, communication, accreditation and standards, assessing and evaluating technologies	Articulating needs and opportunities (foresight and diagnostics), scanning and information processing, testing. Also providing a creative, neutral and open meeting arena where free and open discussions can take place. Managing communication among partners during the project development process. All activities at Project Arena and Knowledge Hub	<i>Innovation Process Supporter, Facilitator, Bridger</i>
3. Guidance of the search	Strategy development, foresight and diagnostics, identification of problems and opportunities (articulation of needs)	Articulation of needs and opportunities, managing projects, providing updated information for partners and it is guiding in their decision-making process. This is achieved through external/social communication and communication within projects	<i>Innovation Process Supporter, Bridger</i>
4. Market Formation	Implementing and commercialising new solutions through market research and business planning, accelerates and supports in selling and commercialisation process. Identification of new opportunities	Support implementation and commercialisation stage, meeting arena, matching needs and opportunities, assisting in development of new business models	<i>Innovation Process Supporter, Facilitator</i>
5. Resource Mobilisation	Establishing and maintaining networks, creating an innovation space, finding potential capital funding, and organising funding or offerings, identification, and management of human resources	Managing different knowledge and competencies, assisting in finding funding resources for projects. Match-making or bridging connections, providing a meeting arena and broad network. Project overlap is a strength	<i>Innovation Process Supporter, Facilitator</i>
6. Legitimation	Gatekeeping and brokering, regulation, assessment of technology and performance, accreditation and standards, arbitration, IP rights protection, interest alignment, social acceptance	Neutral standpoint and trusted environment as a national arena, creating social acceptance. Identifying common goals for different partners to avoid conflicts of interest, providing broad network, arbitration. Initiating dialogues across borders of Triple Helix actors.	<i>Facilitator, Bridger</i>
7. Creating positive externalities	Supporting the entry of new actors. Network establishment and maintenance, through all prior functions.	Ability to attract new potential partners to enter. Especially by providing a creative, neutral, and open meeting arena where free and open discussions can take place.	<i>Bridger</i>