



The willingness of firms to participate in a project that aims at enabling an industrial symbiosis through a web based resource exchange

MScRes Thesis

Agnese Tomassini (4113845)

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Thesis Supervisor Doctor Oedzge Atzema

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"Strength does not come from the physical capacity, but from an indomitable will"
Mahatma Gandhi

Acknowledgments

I want to thank myself, my family, my friends, and my supervisor for having supported me in this challenging, interesting and revelatory growth path.

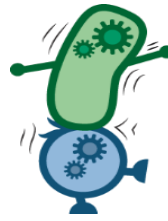


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1 Introduction ~

The preparation for the International Climate Conference in Paris (December 2015) clarifies that the current dominant economic paradigm of development stands at a crossroads. Recent projections in earth sciences research made it possible to quantify our limited possibilities in terms of use of non-renewable energy resources (especially fossil energy), while it has not gone unnoticed the industry's responsibility in determining environmental constraints like the depletion of the ecosystems and the climate change (Almasi et al., 2011). Not only the climate change but also the continuing growth of global resource consumption, the urbanization, and the population growth, challenge today's resource-intensive economies and companies. Until forty years ago, the world did not seem to have limits, and therefore, could produce and provide with resources ad infinitum. This perspective justifies and explains the current dominant *linear* economic model of development based on a 'take-make-waste' economy of scale (McDonough & Braungart, 1998; Mentink, 2014; Gladek et al. 2015), which assumes (an unrealistic) infinite basin of resources (Sijmons, 2014). In the last decades, the increasing pushing constraints of an economic and environmental nature has rendered this linear model of development obsolete and in contrast to a sustainable perspective of development, which is a '...development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (United Nations, 1987, p.54, quoted by Oberhofer and Fürst, 2013).

To attain a sustainable development, experts from the innovation studies, industrial ecology, economic geography, among other academic sectors, are exploring the so-called 'natural system paradigms' like the circular economy, 'cradle-to-cradle', biomimicry, urban metabolism, and industrial symbiosis, to redesign the economic and industrial system in a new and sustainable way (Pauli, 2010). These perspectives apply the metaphor of natural systems to the production of goods and services in industrial economy. Natural ecosystems are characterized by the 'cascade model' where the concept of waste does not exist because the wasted resources produced by a part of the system become the main resource for one or more other parts of the system. The resulting system is effective and 'regenerative' (Bastein et al., 2013; Pauli, 2010; Sijmons, 2014). The ambition of these frameworks is a neat and quick reduction in natural resource use and in the associated carbon emissions as soon as possible (Brennan, 2013). The application of this idea at an economic level has risen to prominence since the 2012 World Economic Forum (WEF) where the Dame Ellen MacArthur launched the 2012 Towards a Circular Economy Report. Since then the European Commission and in particular the Netherlands are working at a range of measures to accelerate their transition to a more circular economy (the road to a circle economy 2014; Circle Economy n.d.).

The natural systems paradigms propose the structural transition from a *linear* to a *circular* economic and industrial model of development. This means adopting the strategies of 'eco-effectiveness' and 'sufficiency' in addition to the strategy of 'eco-efficiency' that goes with the linear economic model. The eco-efficiency strategy is widely adopted by industries and authorities; its dictate is 'doing more with less' (Kopnina, 2015; McDonough & Braungart 1998). This strategy however does not solve 'the problem' because it only provides a superficial response to the big global issues given that it slows the depletion process without stopping it (McDonough & Braungart, 1998). In fact, despite the growing rates of

recycling, most resources still re-enter the material cycle as wastes or downcycled materials, contributing to the *linear* structure of our economy (Gladek et al., 2015). The *circular* economy, together with the other natural systems paradigms, may constitute an alternative solution to attain eco-effectiveness and sufficiency, which means designing the economic and industrial system in a way that guarantees the optimal use of every resources, upcycle waste materials, and selling the use of resources instead then the resources itself (Gladek et al., 2015; Kopnina, 2014; McDonough & Braungart, 1998; Pauli, 2010). In fact, a circular economy is an economy with closed material loops whereby materials, components, and goods have more than one useful life and are re-used, repaired, reconditioned, remanufactured, and ultimately cycled at different levels of the economy, while waste is drastically reduced by design (Brennan, 2013; Mentink, 2014; Pauli, 2010). Beyond risk mitigation, implementation of circular economy may reveal new profit benefit from societal changes towards collaborative consumption (sharing economy) and towards new ways of organization, higher levels of collaboration throughout the supply chain and new ways of creating value (Mentink, 2014). This means designing next urban, industrial and economic development keeping in mind the limits of our planet and our (human) dependency from it.

The circular economy (or closed-loop) model has emerged from the discipline of industrial ecology (also known as industrial symbiosis) in which the functioning of ecosystems has been used as an exemplar for industrial processes and systems. Companies located close to each other in an industrial park can work like an ecosystem realizing symbiosis (exchanges of resources and energy flows between the companies) and sharing of assets through the formation of a complex system of links (Leeuwen & Vermeulen 2003). Industrial parks that hosts synergies are called eco-industrial parks. The creation of eco-industrial parks that are based on industrial symbiosis constitutes one of the solutions to attain this shift in the industrial and economic paradigm. Lambert and Boons (2002) defines an eco-industrial park as “a community of businesses that collaborate with each other and with the local community to efficiently share resources (information, materials, water, energy, infrastructure and natural habitat), leading to economic gains, gains in environmental quality, and equitable enhancement of human resources for the business and local community”. In other words, an eco-industrial park is a clearly defined area where materials, energy, and information exchange occur between various (co-located) companies and actors (Saikku, 2006). An eco-industrial park tends towards becoming a ‘re-generative system’. This means that in eco-industrial parks not only eco-efficiency, but also eco-effectiveness and sufficiency strategies are applied to the economic and industrial development.

The adoption of new strategies of development required by the big global issues of the current time have also forced governments to pledge positions in order to limit human impacts on the environment. Consequently, several measures to develop economic and legal incentives have brought to the development of management systems within organizations, aiming at reaching a sustainable situation (Remmen, et al. 2007). Generally, symbiosis among different actors of an industrial area can evolve by themselves over a long period of time, as it has happened in Kalundborg in Denmark, which is frequently referred to in the literature, or in Houston Ship Channel in Texas (Alamasi et al., 2011; Grant et al., 2010; Saikku, 2006). In these places spontaneously emerged industrial complexes in which the different industries exchanged material flows on a large scale (Almasi et al., 2011; Lambert & Boons, 2001; Leeuwen & Vermeulen, 2003; Saikku, 2006;). On the other hand, eco-industrial parks can be intentionally planned

for a totally new area or around existing operations (Saikku, 2006). Last decades have witnessed many attempts of implementing symbiotic or synergic industrial systems, but not all of them reached a self-sustainable situation. Indeed, a project aiming at implementing symbiotic or synergic industrial system is characterized by a high complexity degree, and its realization takes a long time.

The current emergence on the scene of various sharing economy online websites may affect this state of affairs, because Information and Communication Technology (ICT) tools can facilitate cooperation among firms providing a coordination mechanism and information sharing enabler. The virtual organization of exchange of resources is an interesting option brought by the diffusion of the Internet that goes with the maturation of the industrial revolution which has created an economy that is increasingly interconnected and information based. In fact, ICT web-based resources exchanges initiatives are explored by urban developers and academics (Cecelja et al., 2014; Gladek et al., 2015; Grant et al., 2010). Enabling industrial symbiosis through web-based resources exchanges constitute an interesting perspective that fits the Smart City framework (Gladek et al., 2015). ICT-based interventions can smartly connect local residents with one another and boost the efficiency of resource flows (Gladek et al., 2015). Industrial symbiosis linkages often form between companies of different industrial sectors that do not have established customer/supplier relationships and thus require communication that transcends the existing customer/supplier network (Grant et al., 2010). To address this challenge, many ICT tools have been developed in support of industrial symbiosis, like web-based resources exchange. Yet, the contribution of these tools to the realization of industrial symbiosis linkages is unclear (Grant et al., 2010).

This thesis research contributes to the bulk of research concerning firms' acceptance of the transition of an already constituted mixed industrial park to the status of eco-industrial park by means of a web-based resource exchange. In particular, this research looks at some of the factors that affect a firm's willingness to participate in the creation process of a web-based exchange of resources in the Spaanse Polder. The Spaanse Polder constitutes an important Small- and Medium-sized Enterprises (SMEs) mixed industrial park (Lambert & Boons, 2002) of the city of Rotterdam, as well as the focus of the attention of the Pulsup Project. The Pulsup Project, which constitutes the case-study of this research, is a project of industrial renewal that concerns the study of the opportunities and constraints to the development of a web-based exchange of resources in the Spaanse Polder. The project is inspired by the concepts of circular economy, sharing economy, and industrial symbiosis, among others, which constitute the background concepts of the project. The end goal of the project is to define the guidelines to develop an ICT tool in a sharing economy website fashion. The ICT tool would constitute a coordination mechanism and information sharing enabler to support daily exchange and sharing of resources among the firms of the Spaanse Polder, and thus foster the transition to those more sustainable business practices to requalify the Spaanse Polder in a sustainable and smart fashion. However, at the moment the project finds itself in exploratory phase that is functional to the development of the ICT tool; the phase the Pulsup Project is passing through is defined of 'opportunity identification and assessment' (Grant et al., 2010). To what extent is a transition to a more symbiotic and circular way of doing business possible in the Spaanse Polder? What are the opportunities, challenges, and constraints of such project? What kind of features should an industrial area have to transit towards a more synergic and circular business system by means of a sharing economy platform? Do the entrepreneurs of the Spaanse Polder have any cognition of

sustainability and circular economy, or of the other background concepts? Do they use those concepts in their daily practice? Is it part of their routine to collaborate with other local firms? Do local network of firms have a self-augmented function in the acceptance and use of those concepts?

This research investigates the effects of three selected factors on the *willingness* of the firms of an already constituted mixed industrial park (the Spaanse Polder) to participate in the creation process of a web-based exchange of resources (the Pulsup Project), given that to define the features and characteristics of this ICT tool is necessary to involve local firms. As Grant et al. (2010) noticed, the top down autocratic model of management of projects promoting ICT based industrial symbiosis are destined to failure. Hence, offering to firms a participatory process enhances the chances of success of the project: firms must be willing to participate in the project. Spaanse Polder firms' *willingness to participate* in the Pulsup Project constitutes a condition *sine qua non* would not be possible to realize a project that like the Pulsup Project wants to support resource exchanges by means of a web-based ICT tool as well as the transition towards a more symbiotic and circular way of doing business in the Spaanse Polder (Almasi et al., 2011).

This thesis research presents the valuation of Spaanse Polder firms' willingness to participate in the Pulsup Project with the help of primary data collected through a qualitative field research based on fifteen semi-structured qualitative interviews with relevant entrepreneurs and stakeholders of the Spaanse Polder mixed industrial area of Rotterdam. The main research question supporting this empirical and exploratory research is:

“Given the Pulsup Project, which aims at enabling the transition towards a more symbiotic and circular way of doing business in the Spaanse Polder industrial park through the realization of a web-based resource exchange, to what extent local firms awareness of (and interest in) the project’s background concepts, their features, and their interest in making a collective use of resources affect their willingness to participate in this project?”

First of all, it was assumed that the Spaanse Polder's firms' awareness of (and interest) in the Pulsup Project and its background concepts – sustainability, circular economy, sharing economy, and industrial symbiosis - positively affect their willingness to introduce a change in their routine and participate in the project. In fact, the first obstacle that must be overtaken in order to implement a systematic transition to a symbiotic industrial system in an industrial area usually is constituted by the firms' mindset in respect to the way they do business. In other words, the success of this kind of project to some extent depends on the 'environmental awareness' of firms (Eriksson et al., 2006; Ettema, 2009; Frij-Andres et al. 2008; Lara Jr. et al., 2006; Gupta, 2015). The sub-research questions corresponding to this hypothesis are: *“To what extent the Spaanse Polder’s firms are aware of (and interested in) in the Pulsup Project’s background concepts – sustainability, circular economy, sharing economy, and industrial symbiosis?” “Does firms’ awareness of and interest in the project’s background concepts affect their willingness to participate in the Pulsup Project?”*

Secondly, it was assumed that certain specific features of a firm (e.g. economic specialization, size, scale of the market, age) to some extent explains a firm's degree of willingness to participate in a project like the Pulsup Project. The features of a firm tell something about its identity and role in the Spaanse Polder

as well as in the 'bigger picture'. The features of a firm are like the features of a person or her/his demographics. Given that the features of a person affect his or her willingness to participate in any kind of activity, the same rationale could be applied to a firm (Newlands, 2002; Oberhofer & Furst, 2012). The sub-research question supporting this hypothesis is: *"To what extent the features of a firm affect its willingness to participate in the Pulsup Project?"*

Thirdly, it was assumed that firms' interest in making a collective use of certain resources (space, transports and deliveries, machineries and equipment, waste flows materials, and energy), which means interest in sharing, exchanging, lending, borrowing and renting resources already available locally, would positively affect firms' willingness to participate in the Pulsup Project. It was also assumed that whether firms' needs in terms of resources are compatible this would constitute a driver of their willingness to participate in the Pulsup Project, because their interests would be at stake in the matter (Almasi et al., 2011; Ben-Elia & Ettema, 2009). The sub-research question supporting this hypothesis is: *"To what extent the Spaanse Polder's firms' interest in making a collective use of the locally available resources (e.g. space, deliveries and transportation, equipment and machineries, waste products, and energy) affect their willingness to participate in the Pulsup Project?"* *"What do affect firms' interest in making a collective use of locally available resources?"*

Overall, understanding the drivers behind firms' decision to participate in the Pulsup Project this thesis defines some of the conditions that either trigger or constrains firms' willingness to participate in a project that aims at implementing a circular and synergic business system in a mixed industrial park by means of a web-based resources exchange. The perspective adopted by this study is relevant at both the societal and academic level. On the one hand, this thesis research is *socially relevant* because by studying a particular case a precedent is constituted. Potentially, studying in depth the factors that affect a firm's degree of willingness to participate in a project like the Pulsup Project explains the degree of effectiveness of the use of websites to overcome the limitations of introducing more sustainable ways of producing like the concepts of circular and sharing economy. Even if this study has been developed to especially understand how to better fit the Pulsup Project to the firms of the Spaanse Polder, the approach that was here adopted could be extended to analyze in depth other similar situations. In other words, the in the depth-study of how certain variables affect, triggering or constraining, the willingness of the Spaanse Polder firms to participate in the Pulsup Project become a case to draw from to develop other projects that aims at enabling industrial symbiosis through a web-based resource exchange to boost the transition of an industrial area from a linear to a more circular and synergic way of doing business.

