



LUND UNIVERSITY  
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# Start-ups' Motives, Approaches, and Opportunities for Using Open Innovation

A study of why and how start-ups practice open innovation as a  
survival approach and long-term business strategy

by

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# Abstract

**Purpose** – The existing literature of open innovation (OI) has focused mainly on large companies and few on SMEs, leaving start-ups with scarce analysis of the use of OI. This paper aims to close that gap and contribute to a better understanding of what drives start-ups to open for innovation, how they use it and comprehend what challenges and benefits OI brings to start-ups.

**Design/methodology/approach** – This research uses a primarily qualitative methodology based on the analysis of 11 in-depth interviews with start-ups within WIN Water, a Swedish business network for the water sector. Also, an analysis of a self-completion questionnaire from 22 start-ups within the same network is used as an additional supportive data.

**Findings** - The research suggests that OI literature for large companies and SMEs might not be fully transferable to start-ups. The thesis introduces the OI model in start-ups. On the one hand, the liability of newness influences the entrepreneur's or manager's decision making process to open for innovation as a survival strategy and address long-term business goals. On the other hand, it shapes the OI process turning it into opportunistic, informal and fully opened one. The research suggests that start-ups tend to use mainly non-pecuniary and outbound OI and analyses and discusses the reasons of this phenomenon.

**Originality/value** – The study offers start-ups a deeper understanding of how to use OI in an effective way and guides the decision-making process to create OI strategies. It also helps OI networks to comprehend the fundamental role they play as intermediaries and meet the start-ups' needs when practicing OI.

**Keywords** – Open innovation, start-ups, liability of newness, innovation, open innovation network, intermediary, water sector.

**Paper type** - Research paper

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# 1. Introduction

"Most innovations fail...Companies that don't innovate, die" (Chesbrough, 2003, p.185).

Innovation has always been of an utmost importance in business. For decades closed innovation strategies have guided companies to do research and development (R&D) internally as a business strategy for innovation in order to create a competitive advantage (Chesbrough, 2003). However, recently this belief has been challenged by the Open Innovation (OI) approach and companies have been moving to an open model of innovation in response to a dynamic and increasing global market competition (Bigliardi & Galati, 2018).

OI has been highly discussed topic in the last decades by the researchers investigating it in different industries, contexts, and companies (Brunswick & Van de Vrande, 2014; Dahlander & Gann, 2010; West, Salter, Vanhaverbeke & Chesbrough, 2014). According Chesbrough (2006, p.1), OI is "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively". By opening up the innovation process in terms of using both external knowledge inside and an internal knowledge outside (Chesbrough, Vanhaverbeke & West, 2006) and collaboration with external partners, OI allows companies to share the risk and costs of exploring innovation, co-create with the market and access the knowledge and business ideas (Alberti & Pizzurno, 2017). Some studies have found that companies practicing OI gain significant benefits in terms of reducing costs and time to the market for new products or services (Kolk & Püümann, 2008) and increasing sales and revenues (Lazzarotti, Manzini & Pellegrini, 2010); others believe that OI must be further researched in order to understand the real cost-benefits of it (Cassiman & Valentini, 2015).

However, most of the research in OI has been done in large companies (Bigliardi & Galati, 2016; Brunswick & Chesbrough, 2018; Chesbrough, 2003) but small and medium-sized companies (SMEs), and mainly start-ups, have been excluded from the discussion. It is only recently that few studies have emerged on OI and SMEs (Usman, Roijackers, Vanhaverbeke & Frattini, 2018; Van de Vrande, de Jong, Vanhaverbeke & de Rochemont, 2009) and even in these studies, not sufficient attention has been paid specifically on start-ups' use of OI. Many scholars are repeatedly suggesting the need to explore the use of OI in SMEs in-depth (Usman et al. 2018; van de Vrande et al. 2009; Wynarczyk, Piperopoulos & McAdam, 2013), and in particular the use of OI in start-ups (Spithoven, Vanhaverbeke & Roijackers, 2013).



The lessons learned from large companies cannot be transferable to SMEs and specifically to start-ups (Usman et al. 2018). The unique context of start-ups differentiates them significantly from large companies. They face the market uncertainty, liability of newness and smallness, information asymmetries, scarcity of resources and lack of dynamic capabilities, which makes them different from large companies (Landström, 2017).

The reasons why start-ups are excluded from research in OI is that some aspects of it require significant resources (Van de Vrande et al. 2009) which start-ups do not have and thus are constrained in their innovation activities (Pittaway, Robertson, Munir, Denyer & Neely, 2004). However, Vanhaverbeke, Vermeersch and de Sutter (2012) stated that because small firms lack the necessary financial and technical resources to meet the rapid market demands they have to collaborate with others and using OI is the logical strategy to adopt. OI is a necessity for start-ups to overcome liability of newness (Bogers, 2011). More and more start-ups are pursuing OI in practice (Van de Vrande et al. 2009).

Van de Vrande et al. (2009) have excluded start-ups from their research on trends and motives for using OI in SMEs due to the above-discussed reason. However, the authors concluded, "these enterprises have been repeatedly identified as sources of breakthrough innovations and challenges of incumbent innovation actors (e.g. Schumpeter, 1934), this is an issue that future researchers should pick up" (p.435).

Even start-ups are already considered open to collaborations, some choose to stay closed in their innovations. This triggers the interest of start-ups' motives to use OI, which is also supported by Brunswicker and Van de Vrande (2014) who claim that there is a need to understand the motives of SMEs, i.e. start-ups, why they use OI practices.

Moreover, even though start-ups play a key role in innovation processes and they are relevant in OI context, it is unknown how start-ups adopt OI practices (Spender, Corvello, Grimaldi and Rippa, 2017).

To sum up, most research in OI is in a large company context and it is not applicable to start-ups due to its unique context and liability of newness.

To fill this gap, this paper aims to contribute to a better understanding of what drives start-ups to use OI approach and how they engage in OI and use it. To achieve this goal, our research question is why and how start-ups use OI. To the best of our knowledge, there has been no study developed that focuses on motives and strategies of using OI in start-ups.

Understanding this is important, as start-ups are an important engine of growth for the worldwide economy, creating new jobs, bringing innovative products and services to the market and developing new technologies (Michelino et al. 2017). However, many new ventures fail and collaborations and successful use of OI are important for them to overcome liabilities of newness and succeed (Kask & Linton, 2013).

To answer the research question, we make an exploratory and descriptive study. Specifically, we conduct a primarily qualitative study with additional quantitative data to support our findings. The context for the study is WIN Water network, which is a marketplace for innovation acceleration in the water sector. Eleven in-depth interviews have been carried out with the start-ups that are members of WIN Water Network and a survey was sent to all member start-ups. WIN Water context was chosen, as it is the arena of OI in Sweden and enables to have comparable cases. In addition, start-ups in WIN operate in the water sector, which is characterized by innovation activities. Also, water protection is one of the most challenging issues for the European Union and innovation is increasingly needed and happening in this direction (Gabrielsson, Politis, Persson & Kronholm, 2018). The study contributes to the OI literature by exploring OI in the start-up context. In addition, the findings are important for entrepreneurs to learn how and why OI can be used. Moreover, this thesis gives an insight to innovation intermediaries to understand the start-ups' needs and perspectives in terms of OI and based on that improve and shape their services for start-ups to better meet their demands for OI.

This thesis is divided into 6 main chapters. Chapter 2 reviews the existing literature in the fields of OI and start-ups' liability of newness. Chapter 3 discusses the research design and the data analysis method. Chapter 4 presents the findings from in-depth interviews and survey. Chapter 5 analyses and discusses the findings in relation to literature. Chapter 6 is presenting conclusions, limitations and future research avenues and contributions to theory and practice.

## 2. Theoretical Framework

### 2.1 Innovation: Closed Innovation and Open Innovation

In this part, we will present innovation, closed and open innovation and the practices and modes of OI.

#### 2.1.1 What is Innovation?

Innovation has always been important for businesses. The Austrian economist Joseph Schumpeter is one of the pioneers referring to innovation as the source of the imbalance in the marketplace, which has an important effect for the economy (Schumpeter, 1934).

One of the definitions of innovation is "introducing something new to the marketplace" (Kuratko, Morris & Covin, 2011, p.12).

According to OECD's (2011) definition of innovation in their Oslo Manual, product, process, marketing, and organizational types of innovation are distinguished. Product innovation is defined as "the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses" (OECD, 2011, p.140). Process innovation is "the implementation of a new or significantly improved production or delivery method" (OECD, 2011, p.140). Marketing innovation is "the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing" (OECD, 2011, p.140). Organizational innovation is "the implementation of a new organizational method in the firm's business practices, workplace organization or external relations" (OECD, 2011, p.140).

For the purpose of our study, we use this guideline to help us identify whether start-ups when engaging in OI have a specific goal in mind and how they pursue that goal.

#### 2.1.2 What is OI?

To understand what OI is, first it is important to know what closed innovation is. For decades the internal production of ideas and technologies and ownership and control over them has

been the firm's core competitive advantage for many years. This view is labeled as closed innovation (Chesbrough, 2003).

Chesbrough (2003) argues that due to increasing R&D costs and globalization and four main enabling factors: increased accessibility and mobility of skillful personnel, growth of the venture capital market, external options for ideas created within the company, and increased ability of external sources, companies changed their ways of innovating, which he called "open innovation".

The concept of OI is connected to the idea that knowledge for innovation cannot just be found inside a company itself but is rather found in many sources outside of a company as well. In his book, *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Chesbrough (2006, p.1) defined OI as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively". While the logic in the closed innovation is self-reliance, in OI, company finds ways to profit both from their and other ideas flowing in both directions, inside and outside.

### 2.1.3 The Process of OI

Three different processes are involved in OI depending on how the knowledge flows in the organization: inbound, outbound and coupled processes.

In the Inbound OI, the external knowledge flows from outside and is used inside (Usman & Wanhaverbeke, 2017). External knowledge can be ideas, actual innovations, technical knowledge, inventions, market knowledge or other knowledge, which is considered useful for the innovation (West & Bogers, 2014). Researchers argue that inbound process can make companies more innovative, as it gives the possibility to have external input (Enkel, Gassmann & Chesbrough, 2009).

Inbound OI process can be further divided into two different types depending on whether money is directly involved in the exchange of knowledge. The non-pecuniary inbound process is called sourcing, when companies get input from various actors, such as customers (Van de Vrande et al. 2009) or other external actors (Wynarczyk et al. 2013). The pecuniary form of inbound process is the acquisition, this is when companies scan the market for existing knowledge and buy intellectual property (IP), license-in or acquire existing know-how (Wynarczyk et al. 2013).

In Outbound OI it is opposite, the internal knowledge flows from inside to outside (Usman & Wanhaverbeke, 2017). The outbound process is less researched than the inbound process and is less applied in companies (Enkel, Gassmann & Chesbrough, 2009). This process can help a company to bring their ideas to the market faster by exploiting them to the outside, compared to developing these ideas completely in-house (Gassmann & Enkel, 2004). External resources can help companies to turn their ideas or inventions into commercial products or services (Dahlander & Gann, 2010).

Outbound OI process can also be divided into two types of forms based on involving money or direct effects. The non-pecuniary type is called revealing when companies expose their internal knowledge for free in the short term but with the aim to gain financial benefits in the long term. The pecuniary type is called the process of selling internal knowledge, e.g. through selling or out-licensing of IP (Wynarczyk et al. 2013), such as inventions and technologies. External recipients of this internal knowledge could be other companies in different market segments or industries, but also competitors (Dahlander & Gann, 2010).

Finally, there is the coupled process, which is a combination of the two aforementioned processes. Companies are accessing external knowledge from external stakeholders (inbound) at the same time as they bring their ideas to the market through these external stakeholders' resources (outbound) (Enkel, Gassmann & Chesbrough, 2009; Gassmann & Enkel, 2004).

It is important to mention that every company is different in its application of OI processes (Gassmann & Enkel, 2004).

#### 2.1.4 Practices and Modes of OI

There are many paths to how companies can apply the concept of OI (Chesbrough & Brunswicker, 2014).

There is a large amount of literature on different types of partners that companies collaborate for exchanging the knowledge. Companies collaborate with various actors such as direct customers (Brunswicker and Vanhaverbeke, 2015), indirect customers (Brunswicker and Vanhaverbeke, 2015), suppliers (Brunswicker and Vanhaverbeke, 2015) universities and research organizations (Brunswicker & Vanhaverbeke, 2015), experts on IP rights (Vega-Jurado, Gutiérrez-Gracia, Fernández-de-Lucio and Manjarrés-Henríquez, 2008), competitors and general public (Pfister, Jack & Darwin, 2017).

Lazzarotti and Manzini (2009) see openness on the continuum where it is carried out from higher to lower degree. To understand more specifically what modes of OI exist, they proposed a framework, which is based on two ways of using OI. One way is engaging with different types and number of external partners from customers to competitors, labeled as "partner variety". Another way is using OI in different phases of the innovation process, ideation, concept development, prototyping, manufacturing, and commercialization, labeled as "innovation funnel openness". By crossing these two variables, the framework offers 4 different modes of OI. First, closed innovator, where firms use low partner variety only for one specific innovation phase. Second is a specialized innovator, where different types and number of external partners are involved only in one phase of innovation. Third, integrated innovator, where few specific external partners are involved in all phases of OI. Lastly, open innovator, where a variety of partners are involved in all phases of OI.

Existing literature will guide us to formulate the questions for the research.

## 2.2 Specific Characteristics of Start-ups in regard to OI

To land this study in the focal point of our research this section presents the start-ups' core characteristics and factors that could affect the adoption of OI practices.

### 2.2.1 New Venture's Nature

There is a high mortality and failure rate for new ventures (Laitinen, 1992) and that phenomenon can be explained by the uncertain and risky context that start-ups face. For example, potential customers tend to struggle to trust in newcomers because they lack track record and business experience (Politis, 2005). Therefore, there is a lot of uncertainty regarding the potential market acceptance of a new product (Busenitz, 1997). In addition, the cash flow constraints reduce the firm's capacity to respond to external circumstances and lack of resources and marketing problems are highlighted as typical factors that affect the high failure rate of the new venture (Politis, 2005).

In new ventures, decision makers decide under a very uncertain condition, without information of historical trends, performance or market information. Therefore, it is argued that entrepreneurs tend to use more bias and heuristics to simplify the decision-making process and deal with multiple problems (Busenitz & Barney, 1997). Literature also explains how as a

response to the uncertain and complex environment, entrepreneurs become opportunistic by acting on an idea without having enough information (Busenitz & Barney, 1997).

Furthermore, start-ups depend on their network, since it helps to acquire influence, recognition in the marketplace and to overcome lack of resources and liabilities (Johannisson, 1988). Overall, it is suggested that business skills and well-developed networks and reputation reduce obstacles and uncertainties for new ventures (Politis, 2005).

### 2.2.2 The Liability of Newness of Start-ups

Start-ups face different challenges compared to large companies. Stinchcombe (1965) argues that new firms are characterized by a "liability of newness", which means that they face problems of accessing resources, coping with different environments and stakeholders, thus affecting their viability negatively. The author mentions that due to the liability of newness, new ventures fail at a higher rate in comparison to established businesses and dealing with it is crucial for start-ups' survival.

Stinchcombe (1965) distinguishes between the external and internal liability of newness that new organizations face. External liabilities exist when resources are scarce and difficult to acquire. Stinchcombe mentions that new organizations have minor chances of survival because they depend on relation with "strangers" (Stinchcombe, 1965, p. 150). These "strangers" are all types of external actors: suppliers, customers, governments, etc. According to the researcher, trust is very important to build strong ties with stakeholders. Acquiring trust takes time, which has negative age dependence on mortality rates. Furthermore, Stinchcombe argues that it is difficult for new ventures to acquire customers and stakeholders, as they do not have previous experience with them, opposite to established firms. This problem has been described sometimes as the legitimacy issue and information asymmetry that makes difficult for entrepreneurs to convince resource providers to start a business with them due to no track record (Nagy & Lohrke, 2010).

Even if the external resources are acquired, start-ups face internal liabilities as well, which refers to the situation that entrepreneurs do not know how to use and manage the resources. They are lacking the processes and routines, therefore, some might use the acquired resources more efficiently and some not (Sirmon, Hitt and Ireland, 2007; Zott, 2003). Another internal liability is that it is hard to attract new employees (Aldrich & Auster, 1986; Stinchcombe, 1965). In addition, when one manages to hire an employee, the roles are not very clear

internally and new employees have to learn completely new functions themselves, while in established business previous employees may teach them (Stinchcombe, 1965). Stinchcombe (1965) points out the importance of trust in terms of internal liabilities as well. According to the researcher, lack of trust is the source of conflicts between the team and inefficiencies from the very early stages of the firm life cycle. When trust is built internally, common action is enhanced, and organizational capabilities are improved.

The research shows that dealing with external liabilities is much more important than the internal ones (Delmar & Shane, 2004; Morse, Fowler & Lawrence, 2007; Stinchcombe, 1965). Thus, it is crucial to establish strong relationships with external stakeholders than to establish routines, process and clarify roles and functions internally (Ulvenblad, Berggren & Winborg, 2013).

## 2.3 OI in Large companies, SMEs, and Start-ups

In this part, we briefly overview how large companies and SMEs apply OI practices to understand the main difference and what would influence the use of OI.

### 2.3.1 OI and Large Companies

In 2003 Chesbrough explained the role of OI through the lens of large companies (Chesbrough, 2003) and some other researchers contribute to this literature (Chesbrough & Brunswicker, 2013; González-Benito, Muñoz-Gallego and García-Zamora, 2016).

Chesbrough and Brunswicker (2014) developed an interesting research with 125 large companies in both Europe and the US that gives us good insights about OI in large companies. The study reveals that large companies (78%) are increasingly using OI but the result is not yet as expected since the companies are learning how to use it. It also exposes that large companies are more likely to use inbound OI (35%) than outbound OI (8%). Besides, large companies used mainly customer co-creation, informal networking, and university grants as inbound practices and that crowdsourcing and OI Intermediary services were the least used practices.

Regarding outbound OI, the survey suggests that large companies are more likely to use joint ventures, selling market-ready products and standardization. It was shown that customers, universities, and suppliers were the main leading partners of large companies to develop OI. In respect to the motives, this research suggests that large companies establish an OI strategy to



enter into partnerships, explore trends in technology and identifying business opportunities. In relation to the challenges, the research reveals that the change from closed to open innovation is the most difficult barrier for OI in large companies (Chesbrough & Brunswicker, 2014).

### 2.3.2 OI and SMEs

One of the main difficulties that SMEs face is the "liability of smallness". Some authors believe that this challenge can be solved through OI, however, they point out that its implementation should be effective to get successful outcomes (Van de Vrande et al. 2009). On the one hand, some studies explain how the short-term vision of SMEs is a challenge to implement an OI strategy since it requires long-term partnerships based on trust (Vanhaverbeke, 2017), also generally SMEs do not have an innovation process established since they are rather focused on their core business, thus focusing on exploring and exploiting new technologies is difficult for them (Qin, Van Der Velde, Chatzakis, McStea and Smith, 2016). Other authors explain the positive side, by underlining that innovation practices will be easier to apply in SMEs than large firms because of their flexibility and lack of rigid organization (González-Benito, Muñoz-Gallego and García-Zamora, 2016).

Among the few existing research about SMEs and OI, Van de Vrande and others, made an interesting research on trends, motives, and challenges in 605 SMEs in the Netherlands (Van de Vrande et al. 2009), the results show that customer involvement, external networking, and employee involvement were the most used OI practices among SMEs, and that buying and selling IP licensing together with venturing and external participation in other enterprises did not play an important role for these companies. In relation to the motives, the data suggest that the main motives for SMEs to adopt OI practices are: first, market-related reasons that mean maintaining current market and customers but also growing; second, gaining knowledge by bringing expertise from outside; and, finally, following an innovation process through improving product development, market innovation and integration of new technologies. It has also been found that the majority of SMEs prefer to practice inbound OI and only little outbound OI is used by SMEs (Van de Vrande et al. 2009).

In relation to the type of OI, Theyel (2013) explains that SMEs have preference to open for collaboration with external partners during the commercialization stage of new product or service development, while Henttonen and Lehtimäki (2017) elucidate that the extent and

outcomes of that collaboration in the commercialization stage will depend on the SMEs' capabilities and OI strategy implemented.

### 2.3.3 OI and Start-ups

OI is a concept that has been specifically researched responding to unique circumstances of a firm and its environment. Some researchers have focused on the analysis of OI in large companies (Chesbrough & Brunswicker, 2013), others have developed some specific studies of this phenomenon in SMEs (Bianchi, Campodall, Frattini & Vercesi, 2010; Van de Vrande et al. 2009; Spithoven et al. 2012) and few investigations have been done in start-ups in this regard (Rousseau, Manning & Denyer, 2008).

Spender et al. (2017, p.4) define their research as "a first step in building a map of the state-of-the-art knowledge of the start-ups in an OI context phenomenon". The existing literature on start-ups and OI highlight the role of OI network as a successful tool in the innovation process since actors in networks define the requirements for new technologies and products which is fundamental for a newcomer in the market (La Rocca & Snehota, 2014).

As an important contribution from the literature, it is suggested that to cope with the liability of newness start-ups have the incentive to collaborate with other firms (Lee et al. 2010) and therefore, the new venture and OI are closely related (Spender et al. 2017).

OI practices not only contribute to start-ups to overcome liabilities, in fact, it is suggested that relations with the external environment could determine the success or failure of start-ups (Kask and Linton, 2013). Existing research also encourage the use of OI explaining that the liability of smallness could become a liability of opportunities since the start-ups' flexibility and adaptability allows them to benefit from OI practices (Parida, Westerberg and Frishammar, 2012).

Even though, some authors believe that OI can benefit SME i.e. start-up (Brunswicker & Van de Vrande, 2014), others have highlighted the cost of an open approach rather than the benefits (Freedman, 2011). This triggers the interest and there is a call to further research on why and how start-ups use OI (Brunswicker & Van de Vrande, 2014).

## 2.4 Research Question

As discussed, the start-up environment is different and new ventures face liabilities of newness and uncertainty which make them fundamentally different from large and even SMEs, which are already established and have previous entrepreneurial and market experience. Therefore, we argue that the use of OI in start-ups might be different, as motives, practices, strategies, benefits and challenges of OI are different in start-ups in comparison to large companies and SMEs due to its very specific context. As there is the gap in the literature in this regard and researchers call for more investigation in the field of OI and start-ups (Spithoven, Vanhaverbeke & Roijackers, 2013; Van de Vrande et al. 2009; Bianchi et al. 2010), we aim to fill this gap and aim to understand the start-ups' motivations to use OI and how this phenomenon looks like in start-ups' context.

Therefore, the research question is: why and how start-ups use Open Innovation.

## 3. Research Methodology

### 3.1 Research Philosophy

The phenomenon of our interest is OI in start-ups, their motives to open for innovation and how they use this tool. Therefore, this analysis needs an exploratory approach to understand OI phenomenon in start-ups. The reality around the phenomenon of our interest (ontology) is socially constructed by entrepreneurs themselves and gathering knowledge around it (epistemology) can be accomplished through learning why and how start-up owners and the management team act the way they do. Therefore, we approach the phenomenon from the interpretivist paradigm. At the same time, in line with the theory building and knowledge development argumentation of Gioia and Pitre (1990), we maintain that a single paradigm cannot explain the phenomenon, as the world is multifaceted. Therefore, we do not focus just on the interpretivist lenses but approach our study with a metaparadigm perspective and look from the functionalism lenses, as well. This philosophy led us to our research design, which is primarily qualitative with additional quantitative data gathered for supporting the findings.

### 3.2 Research Design

As there is not enough literature to understand what the motives for start-ups are to use OI and how and when they use OI practices, we employed an exploratory research design, as getting new insights and deeper understandings of the issue are the primary goals (Bryman & Bell, 2015).

The nature of the study is primarily qualitative with some additional quantitative data gathered to support the findings. The in-depth interview was chosen as a form of research method and was conducted with the founders or the management teams of the start-ups. The approach could be classified as a concurrent embedded strategy where qualitative research is a primary method, but the quantitative study is also conducted to provide the supporting role (Creswell, 2009). The study follows Morse (1991) who argues that primary qualitative research may embed some quantitative findings in order to shed light on some of the aspects of the sample members. The qualitative approach has been selected as a major method of research since there is not much scientific literature available on the use of OI in start-ups and conducting the qualitative study is more appropriate in the circumstances of nascent theory (Eisenhardt, 1989). As mentioned above, the quantitative study was conducted to support the qualitative findings and ensure a triangulation at a certain level (Creswell, 2009).

### 3.3 Sampling

To select the cases, we take a context, an arena where start-ups are engaged in OI activities. In our case, the WIN Water Network is such an arena. WIN is a Swedish OI marketplace and a business network within the water sector that matches public sector, businesses, and academia with innovative start-ups and entrepreneurs to speed up the exchange process of innovation and foster collaboration. WIN unites 40 innovative companies (start-ups, SMEs, University spin-offs, spin-outs, entrepreneurs, and inventors) that provide potential innovative solutions to the water market and 29 partners (large corporations, academia, and public sector). For the purpose of our study, our sampling frame is 40 start-up companies in WIN. See Appendix C for information on WIN.

Theory building through cases is related to different opportunities and challenges. Eisenhardt and Graebner (2007) advise to use multiple cases for theory building purposes, theories based on single cases are more complicated, as far as they ‘reflect’ all the specificities of a single case. In contrast, multiple cases allow for finding certain common areas among different objects of observation and hence, the theory gains more generalizability. Therefore, we aim to take several cases for our study, namely 11 start-ups. Hence, by cases, we mean objects of observation.

As we want to get detailed and rich data, we need start-ups that are using OI at a high or a moderate level. The researchers argue that ‘extreme exemplars’ (Eisenhardt and Graebner, 2007, p.27) have to be selected to allow the access to unusual and rich data. However, in our case, not only extreme exemplars but typical cases are of high importance and they can give valuable information, as well. WIN gave us the list of around 40 companies indicating for each how actively they were involved in WIN Water network on a scale from 1 to 5, where 5 referred to very involved and 1 - to less involved in WIN Water activities. As WIN is the arena for OI, start-ups with a label of 5 can be considered to be more using OI in their practice. In addition, start-ups with the labels of 4 and 3 can be considered as the typical cases for the purpose of our study. Therefore, we choose 25 start-ups with the level of engagement of 5, 4 and 3 in WIN. We contacted them through e-mail initially and later by phone and the first 11 companies that were available for the interviews meeting these criteria were selected. Table 1 shows the selected start-ups for interview.

*Table 1. Overview of selected start-ups for in-depth interviews*

Company #	Respondent(s)	Founded	Briefly about company and its innovation (Adapted from www.winwater.se)	Activity level in WIN (1-5)	Interview duration (hours)
1	Managing Director	2015	Dedicated to developing innovative solutions to cleaning storm water, their technology, the disposable floating storm water filter, is simply dropped in to the storm water drain and it extracts hydrocarbons, chemicals and heavy metals from the water.	5	0:56
2	Managing Director	2014	The innovative solution for preventing bacteria and biofilm inside pipe systems by using electrification of the plastic piping system. Their eco-friendly treatments characterized by lower maintenance costs, offer the possibility of a cleaner and healthier fluid.	5	1:08
3	COO	2013	Innovates, develops, manufactures and sells products for water purification. Offers safe, efficient and intelligent water disinfection from all living bacteria by using UV-LEDs technology with nanotechnology and software control.	5	1:06
4	CEO	2008	Founded based on the research at the University. They have developed the process that selectively can extract nutrients from sludge, digestate and refine them resulting in a high quality fertilizer without any unwanted elements.	5	1:30
5	Head of R&D, CTO, and CEO	2013	Clean washing without detergents and chemicals using ultraclean water and innovative filter technology. With their product, normal detergent chemicals are made redundant and energy used within laundry and dishwashing processes is reduced.	5	0:50
6	Chief Research Officer	2015	Market-tailored solutions for onsite efficient treatment of wastewater, regeneration of usable water and restoration of heavily polluted surface waters and despoiled land. Proven biotechnological inventions with strong scientific background.	4	1:20
7	CEO	2006	They have developed a green technology, which disinfects water using inline electrolysis, without the need of adding chemicals. They have several product lines using their technology in different applications.	4	1:16
8	CEO	2014	The company creates and provides innovative IT solutions and linked services within the water and wastewater industry. Their offers combine business expertise with innovative design, which enables customers to visualize complex data in a simple way.	3	0:44
9	CEO, Chairman of the Board	2012	The cleantech company that offers a new disruptive bio economy technology, which uses only natural physical and chemical forces and involves one step only – four to five different reactions in one reactor for separating particles, oils and ions from liquids/water.	3	1:02
10	Chairman of the Board	2011	Based on Ph.D research at the University, the company developed the unique additive, made from natural and rich components, that captures nutrients in urine from both WC and waterless toilets. The fertilizer can be dried locally and used in agriculture.	3	2:03
11	CEO	2015	Knowledge, products and equipment is what company offers for time and cost efficient, effective and environmentally sustainable treatment of large volumes of water. Their water treatment technology is based on fully biodegradable treatment substances.	3	0:44

The self-completion questionnaire was sent to all 40 start-ups in WIN network and 22 responded. All of them are start-ups in the water sector, the majority is domiciled in Sweden and they have a product as a major activity. See Appendix D for details.