On the other hand, this study is also *scientifically relevant* because it contributes to the bulk of knowledge concerning the enablement of an industrial symbiosis through a web-based resource exchange in a mixed industrial park. Firstly, previous studies about industrial symbiosis and assets sharing project lack a focus on the role played by the willingness of the companies to participate to a similar project in determining the project's success. Thus, this research seems contributing to the bulk of intellectual reflections and knowledge of fields like industrial ecology, sustainable studies, innovation studies, and economic geography about industrial symbiosis and assets sharing practices providing it with this kind of approach which is relatively new and requires more studies. Secondly, it will deepen the knowledge about mixed industrial parks that overall have been overlooked by the international and European literature about

industrial symbiosis (Lambert and Boons, 2001). Thirdly, it contributes to the rising literature about sharing economy providing it with a different angle, because it combines it with circular economy and industrial symbiosis. Finally, it also contributes to the literature about industrial symbiosis implementation.

This research master thesis research is structured as follows. Chapter 2 provides an overview of the theoretical notions and concepts used in this research. In other words, the concepts and notions that have been just introduced, like willingness, awareness, 'natural paradigms', and so on, will be thoroughly explained with the support of the existing literature. Chapter 3 and 4 describe the Pulsup Project and the Spaanse Polder mixed industrial park of Rotterdam that respectively constitute this research's case-study and the relative location. Chapter 5 depicts the methodology of research. The following three chapters show the results of the research: Chapter 6 focuses on the relation between firms' awareness of the project and its background concepts (sustainability, circular economy, sharing economy and industrial symbiosis) and their degree of willingness to participate in the Pulsup Project; Chapter 7 investigates the relation between certain features of a firm and willingness to participate in the project; and Chapter 8 focusses on the in firms' interest in making a collective use of resources in relation to the willingness to participate in the Pulsup Project. Successively, in Chapter 10 the results of the research will be discussed. Finally, Chapter 11 draws the conclusions of this research.

2 The theoretical Background ~

2.1 Firms' willingness to participate

The interest of this research address *firms' willingness to participate* in a project like the Pulsup Project (see Chapter 3) because is seen to be a prerequisite when implementing industrial symbiosis. In the dictionary, willingness is explained as a “disposed or consenting, that is inclined” attitude. Willingness, sometimes called the ‘human factor’, refers to the human feeling of desire to invest into an industrial symbiosis project (Almasi et al., 2011). Christensen (2010) claims that willingness to invest in synergies with other companies is a very important mechanism, if not the most important. The mechanism of willingness is industrial-symbiosis oriented effect (Almasi et al., 2011). Decision-makers must be willing to participate in such collaborations to successfully realize an industrial symbiosis in the long run.

Last decades have witnessed many attempts of implementing industrial symbiotic systems, but not all of them have reached a self-sustainable situation. As we will better see in Section 2.2.4 two types of evolutionary process can emerge in eco-industrial parks; some parks are self-organized while others are constructed or designed (Saikku, 2006). Here, the interest goes to the constructed or designed parks given that the Pulsup Project wants to implement a more symbiotic business system in the Spaanse Polder of Rotterdam (see Chapter 4), which is an already constituted mixed industrial park. Grant et al. (2010) observed that attempts of implementing industrial symbiotic systems tend to fail when a top down autocratic model of management of projects promoting ICT based industrial symbiosis is promoted. Many early ICT systems built in support of industrial symbiosis were first attempts to “put it in a database” and lacked the required investment in usability or sociability. Hence, offering to firms a participatory process enhance the chances of success of the project. In other words, willingness constitutes a necessary ingredient for the success of such kind of project since it is formed by awareness of industrial symbiosis benefits, shared technical knowledge, trust, and good communication with one another (Almasi et al., 2010).

2.2 Awareness

Environmental management usually refers to activities aimed at reducing the unfavorable impact of a company on its environment. Environmental management can be both an organizational and a product-related dimension (Tibor and Feldman, 1996). Environmental management can be found in formal or informal, public or private organizations and concerns natural resources and ecosystems and the quality of these; environmentally derived or related services; and the preservation or improvement of the ambient environment (Seiffert and Loch, 2005), resulting in environmental sustainability (Goodland and Daly, 1996). Many researches have tried to investigate the reasons why firms implement and actively perform environmental management, and they have found out that numerous factors influence the implementation of environmental management (Oberhofer et al., 2013). With regard to the implementation of environmental management itself, both external and internal factors can be seen (Hart, 1995). Barriers to introducing environmental management might include increasing management

costs, a lack of trained staff and expertise as well as limited stakeholder awareness, while the contribution to environmental protection, the reduction of environmental risks and cost savings would foster environmental management (He, 2010). Hence, keeping other variables constant, when a company is aware of the unfavorable impact of its activities on the environment more probably would adopt an environmental management. In other words, environmental awareness to some extent explains why a firm adopt an environmental management strategy. A company that is aware of its impact on the environment could decide to introduce the participation in the Pulsup Project as part of its environmental management strategy.

Hence, one of the first obstacle that must be overtaken in order to implement a symbiotic system in an industrial area is constituted by companies' mindset in respect to the way they do business. In other words, the success of projects that aims at implementing industrial symbiosis to some extent depends on the environmental awareness and attitudes of firms (Frij-Andres et al. 2009; Gupta, 2015), since the personal predisposition of employees to act in an environmentally sustainable manner is strongly influenced by their values and attitudes (Ramus and Killmer, 2007). Attitudes towards environmental protection are strongly related to environmental activities (Cordano and Hanson Frieze, 2000). Sweet et al. (2003) argue that information-processing and decision-making styles are central aspects of the environmental performance of sustainable companies. Believing in a win-win situation for environmental measures results in more proactive environment management behavior and is thus linked to stronger environmental performance (Plaza-Úbeda et al., 2009). According to Ajzen's 'theory of planned behavior', attitudes, subjective norms and perceived behavioral control clearly influence the commitment of companies towards environmental management (Fishbein and Ajzen, 1975; Ajzen, 1991, 2005). Moreover, other studies, while not directly based upon Ajzen's theory, broadly accept its rationale and the fundamental impact of decision-makers' attitudes on their eventual behavior (Kirk, 1998; Kotchen and Reiling, 2000), though some emphasize a gap between the (stated) attitude and the (actual) behavior (Burgess et al., 1998). Many managers have a positive attitude towards environmental management and are aware that activities may improve their results, but only a few businesses convert this into proactive environmental behavior (Gadenne et al., 2009) as they prefer short-term profit over longer-term (environmental) benefits (Sangle, 2010).

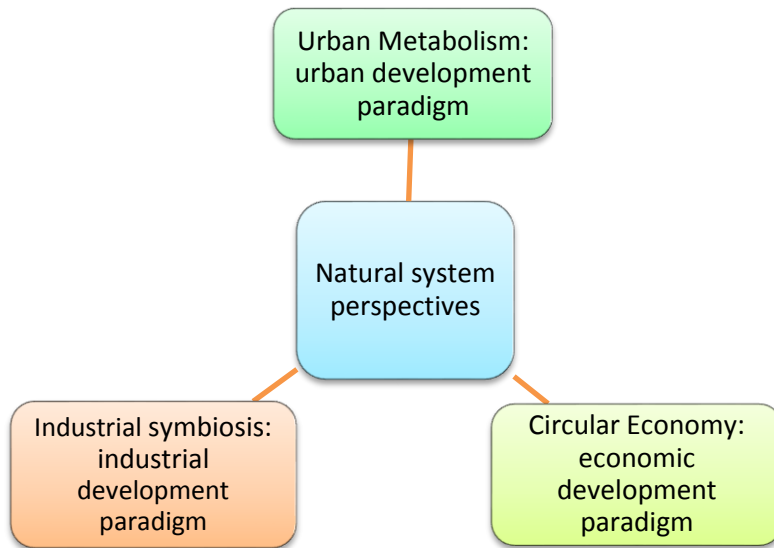
Awareness and willingness to participate are usually correlated (Lara Jr. et al., 2006). As Almasi et al. (2011) observed 'when awareness is taking place and benefits of industrial symbiosis are well known, the interest and willingness into investing in synergies is high'. Industrial symbiosis can either benefit of awareness of the physical synergies possibilities (lowering energy use or minimizing waste, that would decrease handling fee), which may bring ideas into actions (Christensen, 2010), or of awareness threats in their environment. Hence, awareness can be beneficial for synergies when is either driven by economic and or environmental incentives. In this respect, the *first hypothesis* is that firms' environmental awareness, which is firms' awareness of the Pulsup Project's background concepts – sustainability, circular economy, sharing economy, and industrial symbiosis -, positively affect their willingness to participate in a project that wants to realize an industrial symbiosis through a web-based resource exchange. Next sections depict, explain, and contextualize the Pulsup Project's background concepts.

2.2.1 The natural systems perspectives

The climate change constitutes one of the big global issues of the 21st century, and it is in quest for new paradigms and structures in order to deal with it in a sustainable way. Few years ago geologists have announced the end of the Holocene and the beginning of a new geological era, the Anthropocene: the 'era of the human being'. Such passage is due to the acknowledgment that humans impact the earth like those forces of nature that have modified the Earth throughout the whole existence. The fact that humans are powerful enough to manipulate the earth implies a moral responsibility for the consequences of their actions, like the climate change, the energy crisis, the eroding biodiversity, and the depletion of natural resources. The Anthropocene realizes that the earth not only gives the humanity all that needs to work with, but that it is all that humanity has to work with: there are planetary boundaries that human intervention cannot overtake (IABR, 2014). This means 'changing a matter of fact' into a 'matter of concern'. A sustainable perspective looks for development models that are able to conserve the resources of the planet while preserving and augmenting its citizens' quality of life. It comes to foster a transition from the economy of product to an economy of system (Bastioli in the preface of the book *The Blue Economy*, 2010). This requires new techniques and new methods, new models of development, financing, organization, and governance: nothing less than new urban, economic and industrial perspectives.

The *linear* model that currently supports the global economic system does not hold anymore because it assumes inexhaustible supplies on the input side and bottomless natural 'sinks' for waste and emissions on the output side (IABR, 2014). The linear economic model is neither *efficient* nor *effective*. As it was said by the economist Jean Paul Fitoussi the economic and environmental crisis are nothing less than two aspects of the same phenomena: "at the center of their operation is the same perverse ethical problem: the preference for the present, and its corollary, the depreciation for the future. The deepest bond between financial crisis and the ecological crisis seats in this tension between long and short-term" (Fitoussi J. P. quoted by Bastioli C. in the preface to the *Blue Economy* book). Consequently, a new and more sustainable perspective would be one that aims at finding a balance between the aggressive way humans manage the planet and the ecosystems from which humans manage it. This is even more urgent in face of the forecasted growth of the population and urbanization worldwide. New paradigms and structures are needed inasmuch an unprecedented effort is required to accommodate the urban population of 2050 in a consistently livable way, which is going to double its current size. As expressed by Dutch landscape designer Dirk Sijmons, the urbanization is the physical expression of the globalization: "people, money, and ideas 'urbanize' to conquer the world. Cities colonize and cultivate our planet, and cities and landscapes, culture and nature merge" (IABR, 2014). Among other experts, Naomi Klein (*This Changes Everything*, 2015) asserts the need for a cultural revolution that re-equilibrates the social metabolisms into the natural metabolisms. In the light of these facts, experts from different disciplines, like urban geography, economic geography, sustainable development studies, industrial ecology, and architecture, are building new and more sustainable human perspectives and paradigms of development. The urban metabolism, the circular economy, and the industrial symbiosis are 'natural systems perspectives' and they are respectively used as paradigms for urban, economic, and industrial design (Kopnina, 2015; Pauli, 2010). These are defined 'natural systems perspectives' because they provide

experts with a *metaphorical framework* to study the interactions of natural and human systems in specific regions (Pinceti et al., 2012).



Scheme 2.1. The natural system perspectives

The basic idea is to take inspiration from the nature, its ecosystems and biological cycles (biomimicry). Consequently, these metaphorical frameworks considers cities, the economy and the industry as natural ecosystems, which as such have their own metabolism. The metabolism of an ecosystem has generally been defined by ecologists in terms of production

(via photosynthesis) and consumption (by respiration) of organic matter, which is typically expressed in terms of energy (Odum 1971, quoted by Kennedy et al. 2007).