The questionnaire was sent by e-mail and we addressed start-ups within WIN Water Network to identify common OI practices. The data was collected during a 6-week period from March 15, 2018, to April 19, 2018.

## 3.4 Research Instrument

To answer the research questions, we used the in-depth interview and self-completion survey.

### 3.4.1 In-depth Interview

To answer our research questions, why and how start-ups use OI, our interview guide (see Appendix A) was based on oral history method (Bryman and Bell, 2015), namely, following the story of a start-up company creation and development by focusing on the collaborations and partnerships throughout this time.

We decided to follow the company's story, as during our pilot study we realized that by directly asking start-ups which OI practices they were engaged in and why, they would find it difficult to answer or miss some important aspects, as they would not consider those aspects OI, even if they were.

Therefore, our interview guide followed the company's story starting from how it was born and where they are now. To guide ourselves we had three general stages - born, development, commercialization - that we tried to make sure interviewee would refer to. After a brief introduction, an interviewee was asked to start by telling how the company was born and stress specifically on collaborations and partnerships that led to innovations throughout their existence. We had a brief list of themes and points to remind ourselves areas to cover in order to understand thoroughly what the reasoning was behind when start-ups engaged in specific collaborations, with whom they collaborated, what strategies they had in mind and what processes they followed. In addition, we talked about their perception of how each of the collaborations benefited them or what challenges they faced. Moreover, we talked about their motives of joining WIN and evaluated the role of WIN for their start-up and what could be

done further. We purposely did not use the concept “open innovation” in the interviews, rather focused on collaborations they had and we would conclude ourselves whether it was OI or not, based on the literature and our definition. Our interview guide gave the possibility to discuss and ask questions based on what the interviewees would say and make sure to get new, in-depth and rich insights from them. We tried to avoid leading questions but rather used a lot of probing, specifying questions and kept silence to provoke getting further details (Bryman & Bell, 2015).

Because many start-ups were located outside of Lund, in different parts of Sweden and taking the time limit into consideration, we conducted most of the interviews by Skype. Each interview lasted from about 45 minutes to about 1.5 hours. Totally we collected data for 12 hours and 39 minutes. Before the interview, we informed the interviewee that the answers would be used for writing a master thesis that would be published on the web-page of Lund University. Therefore, if they wanted to keep some parts confidential or anonymous, they had to let us know during the interview. In addition, we asked for their permission to record the interviews. Every interview was recorded and transcribed afterwards. In the end, we kept the company’s name anonymous when presenting the cases and quotes to respect their privacy.

### 3.4.2 Self-completion Questionnaire

First, the questionnaire started with the screening questions to identify any factor that could influence the data analysis, ensuring the use of comparable variables. Second, the structure of the questions was adapted from the previous literature and research on OI practices in large companies and SMEs (Dahlander and Gann, 2010; Theyel, 2013), literature on start-ups (Chesbrough and Weiblen, 2015) and OI motives and trends in SMEs (Van de Vrande et al. 2009) and in large companies (Chesbrough and Crowther, 2006).

We included questions to identify if the companies use a specific process for OI and to scan any preference in search for external knowledge and tendency to collaborate with a specific partner.



## 3.5 Data Analysis

### **Qualitative Data Analysis**

We analyzed the interviews based on the systematic inductive approach to concept development (Gioia, Corley & Hamilton, 2013). First, we made the transcripts for 11 interviews. Initially, data was transcribed in the MS Word document. The data was then moved to MS Excel where it was organized in the chunks of texts. After that, the two authors separately made coding for the identification of the 1<sup>st</sup> order concepts (informant-centric terms). We have generated several codes, after which we tried to reduce them based on more frequently mentioned topics. Afterward, we separately developed the 2<sup>nd</sup> order themes (theory-centric terms). Finally, we compared our coding to each other's coding. Having some discussions and debates, we agreed on the final 2<sup>nd</sup> order concepts and the aggregated themes that were prevalent in all interviews, which finally represent our key findings. See Appendix B for an example.

The coding followed an inductive method where the themes would depend on the participants' responses. Nevertheless, in certain cases, the themes would come from the scientific literature. Thus was a constant comparison between the data, literature, and coding. The analysis was a continual process involving reflection of the data, questions, and findings (Creswell, 2009).

### **Quantitative Data Analysis**

The quantitative survey data was analyzed through the basic descriptive analysis in Excel in order to find out the key characteristics of the sample.

## 3.6 Reliability, Validity and Limitations

### **Reliability and Validity**

It was important to achieve the qualitative reliability and validity of the research to ensure the consistency of the approach and accuracy of the findings (Creswell, 2009). It has to be noted that such concepts as credibility, transferability, dependability, and conformability are often discussed as key criteria in qualitative research (Lincoln and Guba, 1985).

For increasing the qualitative reliability of the research, the procedures suggested by Gibbs (2007) were followed. Transcripts were checked to avoid mistakes made during the

transcription process. Through the cross-checking of codes between the 2 authors, intercoder reliability was achieved through consistency of coding in at least 80% of the time that can be considered a sign of a good qualitative reliability (Miles and Huberman, 1994).

For ensuring the qualitative validity of research, following Creswell (2009), the findings were triangulated, thus the consistency of qualitative and quantitative data sources were checked. Besides, the contradictory findings have been also presented, that makes the evidence more realistic.

When it comes to the descriptive quantitative part of the research, the face validity of the survey items was evaluated by the representatives of the WIN Water Network before sending out the questionnaire, to check the relevance and understandability of questions (Bryman and Bell, 2015).

### **Limitations**

As the main strategy was qualitative, this may limit the generalizability of findings. However, it is noteworthy that this can be the limitation of the research philosophy itself and not the research design, as the qualitative approach is characterized more by particularity rather than generalizability (Greene and Caracelli, 1997). Finally, as the two methods used in the research study are unequal in their priority, this aspect may be reflected in unbalanced evidence at the stage of interpretation of findings (Creswell, 2009).

## 4. Findings / Empirical Results

### 4.1 In-depth Interview

The following part presents the findings from the qualitative interviews. It is organized in 3 main parts – why, how and the challenges of OI and around the themes and 2<sup>nd</sup> order concepts.

#### 4.1.1 Why? – The Start-up’s Motives to Engage with OI

The interviews revealed that start-ups mainly had two types of motives to use OI. The first one is linked to start-ups’ liability of newness; we named them as “survival motives”. The second type of motive is related to the business activity of innovation and commercialization, which we named “business motives”. Additionally, entrepreneur’s attitude towards openness was an important factor for using OI.

##### **Survival Motives**

Start-ups biggest challenge is to survive in an uncertain environment and that becomes the main driver for them to open up. Using OI is perceived by them as a means to gain complementary resources that are crucial for them.

*Company #1: the benefits from collaboration are existential. I mean no company is an island; [they] need to have a lot of supporting, supplying and purchasing entities around you. Otherwise, it's sort of pointless.*

##### *Gain resources*

One of the liabilities of newness for start-ups is the lack of resources to develop their business ideas and technologies. Wanting to cope with this, start-ups are motivated to engage in OI as a way to compensate their challenge.

*Company #2: There is a water processing plant outside of Lund... They have provided us with space and they allowed us to connect the municipal water and make the measurement (for our technology). We are not paying for them; they allowed us space because they were also interested to see the results.*

As the extract from the interview shows, one of the reasons start-ups use OI is that it gives the possibility to access the free resources, such as the space to make testing. Likewise, start-ups save costs, which is very important for them.

#### *Gain knowledge*

We have found out that start-ups engage in OI because they realize they do not and cannot know everything. To develop the business further they need to find partners who can give them the complementary knowledge and save time.

*Company #6: For some dots, I am still not convinced about or I do not know them enough. So, I am cooperating with people who may help me. It's like... almost like outsourcing. Because I know that they are good, strong in that, instead of me going a long way, I say, can you help me with this?*

#### *Gain the legitimacy*

Another very important motive, mentioned in all interviews was gaining the legitimacy. The interviews revealed that they needed to engage in OI collaborations to gain the credibility, prove their technology, product or service on the market.

*Company #4: Why? Credibility, approval. If you're a small company, and you have a new technology, very few people would like to risk the investments. So, you're always trying to get partners who can justify our technologies.*

In sum, start-ups motives to engage in OI are closely related to their liabilities of newness. The liabilities shape their motives; they perceive OI as a way to cope with them that drives them to engage in OI in order to survive.

### **Business Motives - Commercialization**

The interviewees showed that commercialization was the final goal for start-ups to why they engage in OI.

#### *Access to market*

Most of the start-ups had technologies, products, but the biggest challenge for them was where and how to sell. They used OI to get the first customer and access the market.

Company #2: *The collaborations have two purposes... finding out how the market works and what the different parties on the market are, because this is something we want to sell.*

Some start-ups mentioned that they used OI because it is useful for internationalization and where the company has no knowledge, history, and partners.

Company #10: *If we want to expand to developing countries, we need both established market partners... and also access to people in the local network.*

#### *Accelerate to market*

In addition, start-ups' motive to use OI collaborations is to accelerate and go faster to the market with the help of strong partners.

Company #4: *We have collaboration with Water Treatment Company who is very well aware and well known in the world. Of course, our collaboration helped us move in quicker in the market.*

#### **Business Motives - Innovation**

One of the main drivers to use OI was the product innovation need, which means to constantly innovate and develop their products, technologies or services.

Company #5: *To constantly improve the product and that is everything from industrial design, the changing or making the steel cabinets.*

#### *Product development*

It was mentioned quite often that OI collaborations helped start-ups to work together with different partners, improve their technologies, and become more competitive.

Company #1: *So that was the main driver of the collaboration, to improve the product...because our idea is an actual filter, the absorbent is not our invention. So we said, let's try it.*

#### *Product improvement*

Improving technology and innovation is crucial; otherwise, start-up will lose competitive advantage and customers.

*Company #4: Our technology is only prime if we continue to develop. If we don't, then people will run by us.*

#### *Customer satisfaction*

The most prevalent way of product innovation and use of OI emerging from interviews were working closely with customers for product improvement and reaching their satisfaction.

*Company #11: We focus on one typical client and what the client needs... their outcome is to develop their services and our outcome is to find more opportunities for our products.*

#### *Find new applications*

Another important incentive for start-ups is to find new applications for their products or technologies through OI.

*Company #7: In WIN, we are now working together with 2 innovation companies (start-ups)... We are trying to make new business and new applications with them for the same technology.*

### **Entrepreneur's Attitude towards Openness**

Another factor that defines if a new venture bets for OI is the entrepreneur's openness:

*Company #7: we are not afraid to share our knowledge, because if you don't share knowledge things go to slow.*

#### **4.1.2 How? - OI Process and Stages**

We found four main characteristics of OI practices for new ventures: opportunistic approach, full openness, trust-based OI collaborations, and informality. The results also suggest a fundamental role that OI intermediary plays during this process.

#### **Opportunistic Approach**

The interviews allowed us to discover a clear opportunistic approach when start-ups use an OI approach. They aim to open doors, understand the market and leverage the resources

sometimes without a clear understanding of the possible benefits or costs at the beginning but aiming to gain economic benefits or innovation development in the end.

*Company #7: We don't have any idea, so is very opportunistic when you go into things like that. We don't even know if they will sell our system or if they even will make it. We join them because we can help them, we can develop our system but is not because is from the start a business case for us, it is an innovation case!*

### Full Openness

We have found that OI is used in all new ventures' stages from ideation to market expansion. See Table 2 for further details.

Table 2. OI - Start-up Stages

<b>When? OI in startup's all stages</b>		
<b>Stage</b>	<b>Description</b>	<b>Quote</b>
<i>Business idea Discovery</i>	When startups open to collaborate with external environment, they might end up discovering a business opportunity. Working to satisfy customer needs can help to discover a business opportunity.	<i>Company #8: The customer had a need and I developed in a very close cooperation with the customer. The next step was to make it so general that it was possible to sell to customer number 2.</i>
<i>Validate and testing</i>	An open approach also allows startup to bootstrap their resources and reduce the prototyping cost.	<i>Company #5: The collaboration was that we were allowed to put in our system and develop it inside and they did not pay for any filter changes and they were free to use it 24/7.</i>
<i>Product Development</i>	The feedback from the pilot test can push startups to innovate by creating new products or applications or by improving the existing products.	<i>Company #6: The feedback from our customers... they may say, well, why this looks like as it looks, can we do it in other way? So, we get free feedback... So when the customer comes and I feel that this niche of market is important for us and we can develop that direction, so I try to invent things.</i>
<i>Commercialization</i>	Collaboration with external partners not only pushes innovation but also helps in the commercialization phase. For example, take the case of this startup the product of which forms a part of a bigger system and is now sold by the huge sales force of a large company.	<i>Company #3: We sell our product as part of the one unit product of this large corporation. It is very important for us because instead of 5 of our company's persons trying to contact customers, the large company have 800 salespeople that is a very different way to getting the products out.</i>

The results show that new ventures tend to interact with diverse partners, and exchange knowledge with diverse sources. See Table 3 for further details.

Table 3. OI - Diverse Partners

<b>With whom? OI Actors for startups</b>		
<b>Actor</b>	<b>Description</b>	<b>Quote</b>
<i>Public sector</i>	Most important and frequently mentioned partner type was public sector, as they were often the main customer for the startups. With them it was appealing to collaborate, as they had a strong interest to solve the problem. As seen from the extract of interview, public sector often gives startups free access for pilot testing and thus, getting market feedback and technology improvement. If the pilot is successful, public sector often becomes a paid customer.	<i>Company #11: We made a prototype and talked with Trafikverket and with some major players in construction market, they are all public entities. One of the constructions in Göteborg was working with water treatment, so we started with a pilot and then they paid for it.</i>
<i>Academia</i>	Interviewed startups have close collaborations with universities mainly for providing needed expertise that they are lacking to develop and improve their product and do testing.	<i>Company #5: We will start a collaboration with a university to develop an intelligence for our system.</i>
<i>Startup</i>	Startups often collaborate with other startups. Parties have the same negotiation power, each has its core knowledge and technology and by sharing the knowledge, costs and efforts, they join forces to develop a totally new product or improve existing ones.	<i>Company #1: So, we had developed a sort of informal collaborations so far. They have shown our filter as an example of an application of their technology and now they would like to sell our filter, and we have used their innovative absorbent making a couple of prototype filters.</i>
<i>Large company</i>	Another very important partner type that was stressed in interviews related to large companies. Large companies have resources to pay startups to develop and prove their technologies by solving their problems and improving their products or services. Large companies' role is huge for startups; they not only help them develop products, but also give credibility and publicity, which is crucial for them.	<i>Company #6: Through WIN we also opened cooperation with a large furniture company... They started working with us with a vision to refurbish all the warehouses in the world with our system.</i>

### **Trust-based Collaborations**

Interviews show the strong role that trust plays in OI practices. Companies open their technologies protected generally only by a non-disclosure agreement (NDA). From the closed approach that could be dangerous, however, it is possible if collaborations are built on trust. Respondents also emphasized that trust takes time to build and is founded on strong personal relations.



Company #6: *Because it's like a family feeling... and this also needs some time in order to feel at home... This takes time. You have to create this trust.*

### **Informality**

Start-ups are characterized by internal liabilities, meaning that they lack processes and structure. Interviewees showed that when using OI start-ups had an informal internal approach without specific processes for it. Also, as they are only a few people working in start-ups, usually there is no specific person dealing with OI. Mostly it is the CEO or the founder who deals with it.

Company #2: *Mostly it's me (CEO) and the founder... so it's a little bit who is the most suitable at that moment, that decides who does that.*

We found that start-ups' OI collaborations are mostly based on personal communication, informal meetings.

Company #1: *So I tapped her on the shoulder and said, tell me more, then she came to our exhibit and I said, OK, this is interesting. And we took it from there.*

### **OI Intermediary - The Trust Builder**

We have also found 4 main factors that turn the OI intermediary into a tool that helps start-ups while developing OI practices.

#### *Credibility enabler*

Due to the liability of newness, start-ups face lack of legitimacy on the market. According to the interviews, start-ups use OI networks as a passport of reference to reach legitimacy faster.

Company #9: *“WIN has been helpful to be the bridge for us because we need to have some sort of legitimation, a passport, someone that said those guys have something”.*

#### *The trampoline effect*

Even though, trust takes time to build, as explained before, being part of these types of networks has a trampoline effect for start-ups, building trust and empowering them with credibility. That normally takes years to build:

Company #8: *Being part of the conferences help us to build trust. When I make a classical selling on the telephone I often say that we are WIN Water company.*

#### *Accelerate to the market*

OI networks help start-ups to reduce the time to build legitimacy and reach the market that without them would have taken years to build.

Company #9: *We needed to reach out to have a trampoline, someone that said we are OK and to be the contact with the market out there that we couldn't reach ourselves.*

#### *Door opener - right matching*

As perceived by start-ups, OI networks also work as door opening platforms that help start-ups to get more visibility in a competitive market, to find more adequate partners, find customers, accelerate to the market and sometimes get low-cost advice.

Company #2: *WIN is a network of a lot of competent people and it's good to know who those people are, and we can contact them if there is something you think they can contribute with.*

### 4.1.3 OI Challenges

#### **Opportunity Cost**

##### *Right partner: time to build trust*

Regardless of the full openness approach that start-ups use to cope with the liability of newness, start-ups cannot manage so many sources of information at the same time, due to their lack of experience to interact with their environment, lack of organizational structure and dynamic capabilities.

Company #2: *But it's not really about finding as many doors as possible, it's about finding a few ones that are good because we cannot handle more.*

##### *Selective attention*

Interviews also revealed that at some point start-ups slow down the innovation process and focus on commercialization. However, we have also found that even in a commercialization

phase they work a lot with academia in research projects. Overall, the study reveals that OI practices help in both commercialization and innovation but for start-ups, it is more important and is mainly used for commercial goals.

*Company #3: Now we are really focused on the big clients that will generate the volumes. We will now focus on selling, but we are engineers, we like development but we need to sell.*

### **Cost-Benefit**

Start-ups do not have a clear understanding of the cost of time and resources they will invest with a specific collaboration nor the potential outcomes it might have. Take for example this start-up that is willing to create free prototypes and open their technology aiming for long-term benefits but with no clear goal at the beginning.

*Company #7: So with two companies we are supplying the technology for free. They came to us and say, we have this problem; can you help us to solve it? Maybe, we will build you some small prototypes and we will see!*

### **Cost and Time of Knowledge Protection**

The survey helped us to understand that among the several liabilities start-ups face the one that has the highest impact on their decision to bet for open approach is the high cost of IP annual fees and the cost and resources it will take to defend their IP rights in court. These challenges push them to sell their IP rights or find partners who have the resources to develop a product with their technology and have the business knowledge to put it on the market.

*Company #9: To be able to have our patent and to be able to afford our yearly fee for the patent we have to work double jobs.*

### **Need to Prove the Technology**

Another main challenge is the lack of legitimacy that start-ups have in the market. They need to prove their technology and get their first important customer to be able to survive.

*Company #8: we were so small that is a problem because big organizations don't want to buy from so small company, it's a risk, you can lose time and money,*

Figure 1 summarizes and shows the data structure of the findings from the in-depth interview.

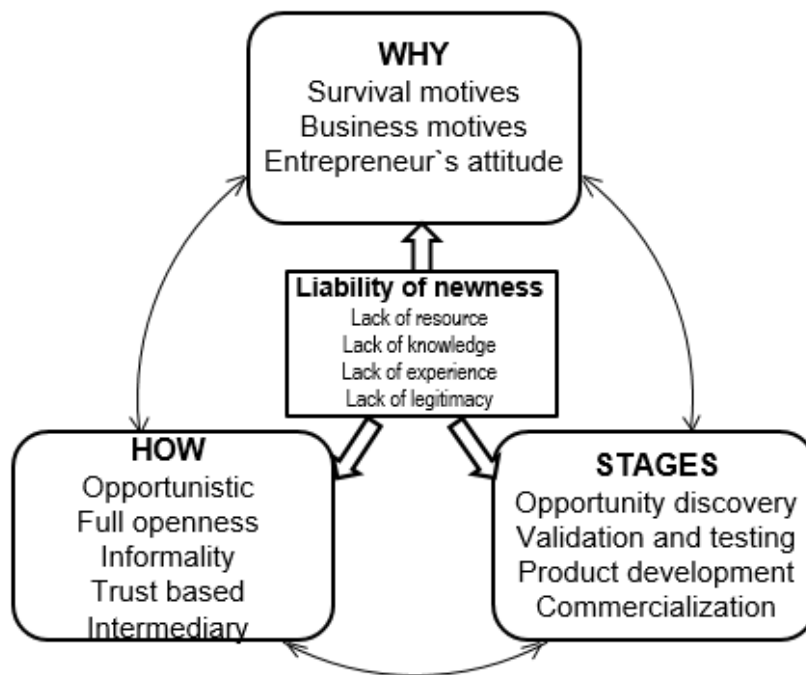


Figure 1. OI in Start-ups: data structure from an in-depth interview

## 4.2 Self-completion questionnaire

As a supportive data, we present the findings from the self-completion questionnaire. The 22 respondents are all start-ups within WIN Water, and the majority has a domicile in Sweden and they have a product as a major activity. The findings are presented in Appendix E.

### 4.2.1 Why? The Start-up's Goals to Open for Innovation

We identified that “finding partners” is the main goal for start-ups to practice an open approach, the second is “commercialization”, followed by “discovering new ideas”, “marketing” and “funding”. The least pursued goals for start-ups are “starting a new organization” and “leveraging employees’ knowledge”. These relate to the findings from the interviews where, on the one hand, the main survival motives for start-ups were: to find the first important partner, to gain legitimacy, to prove that their technology works and to overcome resource scarcity; on the other hand, commercialization and innovation were the main business motivations.

## 4.2.2 How? - The OI practices in Start-ups

### *Outbound OI for start-ups*

The questionnaire revealed that start-ups tend to use predominantly outbound OI (50%) than inbound OI (14%) and many start-ups (27%) practice coupled process with a combination of inbound and outbound OI practices.

Within outbound OI, the prevailing form is revealing internal knowledge to the external environment (55%) followed by selling out licensing (32%) while within inbound OI the predominant activity is sourcing external knowledge from various actors (41%), followed by acquiring inventions to use them internally (14 %).

### *Non - Pecuniary OI for start-ups*

Half of the companies practice non-pecuniary OI, 18% use pecuniary OI and 23% use both. According to the qualitative research, this is caused by the lack of legitimacy of newcomers that need to prove their technology before getting credibility and being able to sell. Therefore, the alternative they have is to show the knowledge for free and prove that is valuable.

### *Main OI partners*

In relation to the partnership, we could observe that more than half of the start-ups collaborate with diverse partners, 27% of the start-ups focus their collaboration with the value chain. During the interview, we also found that new ventures tend to have a full openness OI approach exchanging knowledge with diverse partners.

### *The decision maker*

People who filled the questionnaire were the decision makers in the start-up, such as the CEO, the founder, the head of the board and they also responded that they are the ones in charge of defining OI approach and practices.

### *The intermediary*

Most of the start-ups are engaged in OI in different ways. More than half of them are involved in partnerships due to WIN and 76% have also partnerships outside the WIN context. This relates to the 59% of respondents that participate in other arenas to engage in the OI process, most of those arenas are similar to WIN, showing the perceived importance of the intermediary for start-ups in the OI arena.

### *Procedure*

Regarding pecuniary OI, the data showed that 55% of the companies have no procedure to sell their license. Regarding acquiring a license, more than 80% of the companies reveal they don't have a specific procedure.

About non-pecuniary OI, nearly 70% of the start-ups believe that they don't have a specific process. The qualitative research also showed the same pattern.

In relation to collaboration with external actors, nearly 60% of the companies responded positively to having a specific procedure. The qualitative research suggests that the intermediary plays an important role in this respect.

## 5. Analysis and Discussion

In this chapter, we focus on two main topics. First, we analyze and discuss why and how start-ups practice OI. Second, with our findings, we compare the OI approach used by start-ups, SMEs, and large companies.

### 5.1 A Panoramic View of OI and Start-ups

Our research supports the argument of the researchers that the start-ups' liabilities of newness and smallness impact on the entrepreneurs' motivation to open for innovation and shape the whole OI process which becomes fully opened, meaning that they collaborate with several partners and receive knowledge from several sources. The OI process seems also informal, as new ventures do not follow any specific procedures to practice OI. It is also opportunistic since start-ups use OI practices, on the one hand, to cope with liabilities of newness and smallness or what we call "survival motives" and on the other hand, to reach "business motives" of commercialization and innovation. However, in the short-term, the OI process is generally characterized by full uncertainty regarding potential costs or benefits of a specific collaboration. We have also found that due to those liabilities that start-ups cope with, they tend to use predominantly non-pecuniary OI and outbound OI to prove the effectiveness of their technology, gain legitimacy, and attract resources and knowledge to be able to convert that technology into a commercial product, get into the market and keep innovating further.

The lack of track record as newcomers in the market (Nagy and Lohrke, 2010), the lack of experience to interact with the external environment (Aldrich and Auster, 1986) and the difficulties to establish routines and organizational structures in early stages of a firm (Sirmon, Hitt and Ireland, 2007; Zott, 2003) push start-ups to use OI approach to reduce their cost to prove their technology and develop prototypes aiming to find a partner to contribute with knowledge or resources to convert a specific technology into a commercial product and accelerate to the market. The study shows that regardless of the informality of the OI process in start-ups and the opportunistic approach, overall, OI can help start-ups to take their ideas into the market to leverage the commercialization process and to discover business opportunities by understanding specific industry problems and collaborating with external actors to create new applications for their technology.

### 5.1.1 Why? - The Start-up's Motives to Open for Innovation

#### **Survival Motives**

The study suggests that entrepreneurs use an OI approach to gain credibility, visibility and overcome resource scarcity. Chesbrough and Bogers (2014) emphasize that this is a process based on a purposive management of knowledge, however, the collected data in this research shows how start-ups use OI in a very opportunistic manner, meaning that they use OI as a door-opener without always having a clear understanding of potential outcomes and the time and cost it would imply. This phenomenon happens mainly and more obviously in non-pecuniary inbound and outbound OI processes where firms engage in OI to leverage their resources on hand aiming to have commercial and innovation benefits in the long run (Dahlander & Gann, 2010). Overall, the study suggests that in early stages, firms use an open approach as their best alternative to cope with liabilities of newness and survive in a competitive market.

Among all the motives, we have found that survival and gaining legitimacy are the main factors that incentivize the use of OI in start-ups.

Furthermore, in the research literature the often-mentioned barrier for using OI paradigm is a financial factor, meaning that it is costly to adopt OI and develop products in an open collaboration (Enkel, Gassmann & Chesbrough, 2009; van de Vrande et al. 2009; Verbano, Crema & Venturini, 2015). Contrary to these, our findings show that finances do not hinder but actually leverage resources and reduce costs start-ups use for OI. Interestingly, in line with our findings, Bigliardi & Galati (2016) found that financial issues were more of a concern to large firms rather than to small firms and according to the resource-based view, small firms could use OI to leverage resources.

Van de Vrande et al. (2009) note that the SMEs mainly get involved in OI for meeting demands of their customers and remaining competitive on the market that is supposed to result in increased growth and a higher market share. Though such motives as control, focus, costs, and capacity can be also traced among SMEs, the market-related motives are still dominant for SMEs to engage in OI (Van de Vrande et al. 2009). Furthermore, the lack of resources in SMEs is argued to be a barrier to look for knowledge outside, however, a lack of resources is also considered to be a key motive among SMEs to search for outside knowledge and technologies (Spithoven, Vanhaverbeke & Roijakkers, 2013). Our findings are in line, showing the paradox



that the barrier is also the main motivation among start-ups to use OI, namely to get the resources from outside and survive.

Research on SMEs shows similar results that SMEs use OI to gain the knowledge or resources that they lack (Hoffman and Schlosser, 2001; Pullen, Weerd-Nederhof, Groen & Fisscheret, 2012; Van de Vrande et al 2009).