On this wake of reasoning, human activities (social and industrial metabolism) needs to adapt to the natural metabolism where the development of an element is regulated by a series of factors correlated to other organisms in way that guarantees the local biodiversity with a specific role for each species in the ecosystem. Taking inspiration from the natural systems means learning from their ‘cascade model’ and ‘circular model’. Nature is able to integrate chemistry, physics, and biology in circular systems that not produce wastes and every element of the chain, even the smaller, has an essential role (IABR, 2014). Through the use of a system and circular approach, like the urban metabolism, circular economy, and the industrial symbiosis, even the huge bulk of wastes, generated by the current linear development model, actually could be source of an inexhaustible quantity of primary materials, for local initiatives in network with other interlocutors of the industry or supply chain.

Overall, there are several conceptual relations between the notions of urban metabolism, circular economy, and industrial symbiosis, despite their different scientific origins and focus (respectively urban, economic, and industrial development). All these notions adopt a natural system and holistic approach that aims at realizing a ‘cascade model’ and tends towards “closing the loop”. The ‘cascade model’ refers to how any waste product becomes the input material for another mechanism, while ‘closing the loop’ similarly means to design human activities (e.g. economic, industrial) so that by design the concept of waste does not exist because resources circulates in a transformative system passing through the stages of input-waste-input-waste. The application of these three natural systems perspectives are complementary and intermingled, given that in reality urban, economic and industrial activities depend from and affect each other. Next three sections respectively deepen the ‘natural perspective’ concepts of urban metabolism, circular economy, and industrial ecology because they all provide with insights and

knowledge to the Pulsup Project, which draws from them. Eventually the concept of industrial symbiosis provides the Pulsup Project, as well as this thesis research, with major theoretical support and inspiration. Successively, the concept of sharing economy will be explored as well, because with the other three concepts, constitute the elements that characterize firms' (environmental) awareness.

2.2.2 Urban metabolism and the flow approach

The urban metabolism is a model to facilitate the description and analysis of the flows of resources within cities. Venkatesh et al. (2014) developed a 'Dynamic Metabolism Model' to adopt a holistic system perspective to the analysis of metabolism and environmental impacts of resource flows in urban landscapes. It is based on the 'metabolism concept' of industrial ecology (see section 2.1.3 for further explanation of the industrial ecology concept) which understands systems in terms of its inputs and outputs, and the processes which transform the former into the latter (Hoek et al., 2015).

To understand the meaning of flow of resources, recalling the Castells' concept of 'space of flows' and 'space of places' may be useful (Castells, 1999). An urban landscape is both a 'space of places', hence a territorial unit subdivided and organized in overlapping subsets of territorial units, and a 'space of flows', hence a set of networks of flows that cross and interconnect the several subsets of territorial units that organize a city. Despite the intangibility of the 'space of flows', it exists; it may be considered the spine and the soul of an urban landscape, what it makes it alive and dynamic. For the urban metabolism framework, nine vital flows have been identified. Flows of people, goods, waste, biota, energy, food, fresh water, air, sand, and clay (IABR, 2014), but also data (information and knowledge) continuously circulate through urban landscapes (Castells, 1999; Grant et al., 2010).

Whether cities have usually been built, managed, designed, and re-designed on the base of the functionalist approach, the urban metabolism suggests to switch to the flow approach, which implies an adaptive thinking. This idea is expressed by Dirk Sijmons with these words "city planners have traditionally learned to create cities on the basis of public housing needs; now they are being asked to design cities on the basis of flows" (IABR, 2014). In other words, urban policies traditionally draw upon categories to organize space, society, and its needs, which require an exercise of pigeonholing life. By contrast an urban policy based on the urban metabolism framework draw upon flows of resources. Being the flows more dynamic than categories, such approach would be stronger because more versatile, holistic, and respectful of the environment. Adopting a *flow approach* needs a change in mindset and the adoption of an adaptive thinking to realize the historic change of the current planning, production, and consumption models that is here suggested. Gunter Pauli explains the flow approach in his book the 'Blue Economy' (2010):

"Every flow influences the dynamic equilibrium that creates the vital conditions in which everybody can survive and feel good. [...] There are studies about each flow that contributes to the functionality and efficiency of the environment that surrounds us: they are all really important components of our lifestyle, which have an impact on our comfort level. Yet we seem planning our houses without taking in consideration such flows. [...] Flows imply a continuity 'of movement without obstacles, and if we would valorize them instead of blocking them, in our homes, we could take advantage of a wide range of innovations that would make our living conditions more comfortable

and healthy, reducing costs and saving energy. A natural system is always planned in function of the flows. There is nothing that evolves in a static way: everything interacts with what surrounds it" (Pauli G. quoted by Bologna G., 2010, p. 14).

Furthermore, the urban metabolism approach provides more guarantees from a sustainability point of view. A sustainable development can be understood as development without increases in the throughput of materials and energy beyond the biosphere's capacity for regeneration and waste assimilation (Kennedy et al., 2007). Coherently, the flow approach envisages that in an urban region the inflows of materials and energy and the disposal of wastes do not exceed the capacity of its hinterlands. In other words, urban metabolism policies and development strategies want to make a more efficient and effective use of the circulating resources. Dirk Sijmons states that "if we consider the city our natural ecology and analyze, understand, and learn to use its metabolism, then we can actually work on more resilient and adaptable urban future; in cities in harmony with nature" (IABR, 2014, p. 8).

A concrete example is constituted by Buiksloterham which potentially will become an example of Circular City development in Amsterdam. This area of Amsterdam North is undergoing a transformation because several stakeholders have designed a plan to transition the area towards a 'circular state'. The topics investigated as part of this plan included energy and material flows, biodiversity, environmental conditions, socio-economic data, an assessment of local stakeholders, policies and strategic plans, and factors that may influence the health and wellness of individuals living the area (Gladek et al., 2015). The proposed interventions were refined and evaluated using the material flow model that was built as part of the metabolism analysis. In fact, an 'urban metabolism scan' was used to understand the full workings of Buiksloterham from an integrated, systemic perspective.

Governance styles that rely on this complexity and holistic theory, instead than on cybernetics, may create an urban ecosystem where authorities, knowledge institutes, businesses, and citizens effortlessly manage to relate to each other on the base of the concepts of *efficiency*, *effectiveness*, and *sufficiency* (IABR, 2014; Pauli, 2010). For the urban metabolism, as well as for the circular economy and the industrial symbiosis perspectives, these three concepts constitute driving values to apply to every kind of urban, economic, and industrial policy, activity, and project. As we are going to see in the next section, these concepts provide with more guarantees to the threatening effects of the big global issues of the current age (e.g. climate change, population growth and increased consumption, coupled with urbanization), which urgently determine the need for a transition to a new perspective of development.

2.2.3 Circular economy

The circular economy implies a transformation of the current linear economic model, in which the recovery of raw materials eventually ends up as a waste that is subsequently destroyed - *eco-efficiency strategy* -, into a circular economy, in which the recovery of raw materials is maximized and value destruction minimized - *eco-effectiveness strategy*. The circular economy theoretically would tend to the recycling of nearly 100 per cent of essential materials. Its application implies a passage from an *economy of product* to an *economy of system*. This new economy is more effective and resilient, hence more

resistant and able of an ongoing adaptation that guarantees a better quality of life for everybody, living within the ecological limits of a unique planet.

The circular economy approach reflects the circularity of the flow of resources to which urban metabolism policies aim to. These kind of policies are based on three complementary and inseparable areas of scope. On the one hand, they aim at the *efficiency* that means “doing more with less” which is obtaining the same goods and services with a minor use of energy and materials. This strategy, with its famous three R – reduce, reuse, recycle – has gained popularity since the end of the 20th century, also because it stems considerable economic benefits. The hope was that eco-efficiency would transform human industry from a system that takes-makes-wastes into one that integrates economic, environmental, and ethical concerns, but, unfortunately, it is not a strategy for success over the long term. The reason was explained in an article wrote by McDonough and Braungart in 1998: “the eco-efficiency strategy works within the same system that caused the problem in the first place, slowing it down with moral proscriptions and punitive demands. It presents little more than an illusion of change. Relying on eco-efficiency to save the environment will in fact achieve the opposite – it will let industry finish off everything quietly, persistently, and completely”. This explains why circular policies, on the other hand, also aim at attaining *sufficiency*, which means obtaining wealth reducing the consumption levels while enhancing them qualitatively (Bologna G., 2010, p. 25), which means recognizing the human and natural limits and deal with them in a sustainable way. The main sufficiency criterions for a proper management of the relations among the metabolisms of the natural systems and those of the social systems thus concern the minimization of the input of matter and energy, the optimization of products’ life through their lifespan, their possibility of reuse, and their possibility of recycle (IABR, 2014, McDonough & Braungart, 1998; Pauli, 2010). The third area of scope of circular and metabolic policies is constituted by the *eco-efficacy* or *-effectiveness* strategy, which was developed by William McDonough and Michael Braungart in the 2003 book ‘Cradle to Cradle’, as well as by Gunter Pauli in the 2010 book ‘The Blue Economy’, among others academics. They claim that if the humanity desires to conserve the current wellbeing it will need to learn to reproduce the system of flows of nutrients and the highly effective natural metabolism, where the concept of waste does not exist because waste products are up-cycled. Up-cycling is the process of transforming by-products, waste materials, and useless and/or unwanted products into new materials or products of better quality or of better environmental value. In the introduction to the book ‘The Blue Economy’ (2010) Bologna about the eco-effectiveness strategy says:

“To eliminate the concept of waste means designing everything – products, packaging, and systems – from the beginning, on the base of the concept that waste do not exist. This means that the nourishing substances contained in the materials will mold and define the project, and that its shape will be defined by the evolution, not just by its function. We are convinced that this is decisively a more valid solution than the prevailing. [...] There are two different metabolisms on our Planet. The first is the *biological metabolism*, or of the biosphere, that is the cycles of nature. The second is the *technic metabolism*, or of the techno-sphere, that is the cycles of the industry that also includes the extraction of the technical materials from natural places. If they are designed correctly, all the industry’s products and materials will fuel without risks both metabolisms”.

Overall, the circular economy would be a ‘self-replenishing’ or ‘regenerative’ economy (Bastein et al., 2013; Pauli, 2010; Sijmons, 2014), where ‘waste equals food’ (McDonough & Braungart, quoted by

Kopnina, 2015). The ambition of this framework is a neat and quick reduction in natural resource use and in the associated carbon emissions as soon as possible (Brennan, 2013). The application of this idea at the economic level has risen to prominence since 2012 World Economic Forum (WEF) where the Dame Allen MacArthur launched the report *Towards a Circular Economy*, which emphasizes design for reuse and access over ownership models that promote greater circularity as a lucrative business opportunity. Selling the use or function of the product (e.g. service) rather than the product itself enables the efficient cycling of materials while simultaneously giving incentives for innovation (Scott, 2011). Since then the European Commission and in particular the Netherlands are working at a range of measures to accelerate their transition to a more circular economy (e.g. *The Road to a Circle Economy Dutch report*, 2014).

2.2.4 Industrial symbiosis (enabled through ICTs)

Industrial ecology is a science that attempts to face the problems that are related to resource consumption, waste production, and emission, by an integrated approach. In developing this concept, the challenge for sustainable development played a significant role. In particular, industrial ecology is a science advancing sustainable industrial ecosystems through paradigms that support interactions and exchanges between industrial flows and their surrounding environment (Grant et al., 2010). Industrial ecology tries to integrate human-activity into its wider context that supports it - the ecosystem (Almasi et al., 2011). Thus, industrial ecology is about understanding industrial systems and how they interact and construct the industry to fit the way ecosystems are working (Erkman, 1997).

Industrial symbiosis constitutes one of the most successful and convincing applications of industrial ecology principles (Grant et al., 2010; Harris, 2007). As a part of industrial ecology, industrial symbiosis has gained increasing attention, especially since 1989, when industrial ecology has created a new perspective on industrial development: industrial parks should be designed to resemble natural ecosystems in order to use energy, water, and material resources optimally while minimizing waste (Heeres, Vermeulen and de Walle 2004).

Industrial parks that host industrial symbiosis are called *eco-industrial parks*. Hence, designing eco-industrial parks is another concrete applications of industrial ecology (Boons and Baas, 1999, quoted by Van Leeuwen et al., 2003). The discussion on eco-industrial parks has started in the Netherlands since about 1995. Lowe et al. (quoted by Côté & Cohen-Rosenthal, 1998) defines an ecoindustrial park as:

“A community of manufacturing and service businesses seeking enhanced environmental and economic performance through collaboration in managing environmental and resources issues including energy, water and materials. By working together, the community of businesses seeks a collective benefit that is greater than the sum of the individual benefits each company would have realized if it optimized its individual interests”.

Similarly, industrial symbiosis refers to the relation among different firms of a business park. Industrial symbiosis describes industrial networks that cooperatively optimize resource flows for a collective benefit greater than the sum of individual benefits that could be achieved by acting alone (Grant et al., 2010). Through such collaboration, social interactions among participants improve (Zhu, et al. 2007). Industrial symbiosis has been defined as bringing together “traditionally separate industries in a collective approach to competitive advantage involving physical exchange of materials, energy, water and by-products.”