For all the above-mentioned we suggest that: *Start-up's specific nature, characteristics and behavior impacts on the entrepreneur's motives to open for innovation (Why - Survival Motives) [1]*

### **Business Motives**

The research also explains how start-ups use OI having in mind long-term commercial and innovation goals. However, in short-term, new ventures engage in OI collaboration without a clear understanding of potential outcomes or consideration of cost-benefits.

Also, in line with our findings, many authors stress that the main motive for SMEs to use OI is innovation-related. For example, Pullen, Weerd-Nederhof, Groen & Fisscheret (2008) found that the main drivers for SMEs are to achieve a successful innovation outcome, develop new products and commercialize them. Van de Vrande et al. (2009) also have similar findings that OI helps SMEs to overcome the difficulties of commercialization and improve innovation process. Other authors present growth and gaining revenue as the main drivers for SMEs to use OI (Chesbrough and Crowther, 2006).

Overall, we conclude that: *Innovation and commercialization are the final goals that drive start-ups to use OI (Why - Business Motives) [2]*

### **Entrepreneur's Role in OI**

Entrepreneurs' motives and decision-making process plays a fundamental role in early-stage firms (Shane, Locke & Collins, 2003). Also when we talk about OI's search agenda, it is the individual who guides the strategic decisions and defines the interrelation between the firm and the external environment (Cohen and Levinthal, 1990). Our study suggests that in start-ups the decision to bet for open or closed approach relies mainly on the entrepreneur/manager. Therefore, when choosing an OI approach, the decision-maker needs to determine where to focus the company's attention among the universe of information and what information is

relevant and needed by the company (Dahlander, O'Mahony & Gann, 2016). The individual also needs to analyze the company's main challenges and the ways to cope with them. It is argued that dealing with external liabilities is much more important than solving the internal ones (Delmar and Shane, 2004; Morse, Fowler and Lawrence, 2007; Stinchcombe, 1965) but is up to the entrepreneur to define a red line of internal and external liabilities to decide wisely about an OI approach.

For the above-mentioned we suggest that: *Entrepreneurs play a fundamental role in the start-up future and therefore, the individual attitude towards open culture defines the likelihood that start-ups will use OI (Why) [3]*

### 5.1.2 How? The Main OI Practices in Start-ups

#### **Start-up's Liabilities and OI Process**

Uncertainty and liability of newness that start-ups cope with shape the use of OI, turning it into a fully opened, informal and opportunistic approach, meaning that they use OI to leverage their resources on hand, overcome resource scarcity, gain legitimacy and knowledge to convert their ideas or technologies into commercial products and get into the business arena.

#### **Diverse OI Practices**

Our findings show that start-ups not only use OI practices, but they are practicing various forms of it, namely both inbound and outbound, using at various innovation stages and with diverse partner types. In line with our results, Bigliardi and Galati (2016) who have included micro-enterprises in their studies on adoption of OI in SMEs, found that micro-enterprises mainly consisting of start-ups actively use diverse forms of OI. Interestingly, micro-enterprises were excluded from previous research on OI, as it was assumed that they are not involved in OI due to the characteristics of SMEs (Van de Vrande et al. 2009), however, this assumption is challenged by our findings.

Our research revealed that start-ups have diverse partners, open their boundaries, and collaborate at various innovation stages. Lazzarotti and Manzini (2009) label the diversity of partners as “partner variety” and phases of innovation as “innovation funnel openness”. According to their modes of OI by crossing these two dimensions, the start-ups we have

researched fall into an open innovator type, as they use OI at various stages and collaborate with diverse partners. We found that mostly these diverse partners were falling under the same category, which is supply chain partner, mainly customers, such as the large companies or public sector.

### **Full Openness vs. Opportunity Cost**

As an overall OI phenomenon, firms tend to search knowledge from diverse sources aiming to propel the probability of positive outcomes (Li et al. 2013). Our study suggests that start-ups keep their eyes open to catch an opportunity to phase with their uncertain environment and therefore are willing to collaborate with diverse partners and exchange knowledge with several sources. However, start-ups are small, they have few team members, lack the experience to interact with the external environment and lack dynamic capabilities (Sirmon, Hitt & Ireland, 2007; Zott, 2003), therefore, it is fundamental for firms that practice OI to focus their attention and prioritize inflows and outflows of knowledge (Allen, 1977).

The research suggests that once start-ups find the right partner they focus on building a strong relationship with them. It also suggests that start-ups follow a dynamic cycle of exploration and exploitation, so they focus on the use of OI in their innovation or commercialization phase.

### **Informality and Trust**

Our findings showed that start-ups are mostly engaged in OI in an informal way, meaning that rather than having formal legal contracts, they might have an NDA and have cooperation mostly initiated and developed based on personal relationships. A research on service companies found that they are more engaged in informal OI practice rather than manufacturing companies that tend more to formal OI collaborations (Mina, Bascavusoglu-Moreau & Hughes, 2014).

The findings are in line with the recent research on trust and informality in OI where trust is viewed as one of the most important foundation factors. Trust can be achieved both through formal and more flexible relationships; however, the informal form enables more flexible knowledge sharing (Abu El-Ella, Bessant & Pinkwart, 2016). The authors propose a construct of an honorable merchant that changes the former rigid contracts. As in nowadays' fast-changing world, it is more important to innovate and not lag behind; informal relationships are becoming more important (Abu El-Ella, Bessant & Pinkwart, 2016). As Nooteboom (2013)

also argues, because of high uncertainty of innovations, control becomes an outstanding challenge and presence of trust is needed.

Three overlapping levels of trust development are distinguished in OI, namely, interpersonal trust, firm-to-firm trust and network-to-network trust (Abu El-Ella, Bessant & Pinkwart, 2016). The importance of trust is also examined and shown in product development (Brattström, Löfsten & Richtnér, 2012). Delmar and Shane (2004) argue that new ventures focus on building legitimacy with external actors in order to cope with the liability of newness; other authors believe that managing those liabilities can help new ventures improve their survival rate (Singh et al. 1986).

This explains our finding that start-ups rely on trust, as they are mainly small and it is the individual entrepreneur who works on collaborations. As our findings show, some companies do not have collaborations within WIN, as they have recently joined the marketplace network and it takes time to build trust, thus developing OI collaborations needs time.

Based on the above-mentioned, we suggest that: *start-ups' nature of having the liability of newness shapes the implementation of OI practices in new ventures [4]*

### **OI Intermediary**

Our findings showed that an intermediary, such as WIN water marketplace network, plays a big role in how start-ups manage OI and collaborations, and this is consistent with similar research (Gabrielsson et al. 2018). Due to their nature of being small and new, start-ups do not have capabilities to have processes and people dedicated to working on OI and they have no partners, lack legitimacy and resources. To overcome these challenges, an innovation intermediary facilitates the process. We found that among our interviewees the perceived benefits were that innovation intermediaries give them credibility and visibility, they are door openers to market and customers and represent platforms for sharing knowledge and right matchmaking. In the study that was done in the same context, it was found that the major benefits perceived by companies were increasing credibility and sharing knowledge (Gabrielsson et al. 2018). As the authors claim, the overall pattern is that intermediaries, such as WIN Water Network, are more beneficial for companies at the commercialization stage (Gabrielsson et al. 2018). The important role of the intermediary is also stressed in the study by Bigliardi and Galati (2016), who specifically mention that intermediaries can help SMEs in right matchmaking.

Therefore, we concluded that: *An OI intermediary moderates the successful use of OI by start-ups (How? - The trampoline effect) [5]*

### **Commercialization or Innovation for Start-ups?**

The researchers suggest that because of the innovativeness of start-ups, OI helps them mainly to bring their technologies to the market and leverage the commercialization process. Less intensive but still remarkable, OI also helps start-ups to push the innovation process by assisting them to understand the market, discover new business opportunities and collaborate with external partners to create new applications for their mother technology.

#### *Commercialization - Outbound OI in start-ups*

The self-completion questionnaire revealed a predominant use of outbound OI by start-ups. This data need to be highlighted even more as large companies use outbound OI in a little percentage (Chesbrough & Brunswicker, 2013) and SMEs use it very little (Van de Vrande et al. 2009).

Why do start-ups use predominantly outbound OI? From interviews it was evident that developing a technology is not as big problem for start-ups, as the actual challenges they face during the commercialization phase due to the lack of resources, namely, to prove their technology, convert that technology into a commercial product and get into the market. Outbound OI process can help companies to turn their inventions into commercial products or services (Dahlander & Gann, 2010).

The data also suggest that start-ups use outbound OI, expecting that while they open their technology to the external environment it will be easy to get recognition, get the first big customer, build reputation and maybe, find a partner with marketing and sales power. Outbound OI process can help companies to take their innovations faster into the market by exploiting them to the outside, compared to developing them fully in-house (Gassmann & Enkel, 2004).

#### *Innovation - Inbound OI*

Regardless of the fact that outbound is the predominant OI process used by start-ups, inbound OI is also used by start-ups (14%). Through the in-depth interviews, we have also found that

even when start-ups do not have a clear purpose or a process to bring knowledge from outside, in practice the outcome is actually innovation, since close collaboration with external partners helps start-ups to understand problems, discover business opportunities, improve their products or technologies and mainly find new applications for the mother technology. We discovered that once a technology is developed, inbound OI helps start-ups to find new applications for their core technology by sourcing external knowledge that helps them to understand existing problems in specific industry or compensating technical or market knowledge they lack. It is argued that inbound OI helps companies to be more innovative than they would be without collaboration with the external environment (Enkel, Gassmann & Chesbrough, 2009). In our study, we could observe how the outside-in flows of external ideas, innovations, knowledge, and inventions can contribute to the innovation efforts of a company (West & Bogers, 2014).

In conclusion, we suggest that: *Start-ups' motives for commercialization or innovation define which OI process they will use. [6]*

### **Pecuniary or Non-pecuniary for Start-ups?**

The study suggests that liabilities of newness impact start-ups' motives to use predominantly non-pecuniary OI activities. Their lack of legitimacy, reputation and experience on the market and the scarcity of resources incentivize start-ups to use a bootstrapping approach and open their most valuable resource, their knowledge, to the outside aiming to attract the right partner to overcome a lack of resources or find the first big customer to gain reputation and credibility in the market.

Therefore, we argue that: *Due to liability of newness, start-ups tend to use mostly non-pecuniary OI activities (How). [7]*

### **The OI Outcome**

Diverse literature supports the idea that OI can help start-ups to cope with the liability of newness and smallness (Brunswick & Van de Vrande, 2014; Parida, Westerberg & Frishammar, 2012). Our research suggests that sourcing knowledge from outside while opening technologies to the outside can help start-ups to reduce cost and time that is fundamental to survival. It also shows how exposure to the external environment and the use of OI networks can help start-ups to gain legitimacy, find partners and therefore, complement the knowledge and overcome the scarcity of resources. However, a successful OI outcome will

depend on the adequate use of the inflows and outflows of relevant information for the start-ups and building trust among parties of interest, among others.

In conclusion, we agree with the researchers that: *The use of OI reduces the liabilities of newness and smallness in start-ups. [8]*

Figure 2 summarizes our discussion and main findings.

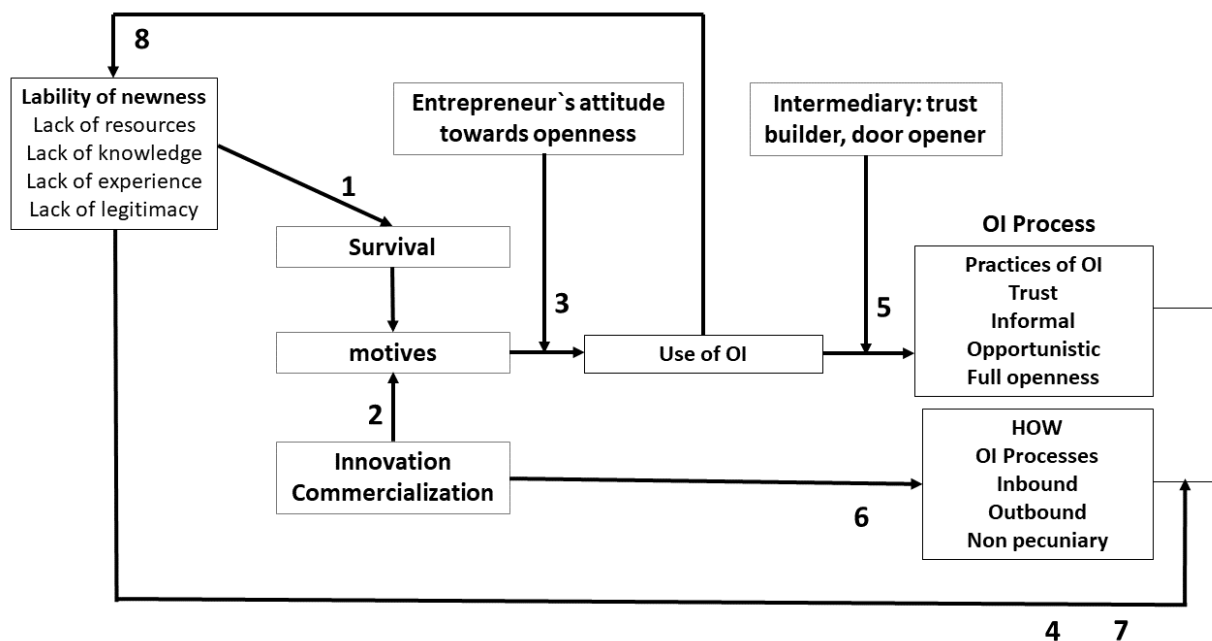


Figure 2. OI Model in Start-ups

## 5.2 Start-ups, Large Companies, and SMEs

Based on the research and literature review on OI in large companies, SMEs and start-ups, we present the comparative table of using OI in different contexts (Table 4).

Based on this analysis, the aspects that attract most attention relate to the increasing use of OI practices showing that more companies bet for an open approach rather than the traditional closed process where innovation is developed mainly in-house (Chesbrough & Brunswicker, 2013).