(Chertow 2000). Companies located close to each other in an industrial park can work like an ecosystem realizing symbiosis and sharing of resources through the formation of a complex system of links. *Symbiosis* are exchanges of resources and energy flows between the companies of an industrial park that otherwise would remain as waste, thus forming a complex system of links (symbiosis) between at least nine different types of economic activity. Examples of symbiosis are exchange of scrubber sludge between a power station and a wallboard plant, or treated sludge between a pharmaceutical plant and neighboring farms; other exchanges include waste heat or steam from a power station (Leeuwen & Vermeulen 2003). The collective environmental performance of an industrial park can further be enhanced with various *utility sharing options* (such as joint exploitation of waste water treatment plants, combined heat and power or a collectively owned wind mill). Chertow (2007) defined three main opportunities giving incentive for symbiosis and resources sharing: 1) the first opportunity is to reuse wastewater or by-products by means of infrastructures like a pipe, to be transported elsewhere to another company; 2) the second opportunity is facilities/infrastructures sharing, and 3) the third opportunity is joint provision of services between the companies.

The aim of industrial parks that hosts industrial symbiosis, thus of eco-industrial parks, is to generate both economic and environmental gains (Ehrenfeld and Gertler, 1997). Closing of material cycles at industrial parks can be achieved by constructing symbiosis. In this way the waste reduction might be considerable even if complete closing the loop of materials flows is utopian (Grant et al., 2010). In other words, the purpose of an industrial symbiosis network is to build collective flows among actors leveraging the exchange of materials to benefit the environment by reducing carbon footprints, minimizing landfill waste, and saving virgin resources (Cecelja et al., 2014).

Evolutionary processes of eco-industrial parks

Two types of evolutionary processes can emerge in eco-industrial parks. Some parks are self-organized. The other type is the constructed or designed park. In self-organized parks resources exchanges and sharing of assets between different actors of an industrial park have evolved spontaneously over a long period of time (e.g. Kalundborg, Denmark) without any policy management or administrative plans to develop cooperation. These parks have become eco-industrial parks by accident, because of independent linkages between its actors. New eco-industrial parks can be built from scratch or constructed around already existing operations (Saikku, 2006). It can be useful to start constructing eco-industrial parks around already existing materials and by-products exchanges. In this stream-based approach linkages are made on the base of specific physical resources. In the business-based approach the companies come first. The developer looks for companies that are interested in the project and tries to fit them in the eco-industrial park concept. The idea is to utilize existing organizational relationships and cooperation networks. The model preferred would be combine both stream-based and business-based approaches and companies would be prosed to join the park on the basis of their streams (Chertow, 2000; Saikku, 2006).

Enabling industrial symbiosis through a web-based resource exchange

The virtual organization of exchange of resources is an interesting option brought by the diffusion of the Internet that goes with the maturation of the industrial revolution which has created an economy that is increasingly interconnected and information based. Information and communication technology (ICT) tools in certain cases are used to support industrial symbiosis (Cecelja et al., 2014; Gladek et al., 2015; Grant et al., 2010). ICT-based interventions can smartly connect local residents with one another and boost the efficiency of resource flows (Gladek et al., 2015). In other words, ICT tools can play the role of a coordination agent, or facilitator, which facilitates communication between the actors in the network (Saikku, 2006).

Beyond coordinating the exchanges of resources among firms an ICT tool also support collaboration among them. As Baker (1992) said communicating and working together across organizational boundaries denote collaboration. Virtual collaboration refers to the use of ICT for supporting the collective interaction among multiple parties involved (Hossain & Wigand, 2004; Kock 2000). Therefore the development and sustainability of virtual collaboration have to be guided by common business goals (Wigand & Imamura, 1997; Wigand, Picot & Reichwald, 1997). Industrial symbiosis linkages often form between companies of different industrial sectors that do not have established customer/supplier relationships and thus require communication that transcends the existing customer/supplier network (Grant et al., 2010). To address this challenge, many ICT tools have been developed in support of industrial symbiosis. However, early ICT systems are heavily criticized for their tendency to focus on explicit knowledge, whereas tacit knowledge, such as social capital and trust, is essential for the mutualistic, nonmarket interactions required for industrial symbiosis (Desrochers, 2004). Knowledge-based economic theory provides a framework to explain the mixed results of ICT for industrial symbiosis (Grant 1996). Explicit knowledge or information is easily communicated, codified, or centralized using tools such as statistics. However, tacit knowledge is complex and is not codified. It is revealed through application and context and is therefore costly to communicate between people (Kogut and Zander 1992). In fact, building trustworthy relationships among agents is dependent on the level of face-to-face communication support (Hossain & Wigand, 2003). The level of face-to-face communication support should be higher when firms are co-located in the same industrial park. Hence, the application of an ICT tool would be more successful when it is introduced in an industrial area characterized by a discreet degree of face-to-face communication.

On this wake of reasoning, the Pulsup Project, which was inspired by the urban metabolism and the circular economy perspectives, wants to enable an industrial symbiosis through a web-based resource exchange in the Spaanse Polder mixed industrial area. In particular, the Pulsup Project aims at fostering the exchange of waste material flow, at optimizing the use of already available resources and at connecting firms through the use of an ICT tool. To be precise this ICT tool is inspired by the opportunities offered by the recent diffusion of sharing economy online websites (see next section).

2.2.5 The sharing economy

The sharing economy is a rather recent concept which is difficult to define in an unambiguous way because the debate concerning it is still open. Surely, the sharing economy cannot be considered a natural system

approach. However, the sharing economy is here briefly introduced because the diffusion of sharing economy online websites have inspired the Pulsup Project. The huge diffusion of the mobile Internet is responsible for the interest that nowadays media, politicians, and scientists reserve to the spread of a myriad of online platforms and application that are generally gathered under the umbrella definition of *sharing economy*. Some of these online platforms could support industrial synergies and circular economy initiatives through web-based exchange of resources, like the sharing economy online platform Floop2 (see later in this Section). In fact, the sharing economy can be also seen as opportunities for new business that employ the leasing model of their products and appeal to the environmentally conscious audiences (Kopnina, 2015).




The concept of sharing economy may stand for many different things. Overall the sharing economy (sometimes also referred to as the peer-to-peer economy, mesh, collaborative economy, and collaborative consumption) is a socio-economic system built around the sharing of human and physical resources. It includes the shared creation, production, distribution, trade, and consumption of goods and services by different people and organizations (Matofska, 2014). These systems take a variety of forms, often leveraging ICT to empower individuals, corporations, non-profits and government with information that enables distribution, sharing, and reuse of excess capacity in goods and services (Sundararajan, 2013). The sharing economy encompasses a wide range of structures and business models including for-profit, non-profit, barter, and co-operative structures. Corporations, governments and individuals all actively participate as buyers, sellers, lenders or borrowers in these varied and evolving organizational structures.

Share-based offerings are based on a set of values that often includes trust, transparency, economic empowerment, creative expression, authenticity, community resilience, and human connection. The concept of sharing economy has been championed by Rachel Botsman and Roo Rogers in their 2010 book 'What's Mine Is Yours: The Rise of Collaborative Consumption'. Herein, different forms of sharing are classified on the base of their features. Sharing economy initiatives can be *product service systems*, *redistribution markets*, and *collaborative lifestyles* (see Image 2.1).

Firstly, *product service systems* enable companies to offer goods as a service rather than sell them as products. Goods that are privately owned can be shared or rented peer-to-peer. Product service systems appeal to the increasing number of people shifting to a usage mind-set: they want the benefits of a product, but they do not need to own the product outright (e.g. Zipcar). Secondly, in *redistribution markets*, used or pre-owned goods are moved from somewhere they are not needed to somewhere they are. In some markets, the goods may be free (e.g. on Freecycle, or Kashless). In others, the goods are swapped, (e.g. on thredUP, or SwapTree) or sold for cash (e.g. eBay, or craigslist). Over time, "redistribute" may become the fifth R -joining "reduce, reuse, recycle, and repair"- and a key form of sustainable commerce. Thirdly, in *collaborative lifestyles*, people with similar needs or interests band together to share, rent and exchange less-tangible assets such as time, space, skills, and car-rides. These exchanges happen mostly on a local or neighborhood level, as people share tools (e.g. Peerby) or working spaces (e.g. Seats2Meet, Citizen Space or Hub Culture), gardens (on SharedEarth or Landshare), or parking spots (e.g. on ParkatmyHouse). However, collaborative lifestyle sharing also happens on a global scale through

exchange houses during the holidays (e.g. LoveHouseSwap) or through peer-to-peer renting of rooms and apartments (e.g. on Airbnb). Otherwise, people give car-rides in exchange of a little fee (e.g. on BlaBlaCar).

Image 2.1. The three main different forms of sharing economy in practice.

	THE PROBLEM	THE SOLUTION
PRODUCT SERVICE SYSTEMS	Half of U.S. households own power drills, but most of them are used for only 6 to 13 minutes during their lifetime.	 Zilok.com offers peer-to-peer daily rental of tools, camcorders, and other goods.
REDISTRIBUTION MARKETS	Americans discard 7 million tons of cardboard annually.	 UsedCardboardBoxes.com "rescues" and resells boxes to movers.
COLLABORATIVE LIFESTYLES	Millions of houses and spare rooms around the world are sitting empty and have "idling capacity."	 Airbnb.com, the "Match.com for travel," allows anyone from private residents to commercial property owners to rent out their extra space.

Through the analysis of these different forms of the sharing economy it becomes evident that the sharing economy encompasses public and private sector organizations and firms, which work within the various realms of the sharing economy. The realms of the sharing economy are the peer economy, the collaborative

economy, and the *circular economy*. The shift from defining unused value as waste to defining it as an opportunity to create value from more efficient resource use is the common factor among all sharing economy organizations. This shift surfaces in two primary ways. First new models for reusing the excess capacity of infrastructure, owned assets, and talents are available to the wider market through networks, community, and technology-enabled platforms. The second approach seeks to redefine waste from something that is thrown away into an opportunity for reuse and redistribution, which is a hallmark of the circular economy approach. These two approaches to unused value as a resource emerge in sharing economy models as a commitment to the design, development, and distribution of products, services, and information that supports sustainable resource use and strong, resilient communities. Hence the circular economy, as well as industrial symbiosis, can be facilitated by the use of technology-enabled sharing economy platforms that allow the achievement of a more effective and efficient use of the flows of resources.

Generally, technology may constitute the tool to realize the needed social and economic changes and realize the circular economy. In other words, the circular economy could be facilitated by the use of technology-enabled sharing economy online platforms that allow the achievement of a more effective and efficient use of the flows of resources. However, it is important to notice that while all these constructive frameworks are the promises for the future, some of them, can be subverted by profit-seeking innovative designs and technologies. The case of AirBnB, which has recently been object of an

intense and critical debate in several European countries, constitutes a clear example of this risk. As Kopnina (2014) said “while ideas, ideals and innovations can be subverted and greenwashing is common, the challenge is to retain the constructive ones. A good guiding principle in adapting these frameworks is an application of ideals and ethics”.

Floow2: an example of sharing and circular economy online platform

Nowadays, some projects have been started in order to implement the circular economy through the use of sharing economy online platforms. Floow2 may constitute an example of how these ‘new economies’ – the circular and the sharing economy – can be combined. The Floow2 is an online platform (www.floow2.com), which may be classified under the lettering of *redistributing market* kind of sharing economy. In the homepage Floow2 is described in this way: “Floow2 is a business-to-business sharing marketplace where companies and institutions can share equipment and the skills and knowledge of personnel. Floow2 unites supply and demand and creates transparency concerning who has what, and where and when it will be available”. Using Floow2 companies and institutions can share, renting out or selling, their idle capacity, unutilized equipment, or the knowledge and skills of the personnel. For example, the users can share an excavator, a crane, print facilities, square meters, cars, trucks, trailers, medical equipment, knowledge and skills of the personnel. In other words companies can share anything that can positively contribute to their business, renting it out when stands idle. This business model is a profitable way of turning the costs on investments into extra money by renting out companies idle capacity; in this way there is an increase of the turnover while lowering the operating costs and contributing to sustainability. Hence, this innovative business approach boosts a more optimized exploitation of the value of already available resources, hence it constitutes a way to attain *eco-effectiveness* and *eco-sufficiency*.

Looking at the *three stages* of whole process of the circular economy, it is possible to understand why Floow2 can be defined a circular economy practice. The first stage is how to design products and produce them, the third stage is the waste management, recycling, and reuse, and the second stage is how to make a better use of what companies already own. Floow2.nl acts in the latter stage. This is a smart ideas because it is financially beneficial (extra money and turnover can be made all over the company’s costs), it is beneficial for the environment (reduction of consumerism and ecological footprint), and the people’s businesses connects and business communities are created. The main constrain of this business model is people mindset. People need to think about it, understand the possibilities and see the opportunities in order to make it a daily business practice.

Last but not least, the Floow2 initiative evokes the co-siting practices existing in certain business parks. There are many definitions of co-siting, but overall it can be defined as the sharing practice of equipment between different systems at a given site. It implies a trade-off between saving resources and maintaining optimum operational performances while creating collaborative networks. In industrial ecology literature, the resource sharing among co-sited firms is defined ‘industrial symbioses’ or ‘ecological symbioses’ (see section 2.1.3).

2.3 Firms' features

This research also explores the relation between firms' features and willingness to participate in a project that like the Pulsup fosters a more symbiotic and circular way of doing business in the SMEs Spaanse Polder mixed industrial park. The Spaanse Polder, which will be more thoroughly depicted in Chapter 4, is a mixed industrial park of the city of Rotterdam, in the Netherlands. A *mixed industrial parks* usually house a variety of small- and medium-sized enterprises (SMEs), although some of them are subordinated to large holding companies, with no or little coupling of production. For example, mixed industrial parks can home the labor or knowledge intensive industries, craftsmanship, services of local importance, and related activities. Lambert and Boons (2001) noticed that "because the enterprises in a mixed industrial area are small- and medium-sized and are active in a variety of branches, there might be competition on the one hand, indifference and difference in interest on the other hand. Coherence is poor" (Lambert & Boons, 2001). Hence, in mixed industrial complexes seems more difficult to realize industrial symbiosis than in industrial parks where the geographically concentrated industrial activities are mainly process industries, with tight couplings of a relatively small number of materials and energy intensive production processes. Divergence in the interests of the involved enterprises, poor organization, and a lack of acquaintance with co-operation have been identified as the principal causes for the slowing down or failing of most of the initiatives. However, this information could be biased by that fact that in the literature, the impact of mixed industrial parks, although increasingly important from both an economic and an ecological point of view, has been underestimated to a great extent (Lambert & Boons, 2001). This became evident by the nearly exclusive emphasis in the literature on the Kalundborg example as *the* model for eco-industrial parks. Hence, this research gathers the request lunched by Lambert & Boons to conduct further research about mixed industrial parks to further explore triggers and constraints to the realization of industrial symbiosis in this kind of industrial park. Furthermore, the emergence of web-based tools for resources exchanges may support the realization of industrial symbiosis in this kind of settings.

Given the diversity that characterizes mixed industrial parks like the Spaanse Polder, it was considered relevant to look at certain features of a firm to detect which one affect a firm's willingness to participate in a project that promotes industrial symbiosis by means of an ICT tool in a sharing economy fashion. It was assumed that certain firms' features explains their willingness to participate in a project like the Pulsup (Newlands, 2002; Oberhofer & Furst, 2012). Usually the research about the factors that explains people behaviors and their willingness to participate shows that the demographics constitute an explicative variable. Given that firms are constituted by people who decides about the behavior of a firm, and that willingness is sometimes called the "human factor" because it refers to the human feeling of desire to invest into an industrial symbiosis project (Almasi et al., 2010), the specific features of a firms were treated as they would correspond to the demographic of a person. The features that were selected are: the industry and the sector to which the firm belongs, the location of the firm in the Spaanse Polder, the size of the firm, the age of the firm, the embeddedness of the firm, the quality of the firm, the scale of the market orientation of the firm, the innovativeness of the firm. A firm's complementary assets and resources, employee commitment, export orientation and further characteristics, capabilities, corporate governance and strategies also play an important role (Fraij-Andres et al., 2007).

2.4 Interest in the collective use of resources

Thirdly, it was decided to look at firms' interest in making a collective use of resources and assets, because it was assumed that this constitute a driver of firms' willingness to participate in the Pulsup Project (Almasi et al., 2011). In particular, it was decided to investigate whether firms' needs in terms of resources and assets are compatible because firms would be more willing to make a collective use of resources whether their interests are at stake in the matter (Ben-Elia & Ettema, 2009). In fact, finding complementarity of needs is fundamental to both realize industrial symbiosis, and guarantee an economic profitability to the firms that are involved, because economic incentives are considered as the primary driver leading to the development of a business strategy (Almasi et al., 2011). Usually, policies and projects that aims at developing symbiosis and matching the metabolic flows of materials that circulate in an area adopt the material flow analysis. Understanding what kind of flows circulate in an area is important to realize the closure of industrial and urban material cycles because the activities that are needed to close these local material flows can be used as driver for local industry and the strengthening of local social networks. ICT-based interventions can smartly connect local firms with another and boost the efficiency of resource flows (Gladek et al., 2015).

3 The case study: The Pulsup Project ~

The Pulsup Project constitutes the case study of this thesis research; this chapter introduces and depicts it. The Pulsup Project (<http://pulsup.org/>) is a project of industrial renewal that concerns the study of the opportunities and constraints to the development of a web-based exchange of resources in a sharing economy fashion in the Spaanse Polder SMEs mixed industrial area (see Chapter 4). The project is inspired by the concepts of circular economy, sharing economy, and industrial symbiosis, among others, which constitute the background concepts of the project. The end goal of the project is to define the guidelines to develop an ICT tool in a sharing economy website fashion. The ICT tool would constitute a coordination mechanism and information sharing enabler to support daily exchange and sharing of resources among the firms of the Spaanse Polder. Furthermore, defining the features of this ICT tool, the Pulsup Project aims at constituting a model to implement more synergic and circular way of doing business in already constituted business parks and thus at fostering more sustainable and smart industrial practices to requalify them in a sustainable and smart fashion. The Pulsup Project is promoted by the Superuse Studios of Rotterdam.

3.1 The promoters of the Pulsup Project

The Superuse Studios (<http://superuse-studios.com/>) are a joint venture that realizes different kind of urban projects that are permeated by the concepts of sustainability, circular economy, blue economy (Pauli, 2010), and urban metabolism. The Superuse is based in Rotterdam since 1997 and it has become a pioneer in the field of sustainable design. The firm is renowned nationally and internationally for its innovative design approach as well as for providing 'open source' methods and tools to the design community. All with the aim to make effective use of frequently wasted resources and energy. In particular, the firm is specialized in urban interventions, design, architecture, urbanism and research. Because of this wide range of specializations the design approach of the Superuse Studios is flexible and easy to apply at different scales and to concepts such as social design, urban farming, the circular and the blue economy. Superuse studios researches, designs, builds innovative products, interiors and buildings and develops strategies for smart urban transformations.



3.2 The vision of the Pulsup Project

The Superuse Studios, in line with its identity and inspired by the 'natural systems paradigms' (see Chapter 2), wants to realize a systematic transition from a linear to a more circular way of doing business in the Spaanse Polder mixed industrial area of Rotterdam. To support this transition the Pulsup Project aims at realizing an ICT tool resembling a sharing economy online website (it takes inspiration from sharing economy platforms like Floop2, Peerby, AirBnb, SnapCar, Blablacar). The idea is that the Spaanse Polder' firms could use this ICT tool to cooperate with each other sharing and exchanging locally available assets and resources. In

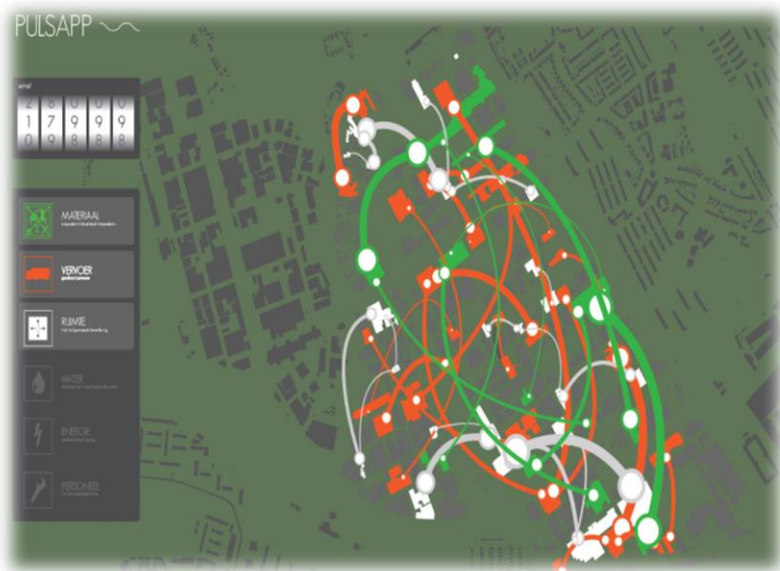
this way, it would be possible to make a more optimal use of the locally already available resources with the consequent reduction of waste of materials and carbon footprint. The project's vision sees the Spaanse Polder as a functioning organism: its parts are connected and complementary, one company's waste becomes another company resource, and the use of local resources is efficient and effective. Here should be the gain, in both individual and communal terms. The single enterprises achieve a gain (e.g. economic, social, and environmental) and the Spaanse Polder as a unit as well (e.g. environmental, fame, innovativeness). In this way the Pulsup Project on the one hand, wants to requalify this industrial area of Rotterdam while fostering its transition towards a more sustainable and innovative way of doing business, while on the other hand, it aims at defining a model that could be applied to realize this transition in other industrial areas of the Netherlands, for example.

3.3 The origin of the Pulsup Project

The ambition of constituting this new kind of business system in the Spaanse Polder mixed industrial park of Rotterdam accidentally originates from the in-depth urban planning study about the Spaanse Polder that was conducted by one of the members of Superuse Studios few years ago to realize his graduation 'urban design' master project. Grant et al. (2010) observed that the formation of industrial symbiosis networks is characterized by a cyclic process comprised of five main phases: 1) opportunity identification, 2) opportunity assessment, 3) removal of barrier for realization, 4) commercialization, and 5) documentation and publication. Accidentally, the just mentioned graduation 'urban design' master project constituted the 'opportunity identification' phase for the definition of the Pulsup Project.

The in-depth urban planning study about the Spaanse Polder provided the Superuse Studios with knowledge about this industrial area in historic and current terms.

In particular, it showed several spatial planning downsides and deficits in terms of optimal use of resources. For example, it was seen that some firms have available space that they do not use, but that they could rent out for a cheap price to start-ups; or, that certain firms generate more energy than that they consume, so that there is an overproduction of energy that could be locally distributed. These constituted just two examples out of many that were drawn in the graduation project that show how the use of available (flows of) resources (circulating) within the area could be optimized. That is, it was noticed that the Spaanse Polder, as well as many other similar industrial areas (not only) in the Netherlands, generates large amount of wastes, where with 'waste' is meant everything that is not optimally used, like



empty spaces, not filled couriers, idle capacity of equipment and machineries, and over -production and/or –consumption of goods, assets, machineries and energy.

The (flows of) resources circulating in the Spaanse Polder constitute one of the most important ingredients for the project, with them the goal is to match different firms' needs. To do so, the interaction among the firms is required, as well as their cooperation, which will be realized by means of an ICT tool. The ICT tool would support the interaction and cooperation among firms in two ways: helping a firm finding the locally available assets and resources, and provide with a structure and an organization to realize the matching of these (flows of) resources. Ideally, in the long-run this project would bring economic, ecologic, and social benefit to every firm of the Spaanse Polder. These observations boosted the decision of the author of this graduation project, who is also member of the Superuse Studios, to sketch the Pulsup Project industrial renewal project for the Spaanse Polder.

Towards the end of the year 2014, for two months, I collaborated as intern with the Superuse Studios at the definition of the Pulsup Project. At the end of this collaboration, the outline of the Pulsup Project was ready to apply for the AARO's 'Urban Transformations' programs called 'Designing the Smart City' that is promoted by the Stimuleringsfonds (<http://stimuleringsfonds.nl/en/>) or Creative Industries Fund of the Netherlands. The objective was to obtain this public grant and finance the successive development of the Pulsup Project. At the beginning of 2015 the Stimuleringsfonds communicated to the Superuse Studios the winnings of the grant it had applied for to develop the Pulsup Project. The Stimuleringsfond, which invest in innovation to stimulate the economy, found the Pulsup Project interesting because of the combined use of technology and sustainability concepts it proposes. This combination was considered in line with the smart perspective of development promoted by the city of Rotterdam, which in 2014 was recognized as one of the leading smart cities of Europe.

The Superuse Studios started working at the project in March 2015. The grant was delivered to the Superuse Studios provided that after a year, at the beginning of 2016, an exhaustive report and feasibility study about how to develop an industrial symbiosis by means of an ICT tool in the Spaanse Polder would be submit to the fund. Hence, in few months from now (December 2015) this phase of the project will be completed and conclusions will be drawn about the feasibility of the project. Successively, it will be evaluated whether and how to bring the Pulsup Project forward in a more operational phase.

3.4 The current situation

As we saw in the previous section of this chapter, Grant et al. (2010) observed that the formation of industrial symbiosis networks is characterized by a cyclic process comprised of five main phases: 1) opportunity identification, 2) opportunity assessment, 3) removal of barrier for realization, 4) commercialization, and 5) documentation and publication. Whether the in-depth study conducted by one of the members of the Superuse Studios for his graduation constitutes the 'opportunity identification' phase, currently the Pulsup Project finds itself in the 'opportunity assessment' and 'removal of barrier for realization' phase. Despite its long-term ambition, this means that currently the Pulsup Project is gathering knowledge and information about the area and the Spaanse Polder's firms (e.g. flows of resources, compatibility of needs among the companies, kind of existing relations among the companies),

as well as about the local institutional framework, but it is also networking and rendering local stakeholders aware of the project, defining strategies of industrial symbiosis development, and evaluating the feasibility of the project. The aim of the project is to detect triggers and constraints and develop a feasibility study, which in future could be used to develop the ICT tool and implement web-based resource exchanges in the area, as well as in other industrial areas.

A critical aspect for the success of the project is rising stakeholders' awareness of the project, its background concepts, the necessity to increase the environmental management, and that environmental and economic opportunities can be drawn by the adoption of symbiotic practices at the local level. The formation of a first group of supporters is particularly delicate, because as the Network effect theory suggests, as the number of companies is growing, the number of possible synergies grows in a geometrical way (Almasi et al., 2011). Moreover, the first group of supporters of the Pulsup Project would constitute the catalyst of the project's implementation. Hence, of primary importance is to let comprehend the local players that the benefits of participating to this new sharing, circular, and symbiotic system are higher than the costs of it. Accordingly, the definition of a successful communication strategy to involve local stakeholders plays a critical role.

The Pulsup Project's communication strategy recurs to two main tools; it uses a broker of supporters and organizes workshops with local entrepreneurs. The broker of supporters is a person who knows the Spaanse Polder, as well as the 'language' of the entrepreneurs. The role of the broker is delicate because it bridges local firms among them and with the Superuse Studios while triggering their interest in the project. On the other hand, the workshops are meant to inform local firms, understand their needs, let them know each other, and engage them in the Pulsup Project creation process. From March 2015 and December 2015 two interactive workshops have been organized in the Spaanse Polder with some of the local entrepreneurs.