Table 4. Start-ups vs. large companies and SMEs

	<b>Large Companies</b> (Chesbrough & Brunswicker, 2013)	<b>SMEs</b> (Van de Vrande, et al, 2009)	<b>Startups</b> (Own elaboration, 2018)
<b>Use of Open Innovation</b>	78%	Increasing	76%
<b>Use of inbound</b>	35%	predominant	14%
<b>Use of outbound</b>	8%	little use	50%
<b>Couple process</b>	---	---	27%
<b>Main inbound activities</b>	Customer co-creation, informal networking, university grants	Customer involvement, external networking, outsourcing R&D	Sourcing external knowledge from various actors (mainly customers and academia)
<b>Least inbound practices</b>	Crowdsourcing, OI intermediaries	External participation, inward IP licensing	Acquiring inventions to use them internally
<b>Main outbound practices</b>	Joint ventures, selling market-ready products and standardization	Employee involvement	Revealing internal knowledge to external environment
<b>Least outbound practices</b>	---	Outwards, IP licensing, venturing	Selling out license
<b>Main leading partners</b>	Customers, academia and suppliers	Customers, networking and employees	Customers, academia, large companies, suppliers, other startups
<b>Motives for using OI</b>	Finding partnerships, exploring trends in technology and identifying business opportunities	Keeping with the current market, increasing growth, gaining knowledge or bringing experience to the firm, improving product development, integration of new technologies	<u>Business Motives:</u> Commercialization - access to market, accelerate to market, finding partners. Innovation - discovering new business ideas, product improvement and development, satisfying customers, find new applications for existing technologies. <u>Survival Motives:</u> Gain knowledge, resources and legitimacy
<b>Main challenges</b>	Change process from closed to open innovation	Corporate culture related issues and administration related problems	Lack of legitimacy and negotiation power, need to prove technology, lack of resources

The second interesting factor is the predominant use of inbound OI by large companies and SMEs and just a little use of outbound OI, meaning that they prefer to source knowledge from outside to keep innovating, maintain growth and increase revenues (Chesbrough and Crowther, 2006). In contrast, start-ups mainly use outbound OI while inbound OI is used with less intensity, implying that start-ups tend to open their technologies to the external environment aiming to complement knowledge, resources, finance, spread risk, reduce cost and strengthen networks (Hoffman and Schlosser, 2001) to receive customer feedback, serve their customers



adequately and simultaneously, discover business opportunities, open up new markets (Van de Vrande et al. 2009), commercialize new product or service development (Theyel, 2013), convert ideas or inventions into commercial products or services (Dahlander & Gann, 2010) and reduce time to get into the market (Jacobs & Waalkens, 2001). SMEs use predominantly inbound OI and focus on customers' involvement when looking on growing on the market and pay attention to employees' involvement as outbound activity when pursuing innovation (Van de Vrande et al. 2009).

We can also observe that large companies practice more pecuniary activities by selling ready products or merging with other companies, as they have already gained market recognition and can easily attract partners. In contrast to large firms, start-ups predominantly use non-pecuniary OI, due to newness start-ups do not have another alternative than to take their internal knowledge to outside for free, aiming to obtain commercial and innovation benefits in the long-term (Dahlander & Gann, 2010).

In reference to the motives, we can see that all companies look to commercialize their products and keep innovating and all perceive that OI will help them in this regard. However, this study shows that in practice, the lack of legitimacy pushes start-ups to collaborate with external partners without a clear idea of potential cost or outcomes but aiming to gain financial or innovation benefits in the long-run.

Finally, we can see how the lack of flexibility of established firms make it difficult to change from a closed to an open approach (Spithoven, Teirlinck & Frantzen, 2012). This is not a problem for start-ups that are more adaptable and flexible; however, they cope with the issues of liability of newness (Wymer & Regan, 2005).

## 6. Conclusions and Implications

The aim of our study was to contribute to the scarce literature in the field of OI and start-ups (Bianchi et al. 2010; Spithoven, Vanhaverbeke & Roijackers, 2013; Van de Vrande et al. 2009). We aimed to fill this gap by answering why and how start-ups use OI. To answer these questions, our study was conducted in the context of an innovation intermediary WIN Water, a marketplace and OI arena for start-ups, academia, large companies and public sector in the water sector. The study was conducted with primarily qualitative methods with some supporting quantitative data. Based on our findings and analysis, we have developed an OI model in start-ups.

We have found out that there are two main motives that drive start-ups to open for innovation: survival and business motives. On the one hand, due to survival reasons, start-ups' main motives for OI are to access the resources and knowledge, find partners that will give them credibility and visibility. On the other hand, the business reasons, such as commercialization and innovation, are start-ups' drivers to use OI. Thus, we found that start-ups' liability of newness shaped their motives and OI is like a tool to cope with liabilities and achieve strategic business goals.

Furthermore, our research also suggests that start-up's nature and liabilities not only motivate them to use OI but also shape the OI process in new ventures. The OI process is also turned into a fully open process by collaborating with diverse partners at different stages of innovation. OI is also used in an informal and an opportunistic way, new ventures use OI to leverage their resources on hand, open diverse doors and collaborate with several partners without a clear understanding of potential outcomes and cost-benefits but aiming for future benefits in terms of commercialization, innovation, and survival.

The study also shows that start-ups do not face that much challenges in innovation as in transformation of those inventions or technologies into commercial products and succeeding on the market. This explains start-ups' predominant tendency to use outbound OI to convert their technology into a commercial product and accelerate to the market. Our research also explains that even when inbound OI is less used by start-ups, it pushes their innovation process by helping them to discover business ideas and improve their technology.

Finally, the research showed that intermediary plays an important role for start-ups when dealing with OI. It works as a trust-builder and door-opener for new ventures facilitating and

accelerating their access to potential customers and partners, which they would not be able to access otherwise. As start-ups do not have enough resources and process to deal with partners and collaborations for innovation, the intermediary is an effective tool and process for them to cope with their liabilities.

Overall, the study suggests that engaging in OI practices can help start-ups to save cost and time and therefore, has a positive impact on the new venture' survival rate. Our study showed that entrepreneur's role is huge in defining OI strategy. We argue that OI is an important way for start-ups to cope with their challenges and the entrepreneurs can benefit a lot from keeping its cost-benefits and opportunities in mind.

## 6.1 Contributions

### 6.1.1 Academic Contributions

The main contribution for the research is that our study has given an insight of OI in the start-up's context. Likewise, we have contributed to the scarce literature and existing research gap in OI and start-ups' field (Bianchi et al. 2010; Spithoven, Vanhaverbeke & Roijakkers, 2013; Van de Vrande et al. 2009). Our study showed that start-ups' nature is different, and it shapes fully how and why they use OI.

The OI literature for large companies suggests that outbound process is less applied in companies and therefore, less research has been conducted in this field (Enkel, Gassmann, & Chesbrough, 2009; Huizingh, 2011). However, as revealed by our research, start-ups mainly use outbound OI in practice; therefore, our research has contributed to making an OI phenomenon more visible that has been dismissed up until now.

Furthermore, we have presented several interesting findings, for example that OI is used in start-ups at several stages of innovation and with diverse partners, there are specific characteristics of application of OI and finally, an intermediary has an important role in the process. Thus, we have raised interesting issues for researchers to investigate further in the future.

### 6.1.2 Practical Contributions

We believe that this research will help start-ups to understand how to use OI in a more effective way, make decisions and create OI strategies more wisely. It is important for novice entrepreneurs to know that start-ups use different forms and have diverse partners at different innovation stages of OI, as it is the tool to use for overcoming a liability of newness and surviving.

Also, it is important to know that OI has its costs, it is time-consuming to look for and manage the partners, therefore, the finding that it is intermediary facilitated is important, as entrepreneurs and start-ups should look for innovation intermediaries and networks that will open doors for them, give them legitimacy and facilitate the OI practice.

Our findings are also important for innovation intermediaries and marketplace networks that try to foster innovation and match different parties for moving innovation faster on the market. It will also help OI networks to comprehend the fundamental role they play as intermediaries and the start-ups' needs when practicing OI. Intermediaries can understand start-ups' motives and needs and arrange their programs and agendas around them. They can make sure how to give more legitimacy to start-ups, how to encourage sharing of knowledge and resources among members, be customer centered, trying to match start-ups with their potential customers, as commercialization is one of the main motives.

This research has also given visibility to start-ups in the OI arena, offering policymakers the opportunity to emphasize the creation of policies where diverse actors of the society participate in the innovation process and help start-ups and all companies to get involved in an OI arena.

## 6.2. Limitations and Future Research

This research has certain limitations. First, we developed this research focusing on start-ups involved in the water sector. Most of the start-ups were research intense companies, having two start-ups in software services in the water sector. It is uncertain how this specific context shaped the results and if the results can be generalizable. Future research has to develop a similar analysis in other sectors, for example, in tech and non-tech industries, in the service sector, etc.

Second, we focused on start-ups in an OI arena, the marketplace for innovations. As we have seen that an OI intermediary plays an important role, it is possible that being part of an OI network characterized the start-ups with a tendency to have an overall positive experience and perception of OI. As for the future research, a comparative analysis of start-ups that actively participate in OI networks and those that do not could be an interesting topic for research.

Third, the study shows that the start-ups have diverse partners and open up their innovation at various stages. As our unit of analysis was start-ups, which are in the process of collaborations, it was outside of our scope to understand which forms of OI or type of partners were finally more successful and which were not. In the future, it would be interesting to conduct a longitudinal study on successful and unsuccessful cases of using OI.

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# Appendix A

## Interview Guide

### Before the interview:

Check the website of the company, their product, service, and the survey results they have filled to get the first impression.

### During the interview:

- Introduce ourselves, and the purpose of the interview.
- Inform about confidentiality and recording.
- Explain what and how we define open innovation. Afterwards, we do not use the term open innovation, as start-ups might not know and not label their actives as OI, even if it is.
- Explain the plan of the interview - follow the story of the company starting from when it was born until today and focus on the collaborations they had.
- Make notes and when it comes to collaborations that could have been related to OI, ask to clarify, reflect and elaborate more if needed.

*Table 5. Interview Guide*

<b>From born until today</b>	<b>Themes and talking points</b>
<p>Follow the story of the start-up from the beginning, how the start-up was born until where they are now. Below are 3 general stages of start-up life to make sure to refer to.</p> <ul style="list-style-type: none"> <li>● Born</li> <li>● Development</li> <li>● Commercialization</li> </ul>	<p>This is the list of topics to guide the interview. However, as the interview follows the story of the company, an interviewer makes notes and asks to refer, clarify and elaborate more based on concrete collaborations, issues raised by the interviewee.</p> <ul style="list-style-type: none"> <li>● Background information how the start-up was born</li> <li>● What types of collaborations they have had</li> <li>● Actors with whom they have had the collaborations</li> <li>● Why - motives to engage in mentioned collaborations</li> <li>● How - ways, forms, strategies to engage in and manage collaborations</li> <li>● Benefits of collaborations for the company</li> <li>● Challenges of collaborations</li> <li>● Motives to be in WIN network</li> <li>● Evaluate the role of WIN network for the company</li> </ul>

- Concluding remarks, offer to add something if they want.

# Appendix B

Table 6. The example of the data structure for the in-depth interview

Aggregated Theme	2nd order Concept	1st Order Concept	Quote
Survival motives	Gain resources	Start-ups are motivated to engage in OI as a way to compensate their lack of resources and instead, gain the resources	<i>Company #2: There is a water processing plant outside of Lund... They have provided us with space and they allowed us to connect the municipal water and make the measurement (for our technology). We are not paying for them; they allowed us space because they were also interested to see the results.</i>
			<i>Company #5: We had to do many tests to make it sure that it makes the laundry clean, that ...it does not destroy anything in the machines or have any negative effects on the clothes or in the machines. So we did lots of tests on that ...then we asked consumers to try it. ....Our really, really first pilot test was at a multiple flat housing company, our community company, you know like you have LKF in Lund, so ours is called ABK (Aktiebolaget Kristianstadsbyggen)... it was just a way for us to get a site for a pilot test.</i>
	Gain knowledge	Start-ups realize they do not and cannot know everything and to develop the business further they engage in OI to gain knowledge	<i>Company #6: For some dots, I am still not convinced about, or I do not know them enough. So, I am cooperating with people who may help me. It is almost like outsourcing. Because I know that they are good, strong in that, instead of me going a long way, I say, can you help me with this?</i>
			<i>Company #7: When we talk about reuse of water in washing machines, it is a little complicated process, you need to know about washing machines, you need to use some advance controls. So, our technology is just a little part of the whole system. They look to our technology to see if that could be positive for a total solution. If this will become a product, it will be a very specialized product for a very specific solution.</i>
	Gain legitimacy	Start-ups lack legitimacy and they engage in OI collaborations to gain the credibility, prove their product, service or technology on the market.	<i>Company #4: Why? Credibility, approval. If you are a small company, and you have a new technology, very few people would like to risk the investments. So, you're always trying to get partners who can justify our technologies.</i>
			<i>Company #8: The main challenges were that we were so small that it was a problem because the big organizations do not want to buy from such a small company. It is because is a risk, they can lose time and money and they do not want to take risk... With the first client we had to do a legal contract, it stated that if we went bankrupt the source code would be stored in a safe place and the client would be able to use the source code without us... This worked straight away with customer number 2 and after the number 2, it was enough for us to have a good references, it takes time to build name and reputation.</i>



# Appendix C

Table 7. Overview of WIN Water Network (Source: Gabrielsson et al. 2018; winwater.se)

<b>General Information about WIN Water Network</b>		
<b>Aim</b>	A marketplace and a network to increase the speed of innovation within the water area	
<b>Founded</b>	January 2012	
<b>Type of organization</b>	A non-profit organization that is part of Ideon Open, an OI initiative at the Ideon Science Park in Lund, Sweden.	
<b>Funding</b>	Mainly from membership fees and Tillväxtverket – the Swedish Agency for Economic and Regional Growth.	
<b>International co-operation</b>	WIN has been part of several international projects and organizations for business and innovation collaboration for e.g. Technology Approval Group (TAG), NEPTUNE project (H2020), European Climate Network, TIBinggo.	
<b>Members</b>	Innovation companies and partner companies	
<b>Members of WIN</b>		
	<b>Innovation companies</b>	<b>Partner organizations</b>
<b>Type of organization</b>	Startups, SMEs, University spin-offs, spinouts, entrepreneurs, and inventors. By March 2018, there were 40 innovation companies in WIN.	Business (companies, large corporations and service providers), public sector (municipalities and public utilities), academy (universities and research institutes). By March 2018, there were 29 partners.
<b>Role</b>	Receive early feedback from the market, support and assist via the WIN to develop their products, services, and business.	Interested in new solutions to water challenges and are potential customers and/or end users of new products and services.
<b>Membership</b>	Free, through form on the website. Innovation height, market potential and confidence in individuals are criteria for qualification.	Based on membership fee. They contribute by providing support to innovation companies, facilitating market access and setting up test beds.
<b>Major activities</b>		
<b>Partner meetings</b>	Main event organized regularly four times per year. At partner meetings, both innovation companies and partner organizations give short presentations of their needs, challenges, development, and innovations. Active networking and matchmaking takes place during these meetings.	
<b>Small workshops</b>	They can be about issues such as business practice, sales techniques, what investors are looking for, etc.	
<b>Exhibitions</b>	Each year WIN gives a possibility to all innovation companies to participate in Water Fair Exhibition.	
<b>Major tools used</b>		
<b>Mingle map</b>	Active match making is crucial activity in WIN and they use “mingle map” as a tool at partner meetings. Each participating organization is represented by a dot positioned in a circle. The lines drawn between the dots represent business opportunities identified by the WIN team. Participants are stimulated to discover all business opportunities – spontaneous and mapped.	
<b>Open innovation</b>	Uses OI as a tool and encourages all members to share needs and discuss innovation to help one another.	
<b>Tripe helix model</b>	WIN unites all three parts of triple helix model, business, public sector and academia and encourages collaborations among them.	