A communication strategy is successful when it is able to persuade the firms of an industrial area to participate in an industrial symbiosis and asset sharing project like the Pulsup Project. To involve the firms in the project means to help and trigger the firms of the industrial area changing their mindset and motivation to participate. In fact, the mindset of the firms, which is rooted in their routine, was seen as one of the main obstacles to overtake to realize the project that want to realize industrial symbiosis and assets sharing. The reason is that such kind of project requires firms' shift of mindset; it requires them to start conceiving the way they usually do business in a new way, which is through dialogue and cooperation. The mindset will change if the companies are willing to embrace another vision about their business practices. This explains why the research at hand's aim is to look at the factors that affect the willingness of the firms to participate in a project like the Pulsup Project. Once that the firms are willing to participate in the project they can be involved and participate in it. Without willingness an industrial symbiosis and assets sharing project seems destined to failure.

3.5 This research's contribution

This research could contribute to the Pulsup Project because it provides it with further in-depth information and knowledge about the area and its entrepreneurs. Moreover, deepening the knowledge

about the formation of firms' willingness and how it is affected by awareness, firms' features, and their complementarity of needs in terms of resources it is useful to develop a more proper communication strategy to involve local entrepreneurs, as well as to understand what their needs are.

4 The context: the Spaanse Polder ~

This chapter describes the Spaanse Polder SMEs mixed industrial park of Rotterdam because it constitutes the context selected by the Superuse Studios to develop the Pulsup Project (see Chapter 3). As we saw in the previous chapter, the Pulsup Project originates from the graduation project in a master of urban design realized by one of the members of the Superuse Studios. This urban design project revealed several spatial and structural downsides of the area which inspired the definition of the Pulsup Project. Further information about why this area was selected can be found in the Chapter 3.3.

This chapter provides with information about Rotterdam, the Spaanse Polder industrial park, and the two Spaanse Polder's firms organizations. This information is useful to contextualize and better understand the answers that the interviewees provided when they were interviewed to investigate whether the hypothesis supporting this thesis research hold (see Chapter 5 for more information about research methodology).

4.1 The Spaanse Polder SMEs mixed industrial park of Rotterdam

The Spaanse Polder constitutes an important SMEs mixed industrial park for the city of Rotterdam. Rotterdam is the second largest city of the Netherlands, and it is the largest port in Europe. The port's main activities are petrochemical industries and general cargo handling and transshipment. The harbor functions are an important transit point for bulk materials and between the European continent and overseas. From Rotterdam goods are transported by ship, river barge, train, and road.

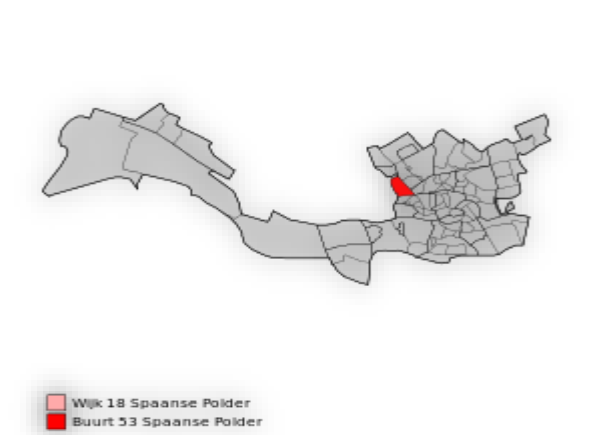


Figure 4.1. The position of the Spaanse Polder in the map of Rotterdam's metropolitan area

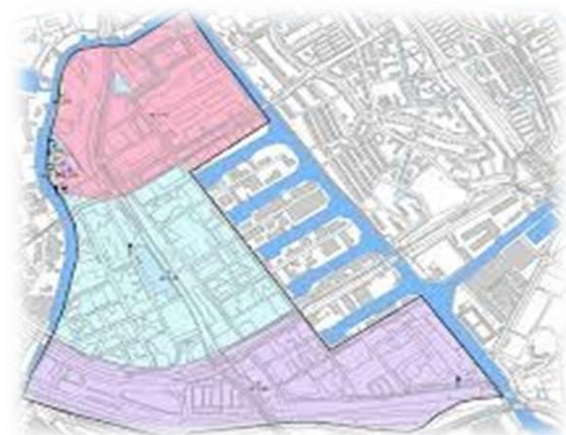


Figure 4.2. A map of the Spaanse Polder

The Spaanse Polder constitutes an important SMEs mixed industrial park that generates a large turnover for the city of Rotterdam. The interviewee of firm 11 said *"Spaanse Polder, Gravelandse Polder, North West. Those are the three biggest industrial areas in Holland, for small and medium companies"* (int. 14, co. 11, p. 1). The Spaanse Polder covers an area of about 770 km² and is located in the North-West part

of Rotterdam (figure 4.1), and it is not far from the city center. In fact, the Spaanse Polder is distant 1.5 km from the Rotterdam Central Station and 1km from the city-airport. The West-part of the Spaanse Polder (figure 4.2) is administrated by the city and municipality of Schiedam, which is part of the Rotterdam metropolitan area, while the East-part is administered by the city and municipality of Rotterdam. The manager of the Environmental Protection Agency of Local and Regional Authorities in the Rijnmond region (DCMR) said *“the Spaanse Polder industrial area is shared by two municipalities. The border between Schiedam and Rotterdam is artificial. It is there, but there is for instance a business association that covers both Rotterdam and Schiedam side”* (int. 3, Institution 2, p. 1). The location of the Spaanse Polder is strategic, because of its accessibility. In fact, the area is enclosed by two highways, the A20 and the A13; one of them, the A20, passes through the area to distribute goods in the region. In addition, for customers it is also easy to visit the area because there is much free parking space.

Because of its history and location, the Spaanse Polder is nestled in the collective memory of the city. In fact, the Spaanse Polder was set in 1935, and since then the area has passed through many changes, which show its robust character. The changes concern its internal composition (type of enterprises, type of users and costumers, location’s value, etc.), its relation with the city, and its spatial design. Initially, the Spaanse Polder’s operations were primarily directed towards the port of Rotterdam; this can still be seen looking at the five small ports of the area (figure 4.2). However, nowadays the waterways are underused. This is partially due to the fact that many manufacturing industries have moved to low-wage countries, and the relationship between the companies (and their location) seems less important. About the possibility of introducing physical and systematic changes in the Spaanse Polder, the interviewee 1 said that because of the physical structure that dates back to the first half of the 20st century structural changes are difficult and expensive to introduce (int. 1, co. 1, p. 5).

Currently, about 600 firms are registered in the Spaanse Polder, however only about half of them are also operatively established in the Spaanse Polder. To better understand this point we can look at what the interviewee of firm 1, which is a printing company, said *“...I don’t think there are 600 firms anymore... in the Spaanse Polder! It depends on what you count. Yes, there are 600 companies here but here we have production companies, but we have also holdings, and that is more like... a legal thing. So you say you have a holding, and you have a business company, and maybe you have two business companies, or five, and there is a holding above, and maybe there is one above... and if you count them, but if you ask ‘what does the holding do?’ ‘Nothing!’ Only legal registration, tax things, that kind of... But there is no one working there! So if you count just only we have a company, this is the company... so, if you walk in, and you see people working there, I count that as a company. Right?! If you count that, maybe 250/300, that’s half of the Polder. Let’s say maybe 400!”* (int. 1, co. 1, p. 21). In other words, about 400 firms are operative in the Spaanse Polder, even if the number of firms that are registered in the Spaanse Polder is higher. This is the reason why the interviewee 1 then added that it is difficult to count the exact number of firms of the Spaanse Polder. He brings his printing company as example. The printing company is mostly a production company, however it is also a holding for the other firms of the interviewee. These other firms operates in the service sector and provide its clients with movies and apps. They respectively have their name, but legally are under the printing company umbrella cover.

As we saw, the Spaanse Polder constitutes one of the biggest SMEs mixed industrial parks of the Netherlands. The image evoked in the following quote of Lambert and Boons (2001) somehow depicts the identity of the Spaanse Polder and clearly explains what a SMEs mixed industrial park is:

“Although the heavy industries have been clustered for long, the picture for most of the other firms is quite different. This concerns, e.g. the labor or knowledge intensive industries, craftsmanship, services of local importance, and related activities. Most of these enterprises are small- or medium-sized, although some of them are subordinated to large holding companies. The role of clustering has always been modest here. Some concentration because of the presence of specialized expertise, cheap labor force, or the vicinity of particular resources such as pure water, originally played a role in traditional industries such as the production of textile, cigars, leather and other. Originally, individual enterprises emerged in or near residential areas. Frequently, these were dangerous, they emitted hazardous substances, or they caused nuisance such as noise, stench, dust, and transport. From the company’s point of view, expansion appeared virtually impossible, particularly because residential districts”.

However, this does not mean that the Spaanse Polder does not also host some big-sized firms. The noteworthy feature of the firms of the Spaanse Polder is their heterogeneity. Heterogeneity in the type of enterprises implies variety of business costumes, standards, and needs. Firms are mainly part of the wholesale sector, small-scale manufacturing industry (e.g.: car industry), and food industry. Large chain companies tends to operate in wholesales, semi-finished product in closed chain, and assemblage. Family businesses mainly operate in the manufacturing industry, wholesales, semi-finished and finished products, logistics, and services. Small-scale businesses like start-ups, garages, and laboratories operate as workshops, trade companies, retail market, and services. Overall, the Spaanse Polder is not characterized for hosting production companies. This is particularly true for what concerns the Groothandelsmarkt Spaanse Polder.

4.2 The Groothandelsmarkt Spaanse Polder

The *Groothandelsmarkt* Rotterdam Spaanse Polder – wholesale market - constitutes a closed area within the Spaanse Polder which gathers wholesalers of fruits and vegetables, and other alimentary products. The relative website says:



“The Wholesale Market Spaanse Polder comprises several markets where a wide range of food products are traded. Such products include meat, fish, vegetables and fruit, potatoes, dairy products and flowers. The Wholesale Market is located in Rotterdam’s Spaanse Polder district and houses some 70 trading companies (residents). The total value of trade

amounts to 1,500 million euro annually and employs approximately 800 staff. The Wholesale Market plays an important role in the food sector as it brings together buyers and suppliers of food products. Its importance therefore extends to the catering and retail industry and many related economic sectors”.

The Market was founded in 1969 and since then it has been under control of the College of Mayor and Aldermen of the city of Rotterdam. Its primary purpose is fulfilling the municipal core task of food distribution: “The municipal control extends to managing the Wholesale Market’s distribution center, i.e. by renting out units to wholesale traders, issuing long lease land, providing supportive services like security, order regulation and surveillance. The sheds from which is traded are let to small traders (1-2 sheds) to medium sized trading companies (up to 20 sheds). As a regional amenity it is an important economic function for the entire region”. Today the Wholesale Market is the biggest employer of Spaanse Polder Business Park, although the market itself is actually not one employer but encompasses multiple employers. The market comprises 45,000 m² of business accommodation, on a market area covering 114,000 m². Currently, preparations are being made for redeveloping the market.



In contrast with the rest of the Spaanse Polder industrial park, this area gathers about 70 firms which industry and specialization tends to be homogeneous and geographically proximate. Thus, the wholesale market Spaanse Polder constitutes a specific ‘habitat’ or ‘ecosystem’ within the Spaanse Polder which presents different features compared to the rest of the industrial park. Does the location of a firm within the Groothandelsmarkt Spaanse Polder affect firms’ willingness to participate in the Pulsup Project? Why? Do the specific features of this area discriminate its firms from the firms that are located outside the Spaanse Polder?

4.3 The Spaanse Polder firms’ organizations

In this section of this chapter, we are going to illustrate the two firms’ organizations of the Spaanse Polder, which are the *Belangenvereniging Spaanse Polder* and the *Spaanse Graave*. The point of view of the interviewee of firm 1 and chairman on the *Belangenvereniging Spaanse Polder* about the difference between the two organizations was expressed with this words: “*you have also the Spaanse Grave... what we have is the Belangenvereniging, it takes care of the problems between the private and the public. While the Spaanse Grave is more like social club, the community club, to know to do some nice things like go to golf, visit a company, have a speaker over to tell you something about it, and then eat and drink, and after words who knows if that brings any extra orders in your pocket, so this Spaanse Grave may be interesting to talk also to, because they have a different position respect to what we do as Belangenvereniging*” (int. 1, co. 1, p. 17). Otherwise, for the interviewee of firm 5, the difference between the two organizations is that while the *Spaanse Graave* is more business club, “*the Belangenvereniging is doing the cleaning of... and safety, and all the safety projects!*” (int. 5, co. 4, p. 1). Again the difference between the two organizations was described by the former chairman of the *Spaanse Graave* as follows: “(the *Spaanse Graave*) *it’s a business club, it’s to gather and do business together but it is not about our interest in the area. The Belangenvereniging is for it. (The Spaanse Graave) is more business to business in a nice environment. It is what we do. We can give some info if people ask for them but we are not active noticing the info shared with our partners (like the Belangenvereniging)*” (int. 6, Institution 3, p. 1). In other words,

these two organizations are meant to perform different functions for the firms of the Spaanse Polder. Does being a member of one of these organizations affect a firm's willingness to participate to the Pulsup Project? How?

4.3.1 The Belangenvereniging Spaanse Polder

Despite the differences among type of businesses of the Spaanse Polder, many firms are represented by the *Belangenvereniging Spaanse Polder's* interest association (www.bvspaansepolder.nl). The birth of this interest association in 2001 is concomitant with the launch of a restructuring project for the Spaanse Polder (2001-2015). This is the Spaanse Polder 2015 that should lead to a better and more attractive business environment when it comes to issues such as accessibility, cleaning, and security. This is the idea behind the project Spaanse Polder 2015 that is performed under the direction of the Rotterdam Development Corporation (OBR). Through the association, the businesses located in the Spaanse Polder can join their forces and determine a collective interest, mostly in relation to the public authorities. In this way, the dialogue between the Spaanse Polder's interest association, which is the official partner of the OBR, and the (local) public authorities is facilitated every time an initiative concerning the Spaanse Polder has to be discussed. Important issues are directly linked back to the members. However most of the contacts among businesses happen by email and phone. If there is a specific reason, a meeting or gathering is held. Finally, the secretariat of the association is accessible five days a week for both businesses and administrations.

The chairman of the Belangenvereniging Spaanse Polder was interviewed. He explained that this organization was born 12 years ago by accident. He said *"well, yes I was the first, but as with all the things you start with some incident... and I had an incident with the government actually because they called me up and they said 'I would like to talk to you' and I said 'OK, what is it about?' 'It is about a highway or the road we'd like to change' and I said 'Ok, interesting, come over!' They showed the maps and the plans. The plan was good, but the road was about half a meter besides our building, so it was not good. However, the plan had been already approved by every institution. So I said 'why do you want to come to talk it over... just tell me that you've decided and tell what is going to happen! So, if I ask you to move your road 5 or 6 meters further from the side of our company...' They said that there was no space to move on one cm. Then we had a really big discussion and I had some agreements on paper with the government. Then in the discussion he said 'I don't remember I have that in my archive!' I said 'ok, what problem is that? This is not my problem, it is your problem. I have this signed by your director, the government, so we can talk it over!' But then, over the shoulders, so, well, we don't remember! And then you have to talk..."* What follows is interesting, he said: ***"so it was the beginning of my awareness that if you want to change or if you are confronted with the government and you're a small firm, there is nothing you can do! The ship is moving and if you're in the way it is too bad for you but it will happen! So, then we started to see if we could do things together! Networking with the others... and there was one company that has any kind of Belangenvereniging in the secretarial way. So they help the Belangenvereniging in the country. I talked them over and they said 'well, let's start it up!' I started it up already, if you become the chairman that would help. So, that's why I became the chairman. At the beginning it was only about communication with the government, only communication and communication and communication, between the companies of***

the Spaanse Polder as a whole and the government. So we tried to make them part of the Belangenvereniging and now we have about 130 companies..." (int. 1, co. 1, p. 20-21).

About 130 firms of this industrial area belong to the Belangenvereniging Spaanse Polder, which is meant to take care of the common interest of the firms of the Spaanse Polder in relation to the authorities. Beyond defending and representing Spaanse Polder' firms common interest, this organization is meant to save resources, because the cost of the initiatives that involve many parts of the Spaanse Polder are shared among the members, like for example the purchase of a cameras for common security issues. The interviewee said *"common interest, common expense... as you could do that with a lot, a lot of things!"* (int. 1, co. 1, p. 15).

4.3.2 The Spaanse Graave

This organization was born about 25 years ago and it gathers about 50 members. Most of the members are firms of the Spaanse Polder, however some of them are not located in the Spaanse Polder. Any firm can become a member of the Spaanse Graave. It is enough to send an e-mail to apply to the Spaanse Graave, and then visit a meeting of its members. However, the former chairman of this organization also said that *"if you're not of this area and there are also one or two companies within the same type of companies we say that it is not the best for our membership, it is not interesting enough for our member, so we basically say that it is not matching our conditions"* (int. 6, Inst. 3, p. 1).

The Spaanse Graave is business club which aim is not enlarge each member network of acquaintances to increase the chance of doing business. The former chairman of this organization also said that *"mostly the Spaanse Grave is networking, meeting with each other, and searching business for each other also. When someone says 'hallo!' I know 2 guys from our business club, I know them quite well, and also I know their expertise, so when somebody needs a lawyer I can say to them 'hey, why don't you go for this person, ask him, tell him my name, and then he will help you better'. Otherwise when one of the lawyers has a friend or a costumer who has trouble with some around the world he thinks I can help out with that he would recommend me. That's what the Spaanse Grave is about"* (int. 6, Inst. 3, p. 4).

The philosophy of this organization is that in a nice and friendly environment is easier to establish new commercial relations. It is a matter of 'trust' building, because trust is important to do business with another part. This is why most of the meetings of the Spaanse Graave members happens in informal settings where entrepreneurs can spend some leisure time together and "play". The members of this organization meet once a month in the Spaanse Polder restaurant Au Marché. The social aspect comes into play, as well as the common commercial interests. In addition, in every meeting a topic is discussed with a guest, and each member can decide to present the topic of the day.

The former chairman of the Spaanse Graave also said *"you can share some experiences with each other, which is one of the main things. Can be part of doing business. It is the restriction also when you become member that you have to be an important person in your company, so you have to be a decision-maker. So that people we have are also with the knowledge and the information about their companies, how they handle with some things. So that when you ask a question to one of your colleagues they can really give*

you an answer with the experience with the government, with the city council, and something like that. Certain issues! That's why we say that or the managing director or the ... should attend the meetings. So, sometimes you get send somebody else but we prefer that is somebody with some relevance for the company. So, that is why... then you get questions about whatever issues ... your stuff, with people there, otherwise we can make a meeting about whatever issue there are questions about" (int. 6, Inst. 3, p. 2). Overall, the Spaanse Graave can be defined a 'business club'.

4.4 This research's contribution

This research wants to contribute to the bulk of scientific investigation that concerns the **implementation of industrial symbiosis by means of web-based resources exchange** in the context of *mixed industrial parks*, like the Spaanse Polder. As Lambert and Boons (2001) noticed most research on the development of industrial synergies focuses on industrial complexes, because their characteristics facilitates the realization of exchanges of materials and by-products and sharing of assets. *Industrial complexes* are defined as the geographically concentrated industrial activities, mainly process industries, with tight couplings of a relatively small number of materials and energy intensive production processes.

By contrast, less attention has been put upon the realization of industrial symbiosis through a web-based resource exchange in mixed industrial parks. *Mixed industrial parks* are characterized by industrial activities, mainly Small and Medium Enterprises (SMEs), which are concentrated in dedicated areas, of a very diverse nature with no or little coupling of production. Hence, in mixed industrial complexes is more difficult to realize industrial synergies: the enterprises are active in a variety of branches, there might be competition on the one hand, indifference and difference in interest on the other hand. However, the emergence of web-based tools for resources exchanges may support the realization of industrial symbiosis in this kind of settings. Studying the Pulsup Project for the redevelopment of the Spaanse Polder mixed industrial park, this research contributes to the bulk of scientific investigation concerning the implementation of industrial symbiosis by means of web-based resources exchange in the context of mixed industrial parks.

5 The Research Design ~

A qualitative research strategy was chosen to answer to **the research question** supporting this master thesis investigation. As we saw in the introduction, this is:

“Given the Pulsup Project, which aims at enabling the transition towards a more symbiotic and circular way of doing business in the Spaanse Polder industrial park through the realization of a web-based resource exchange, to what extent local firms awareness of (and interest in) the project’s background concepts, their features, and their interest in making a collective use of resources affect their willingness to participate in this project?”

The **dependent variable** that we want to explain with this research is the *willingness to participate in the Pulsup Project of a firm* (right variable in the conceptual framework, Image 5.1). In the context of an existing industrial park, a project that aims at realizing a more circular and synergic business system by means of a sharing economy platform to be successfully developed needs local firms’ willingness to become part of this transition process. The aim of this research is to appraise to what extent the following three factors, or **independent variables** (left side of the conceptual framework, Image 5.1), affect a firm’s degree of willingness to participate in the Pulsup Project. These are:

- 1) A firm’s awareness of the Pulsup Project’s background concepts, which are sustainability, sharing economy, circular economy, and industrial symbiosis.
- 2) The features of a firm
- 3) A firm’s interest in making a collective use of resources (e.g. space, transportation and deliveries, machineries and equipment, waste flow material, energy)

Accordingly, the **sub-research questions** supporting the main research question are:

“To what extent the Spaanse Polder’s firms are aware of (and interested in) in the Pulsup Project’s background concepts – sustainability, circular economy, sharing economy, and industrial symbiosis?”
“Does firms’ awareness of (and interest in) the project’s background concepts affect their willingness to participate in the Pulsup Project?”

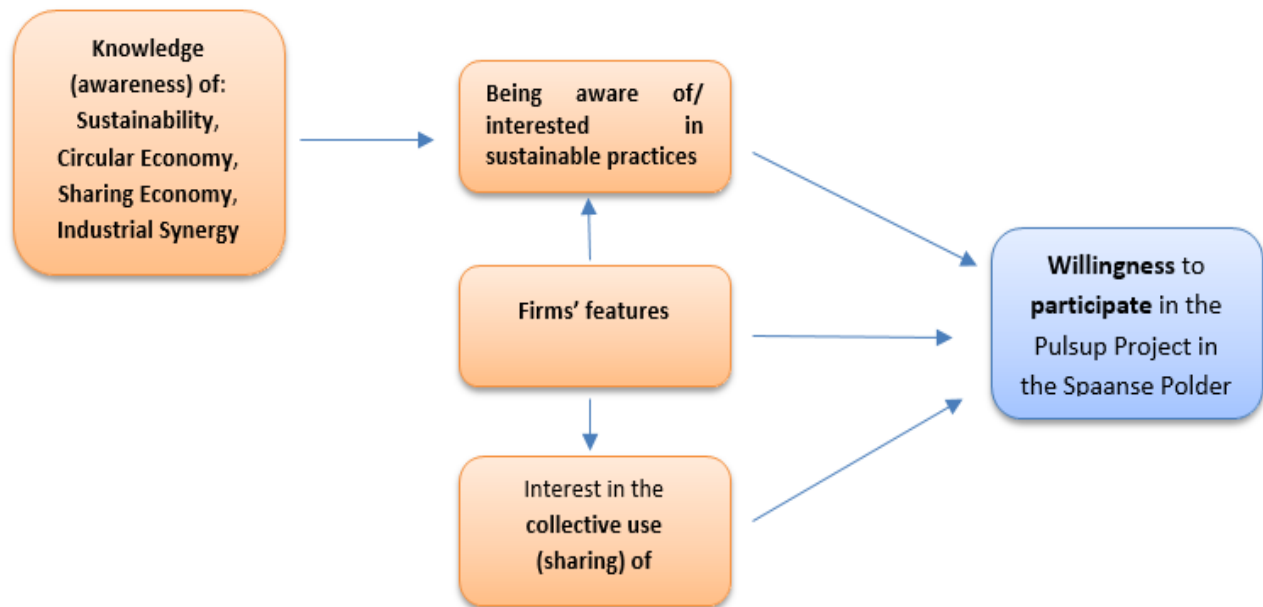
“To what extent the features of a firm affect its willingness to participate in the Pulsup Project?”

“To what extent the Spaanse Polder’s firms’ interest in making a collective use of the locally available resources (e.g. space, deliveries and transportation, equipment and machineries, waste products, and energy) affect their willingness to participate in the Pulsup Project?” *“What do affect firms’ interest in making a collective use of locally available resources?”*

Hence, the main research question was broken down into these sub-research questions. Each question explores one variable. Image 5.1 shows the relation between the independent variables and the dependent variable. In the Appendix at the end of this research it is possible to consult the questionnaire that was used to conduct the interviews to see how the variables were operationalized. The independent

variables were broken down in a series of semi-structured questions. On the other hand, the dependent variable, which is firms' willingness to participate in the Pulsup Project, was operationalized posing to each interviewee the question "given the Pulsup Project (which was previously explained) would you be willing to participate in few meetings with other firms and so participate to its creation process?" As we will see in Chapter 6, the answer gave by the interviewees to this question provide us with a benchmark to refer to while observing the impact of the independent variables upon the dependent variable that is willingness to participate in the Pulsup Project. In the next section, we are going to have a more thorough understanding of the methodology of research supporting this research.