# Appendix D

Table 8. List of self-completion questionnaire respondents

Company #	Respondent	Founded	Domicile	Major Activity type	Joined WIN
1	CEO	2012	Sweden	Product	2015
2	Chairman of the board	2011	Sweden	Product	2016
3	Owner	2016	Sweden	Product	2016
4	Managing Director	2014	Sweden	Product	2014
5	Managing Director	2015	Sweden	Product	2015
6	CEO and partner	2015	Sweden	Product	2017
7	Director	1992	Sweden	Product	2016
8	VD	2011	Sweden	Service	2011
9	Head of Partner Network	2012	Sweden	Product	2014
10	Founder	2016	Sweden	Product	2016
11	Sales & Marketing Manager	2000	Sweden	Product	2014
12	COO	2013	Sweden	Product	2013
13	CEO	2011	Finland	Product	2016
14	Managing Director	2006	Finland	Product	2015
15	Head of Market & Sales	2013	Sweden	Product	2016
16	CEO	1999	Sweden	Product	2014
17	Communications and Marketing	2012	Finland	Product	2014
18	CEO	2006	Sweden	Product	2016
19	Managing Director	2014	Sweden	Product	2012
20	CTO R&D	2013	Sweden	Product	2016
21	Managing Director	1993	Sweden	Product	2017
22	Account Executive	2014	Sweden	Product	2015

# Appendix E

## Findings from self-completion questionnaire

Major activity type

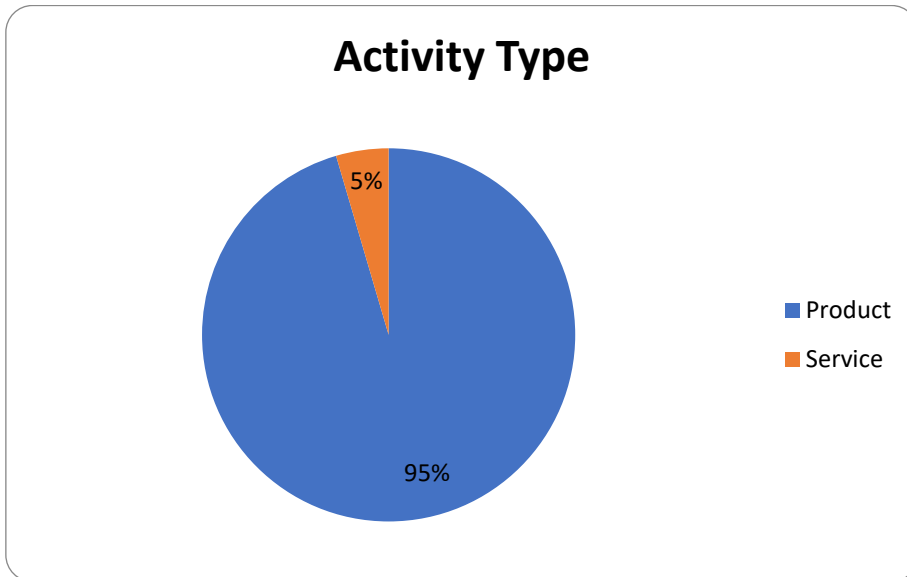


Figure 3. Activity type

Number of employees for 2018: Full-time and part-time

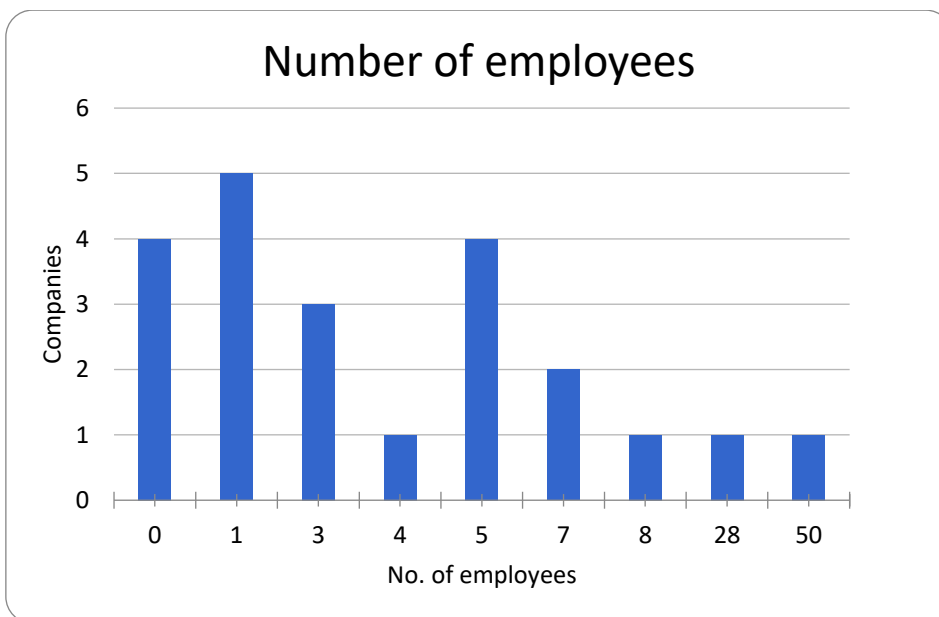


Figure 4. Number of employees

Are you engaged in specific collaborations or partnerships with external partners due to WIN?

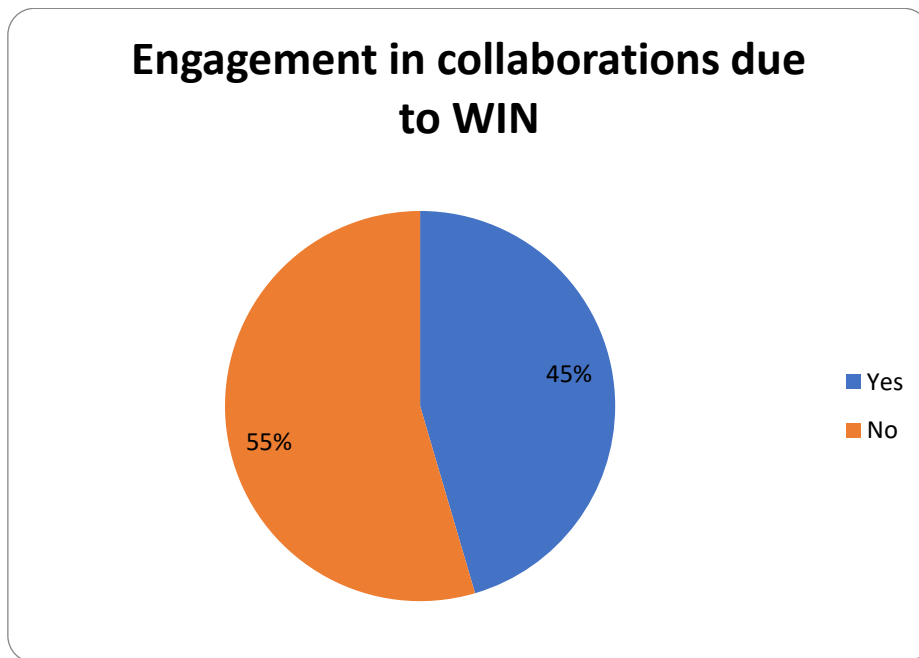


Figure 5. Engagement in collaborations due to WIN

Are you engaged in specific collaborations or partnerships with external partners outside of WIN?

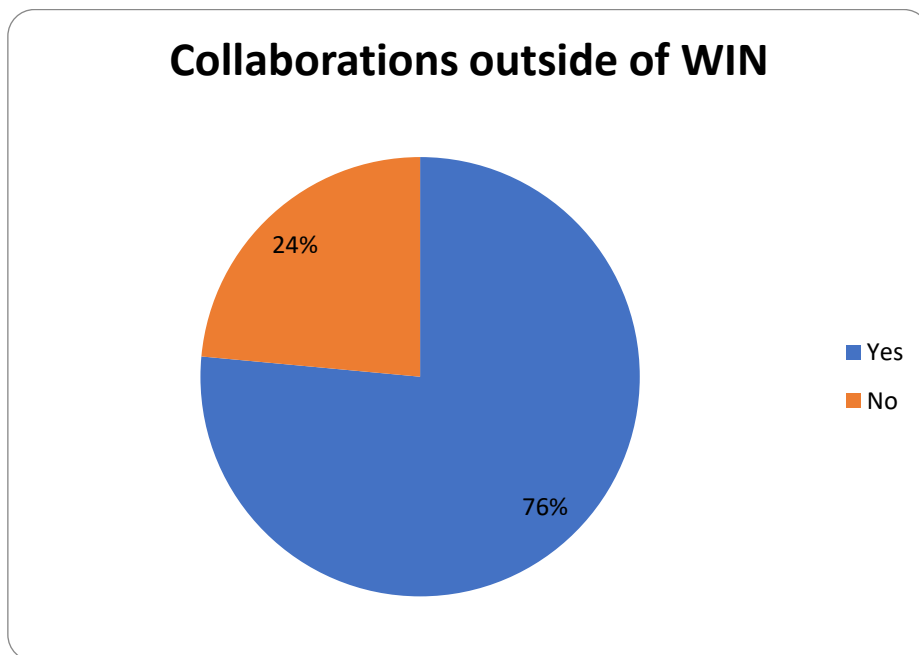


Figure 6. Engagement in collaborations outside of WIN

If yes, how many partnerships or collaborations have you been engaged in since you joined WIN?

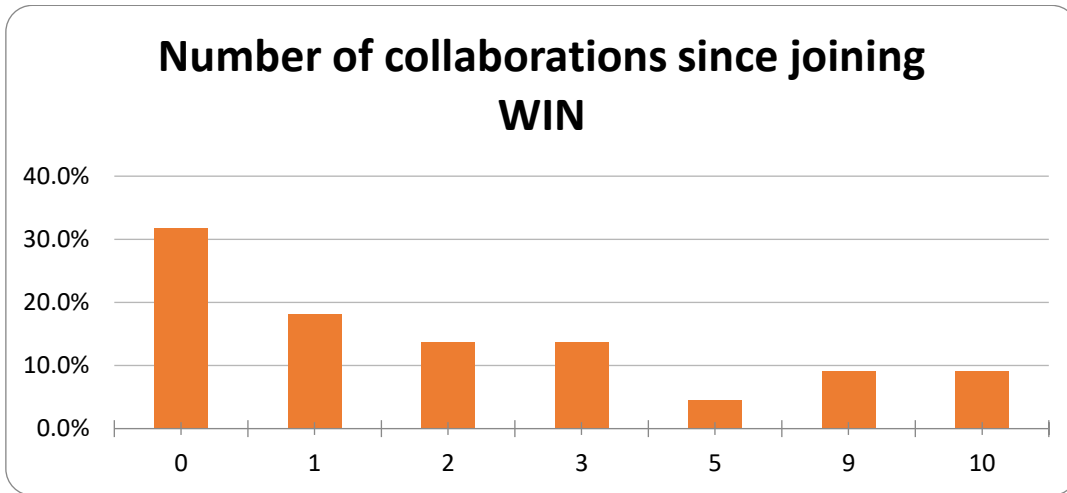


Figure 7. Number of collaborations

What type of open innovation forms have you been engaged in? It is possible to mark more than one form.

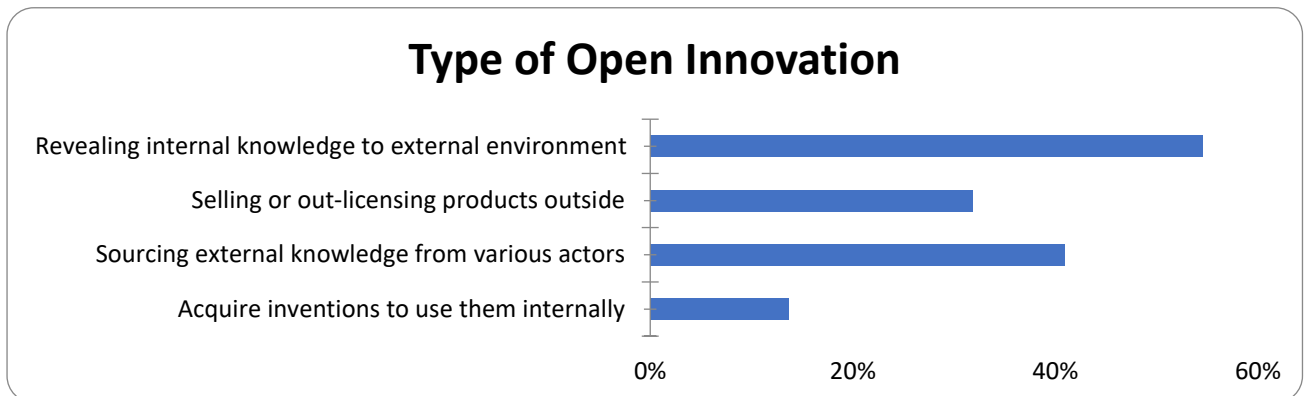


Figure 8. Type of OI

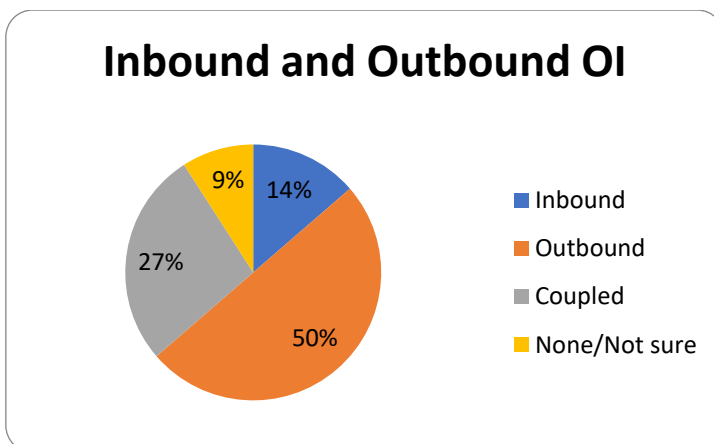


Figure 9. Inbound and Outbound OI

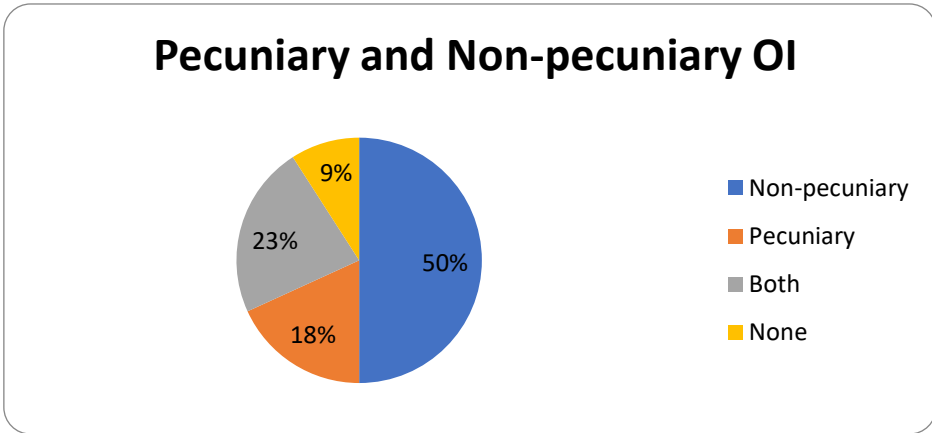


Figure 10. Pecuniary and non-pecuniary OI

With whom have you established external collaboration? It is possible to mark more than one type of stakeholder.

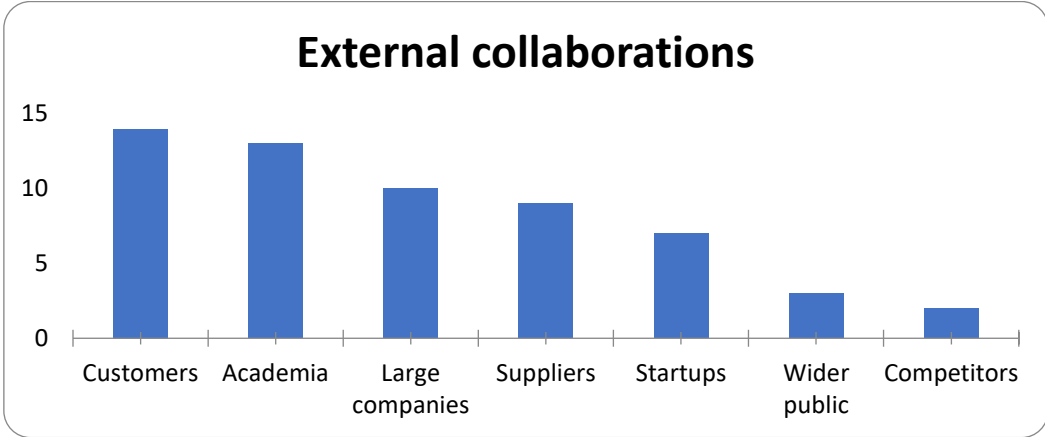


Figure 11. External collaborations

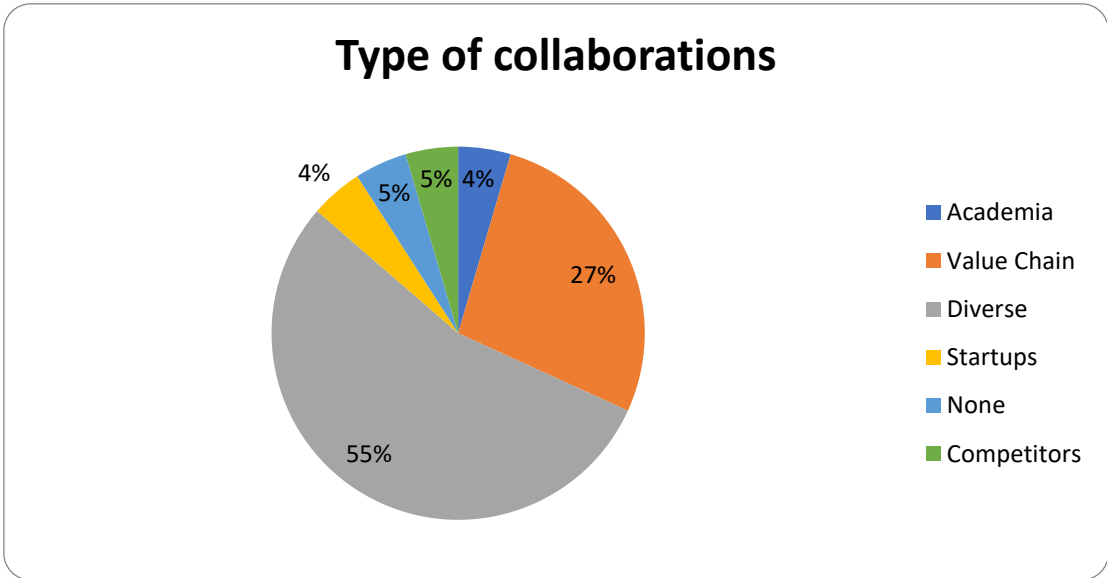


Figure 12. Type of collaborations

How frequently do you interact or get in contact with external actors with whom you have established collaborations from the WIN Water network? Please mark whichever category comes closest to the number

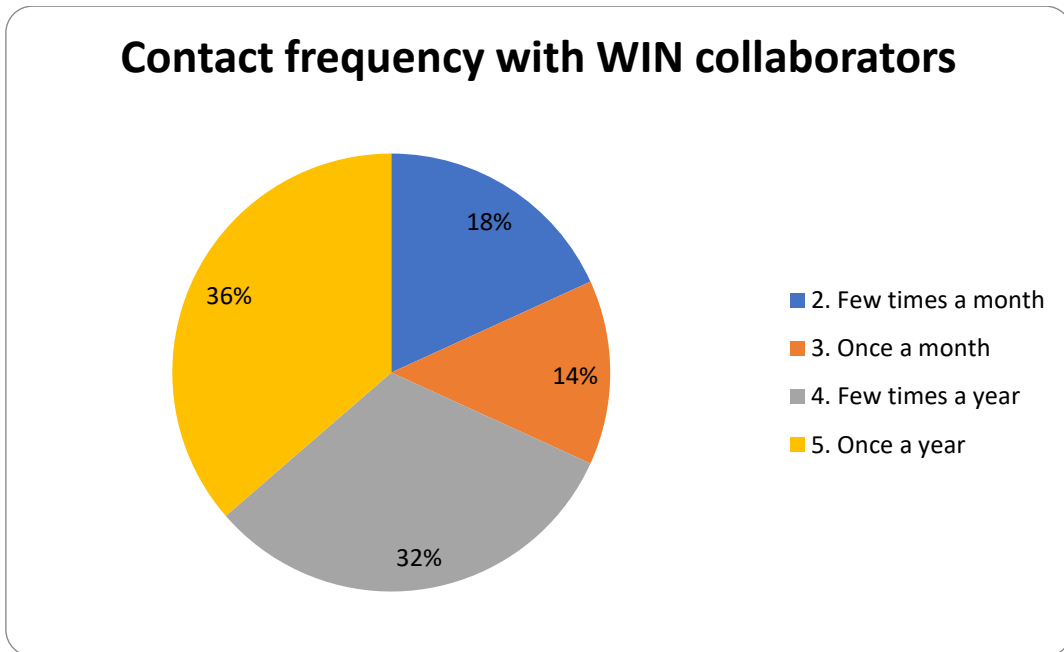


Figure 13. Contact frequency with WIN collaborations

Does your company have a specific process for bringing inside knowledge or technology, taking internal knowledge or technology outside or collaborating with external actors?

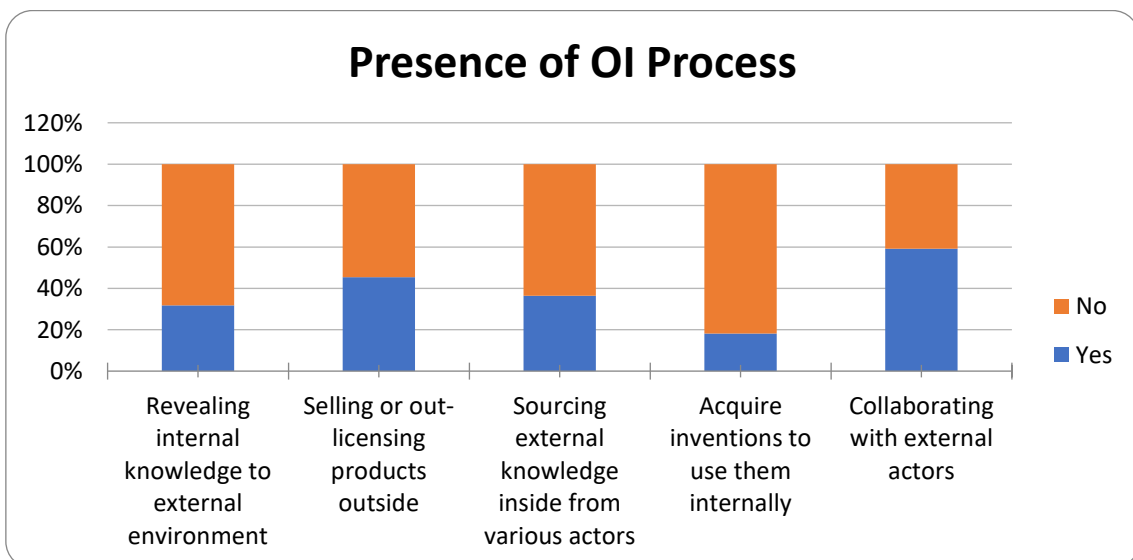


Figure 14. OI process

What are the main goals with respect to searching for external knowledge? It is possible to mark more than one goal.



Figure 15. OI process

Do you participate in similar platforms other than WIN to search for external knowledge?

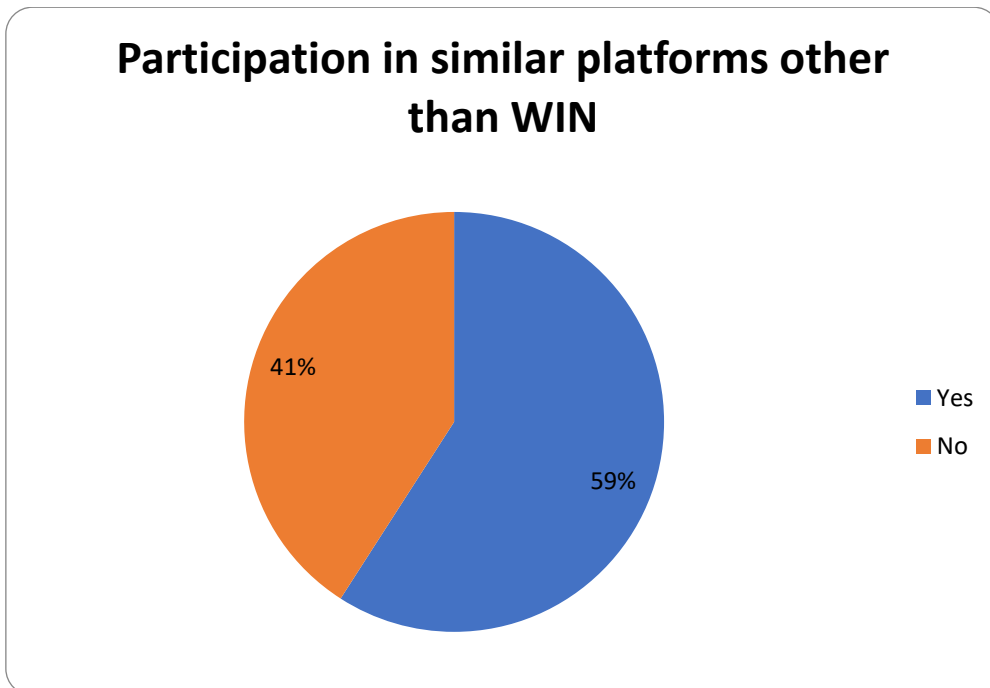
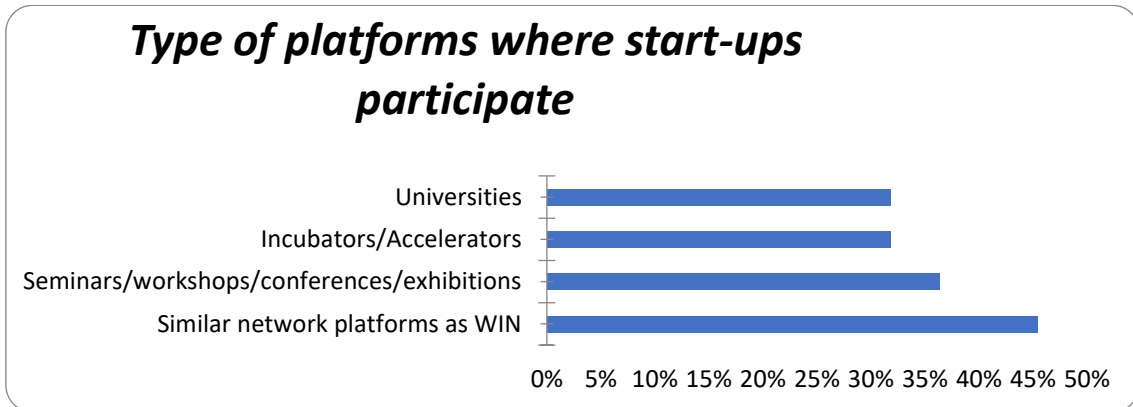


Figure 16. Participation in similar platforms other than WIN



If yes, how do these platforms correspond to the following type of arenas? It is possible to mark more than one type of arena.



*Figure 17. Types of platforms where start-ups participate*