Image 5.1. The conceptual framework supporting this thesis research



5.1 Research Methods

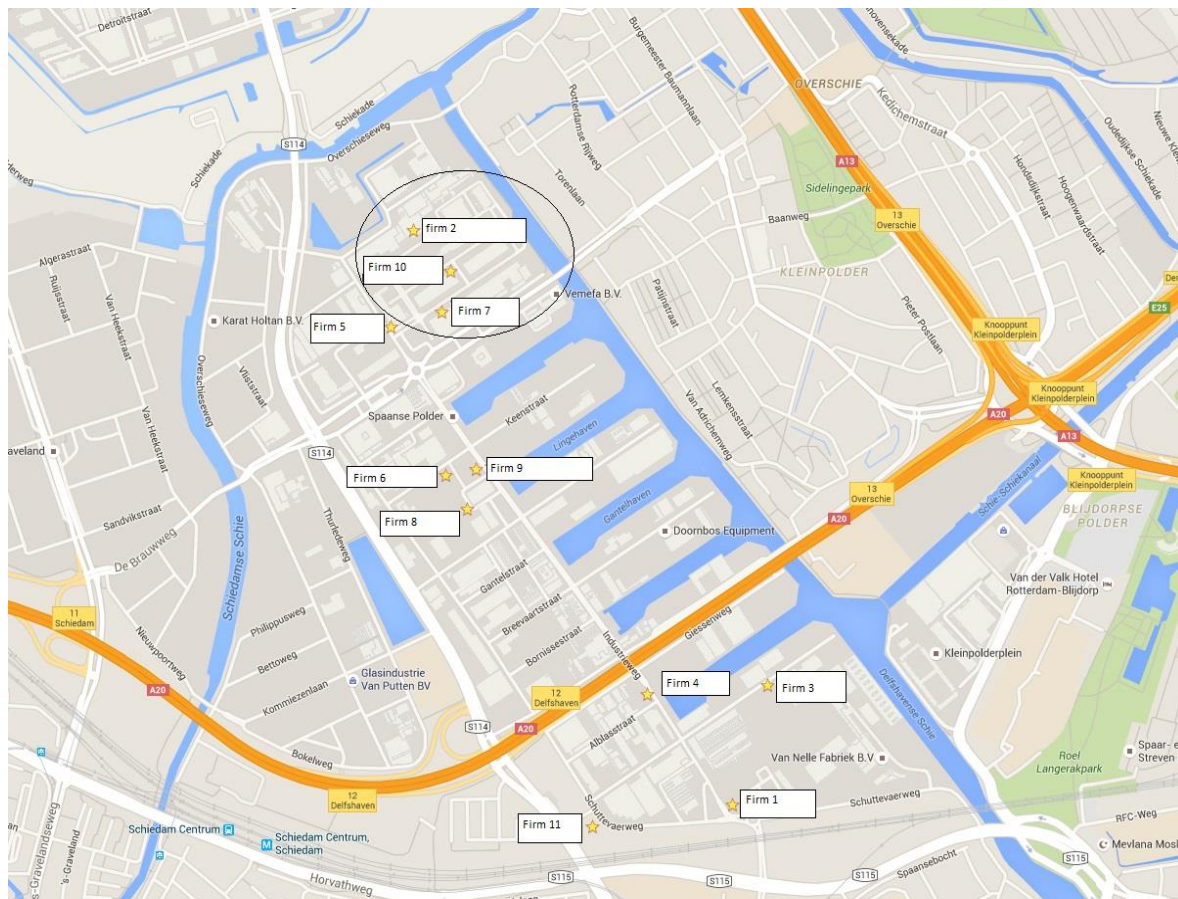
This thesis investigation was mostly supported by a qualitative research strategy, and it is exploratory and empirical in nature. However, it was also supported by secondary data analysis. It was decided to gather *qualitative* data because of the interest in grasping the Spaanse Polder's entrepreneurs' routines and deeply understand them. In fact, talking with the entrepreneurs of the Spaanse Polder it was possible to acquire that oral knowledge that would be difficult to grasp otherwise. In addition, the qualitative strategy of research was also chosen because of this research interest in processes. As the interviewee of the Environmental Protection Agency of Local and Regional Authorities in the Rijnmond Region said "...because the social side of sustainability is undervalued!" (int. 3, institution 2, p. 13).

Semi-structured interviews constitute the research method adopted to conduct this field-study. Each independent variable was investigated asking to the interviewees (that are relevant spokespersons of the Spaanse Polder firms' sample) a series of semi-structured questions. In other words, to investigate each independent variable it was decided to break it down in a series questions. For example, the independent

variable awareness of the Pulsup Project’s background concepts was operationalized posing a series of questions investigating whether the interviewee knew about them. For example, to investigate whether the interviewee was familiar with the concept of ‘sharing economy’, which is one of the background concepts, it was asked whether (s)he had ever heard of/used sharing economy platforms like Blablacar or AirBnB. It is possible to see how both the independent variables and the dependent variable were operationalized consulting the questionnaires in the Appendix at the end of the thesis. As we have just seen in the previous section of this chapter, firms’ willingness to participate in the Pulsup Project, which constitutes the dependent variable, was operationalized directly asking to the interviewees whether they would like to participate in the Pulsup Project creation process. The questionnaire was used to conduct the semi-structured interviews

It was chosen to use semi-structured interviews as method of research for two reasons. Firstly, it left enough margin of maneuver to the interviewee and his/her reasoning, which means that this method guaranteed flexibility to both the interviewer and the interviewee. Secondly, the definition in the questionnaire of certain spheres of interest was useful to come back to the selected aspects when the conversation was moving away from the topics of interest. These semi-structured questions that constitute the questionnaire, were directly posed to the interviewees at the location of their firm or institution.

Image 5.2. The selected firms of the Spaanse Polder and the wholesale market (within the circle)



5.2 Selection and description of the sample

The sample of analysis is constituted by 11 firms of the Spaanse Polder and 4 institutions that are relevant for this research (see Sections 5.2.1 and 5.2.2). Both the institutions and the firms that were interviewed were selected using a snowball sampling technique. This means that each respondent bridged me to the following. This sampling technique was adopted after having realized that pre-defining a representative sample of firms of the Spaanse Polder was useless. In fact, at a certain point I realized how difficult it was to obtain an appointment to conduct the interviews by contacting the selected firms either by e-mail or by phone (I had selected them using the LISA database 2012 for the Spaanse Polder, as well as the Internet). Consequently, I opted for a change in sampling strategy. I attended a job-market fair in Rotterdam, where I met two people who introduced me to entrepreneurs of the Spaanse Polder, and I consulted the Superuse Studios, which is the organizer of the Pulsup Project. That was the beginning of the snowball effect. Even if I must say that in certain cases I just knocked at the doors of firms. In this respect, I can conclude that to obtain the possibility to conduct interviews with the Spaanse Polder's entrepreneurs either the recommendation or a face-to-face approach constitute work much better than sending a cold e-mail or making a phone call. Even if the snowball sampling technique was adopted for necessity, it fits the need for a random selection of the firms of the Spaanse Polder. It provided with a heterogeneous sample of firms that reflect the heterogeneity characterizing the firms of the Spaanse Polder. On the other hand, obtaining an interview with institution's spokespersons was possible also via e-mail. In this fashion, overall fifteen interviews were conducted. Eleven interviews regards firms, while five interviews regards institutions. Out of these five, two interviews regarded both a firm and institution at the same time, because of the double role of the interviewee. In the next two paragraphs, the firms and the institutions that were interviewed will be introduced.

5.2.1 The eleven firms

The eleven firms that were interviewed are shown in the Image 5.1. Image 5.1 constitutes a map of the Spaanse Polder that also shows the location of the Groothandelsmarkt within the Spaanse Polder industrial area, which is indicated by a circle.

Firm 1 is a printing firm.

Firm 7 is a wholesale of fruits and vegetables.

Firm 2 is a wholesale of alimentary products.

Firm 8 is a brewery.

Firm 3 is a printing firm.

Firm 9 is a tailor-shop.

Firm 4 is specialized in the measurement of strain and stresses.

Firm 10 is a wholesaler of fruits and vegetables, and other alimentary products.

Firm 5 is an accounting firm.

Firm 11 is both a bodyshop and a car dealer.

Firm 6 is the mobility director of the taxis of Rotterdam.

5.2.2 The five institutions

Even if this thesis research investigates the factors that affect a firm's degree of willingness to participate in the Pulsup Project, it was decided to also shed light upon the role played by some institutions that are either involved or relevant for this research. Five spokespersons talked about five institutions.

Institution 1 is the Belangenvereniging Spaanse Polder.

Institution 4 is the Stimulerings Fond, which is the institution that provided with a grant the Superuse Studios for the Pulsup Project.

Institution 2 is the environmental protection agency of local and regional authorities in the Rijnmond region (DCMR).

Institution 5 is the Spaanse Graave.

Institution 3 is the Spaanse Grave.

The interviewees of Institutions 1 and 5 are also the interviewees of firms 1 and 11.

5.3 Research tools

To conduct the interviews I used a smartphone to record them, and a Participant Info Sheet. Recording the interviews was considered necessary to avoid the loss of important information. In average, the interviews lasted about 45 minutes. I tried to sense the needs of the interviewee to disturb them the least possible. While I was conducting the interviews with the entrepreneurs of the Spaanse Polder and the spokesperson of the institutions I also started transcribing the interviews to gain time and keep better track of the findings. To transcribe the interviews I used a sound player software and a writing software. Transcribing the interviews was a necessary step that forestalled the analysis of the contents of the interviews. Moreover, every time I conducted an interview I showed to the interviewee an official document of the Utrecht University, the Participant Info Sheet. The Participant Info Sheet explained the academic purpose of the interview and my role of research master student. In this way, the interviewee had all the necessary information to agree upon the conduction of the interview. In addition, the document also served as ice-breaker to open a flowing conversation.

6 Awareness and willingness ~

As said before, the Pulsup Project contains a creation process that would conduct to the realization of a sharing economy website for the Spaanse Polder to boost the realization and maintenance of a more circular and synergic system among the companies of the area. To work, the Pulsup Project needs the support of the firms of the Spaanse Polder, which should be “disposed or consenting, that is inclined”. In fact, the central hypothesis supporting this research is that the *transition* towards a more sustainable, circular and synergic way of doing business in the Spaanse Polder, hence the transition towards a system characterized by a major level of cooperation and sharing of resources among firms, *to be successful necessarily requires local firms’ willingness to participate in the Pulsup Project*. In other words, it was of interest to observe to what extent the Spaanse Polder firms’ degree of willingness to engage in a process that requires their interest and participation to be successful is affected by the *three selected-factors* (see Figure 5.1, the conceptual framework in Chapter 5). These are a firm’s awareness of and interest in the background concepts (sustainability, sharing economy, circular economy, and industrial symbiosis), a firm’s features, and a firm’s interest in collectively use resources. With the aim of understanding to what extent these three factors affect the degree of willingness to participate in a project like the Pulsup, eleven firms of the Spaanse Polder were interviewed.

Out of these four factors, first of all we are going to look at the selected firms’ *degree of awareness of and interest in the background concepts* inspiring and supporting the Pulsup Project in relation to their willingness to participate in the project. Later, in the next chapters we are going to analyze to what extent the other two factors affect a firm degree of willingness to participate in the Pulsup Project. To set the stage it was verified whether the interviewees acknowledge the background concepts that support the Pulsup Project - sustainability, circular economy, sharing economy, and industrial symbiosis, and whether they would like to participate in the Pulsup Project. Are the selected firms aware of and interested in the background concepts supporting the Pulsup Project? Does firms’ awareness of and interest in the background concepts affect their willingness to participate in the Pulsup Project?

It emerged that ‘being aware’ and ‘being interested’ in these sustainable practices constitute interrelated aspects that together affect a firm’s degree of willingness to participate in the Pulsup Project. Hence, firstly we are going to look at the interrelation between awareness of and interest in the background concepts (see Section 6.1). Secondly, we will look at the answer that each interviewee gave when I asked them (more or less) directly whether they would like to participate in the Pulsup Project, which is whether they would assign some of their time to brainstorm with other Spaanse Polder firms to contribute to the definition of the Pulsup Project’s development steps. It was told them that meeting with fellows firms would be necessary to build a sharing economy platform to create, support, and maintain the transition towards a circular economic system in this industrial area. In this “new” system, the Spaanse Polder’s firms would be able to let each other know about their idle capacity in terms of (excess of) assets, or vice versa, about their need of assets (see Section 6.2). Thirdly, we are going to look at the relation between awareness of and interest in the key concepts and willingness to participate in the Pulsup Project. Then, we are going to look at each firm’s degree of willingness to participate in and attitude towards the Pulsup

Project (see Section 6.3). Finally, the conclusions about the relation between awareness of and interest in the background concepts and the Pulsup Project will be drawn (see Section 6.4).

6.1 Firms' awareness of and interest in the background concepts

Looking at the different degrees of the firm's awareness of the background concepts - sustainability, sharing economy, circular economy, and industrial symbiosis - in relation to their degree of willingness to participate in the Pulsup Project, we asked: does firms' awareness of the background concepts support their interest in them?

It was assumed that awareness support interest, and they are necessary to support firms' willingness to participate in the Pulsup Project. *Awareness* and *interest* are somehow overlapping concepts. However, even if similar the meaning of these two concepts – awareness and interest - is different. On the Thesaurus Online Dictionary *awareness* is defined as “the state or condition of being aware, that is having knowledge or consciousness”. In other words, this means that ‘to be aware of’ something means ‘to know’ that something. On the same dictionary, *interest* is defined as “the feeling of a person whose attention, concern, or curiosity is particularly engaged by something”. In other words, this means that ‘be interested in’ something means ‘to care’ about that something.

Given these two definitions, that of awareness and that of interest, we can speculate about how they are interrelated. On the one hand, we can be aware of something without being interested in it. In this case, the dis-interest is conscious, it is a choice. On the other hand, we can be interested in something without knowing much about it. In this case, interest is not supported by awareness (knowledge), thus we can expect it to be more fleeting than when it is supported by awareness. Consequently, we could say that being aware of (or familiar with) something constitutes a condition *sine qua non* is possible to have a consistent and long-lasting interest in that something. *Given the supportive function of awareness it is presumable that when it rises, also interest rises.* In other words, when knowledge of something becomes richer, wider, more detailed and profound, confidence is gained towards the subject at stake. Confidence can be translated in trust about possibilities and increased receptivity about the subject at issue. When this condition is developed then it is easier to become interested in a correlated subject. Interest, however, requires a need, or a query, we want to find an answer to. If there is awareness about something then we can draw from it to answer our query.

Keeping these reflections in mind, table 6.1 was built to confront each firm's degree of awareness of and interest in the background concepts, which constitute different aspects of the more general concept of sustainability. As we have already seen the background concepts are sustainability, sharing economy, circular economy, and industrial symbiosis. During the interviews, the eleven interviewees expressed a lower or a higher degree of awareness of and interest in these concepts. Given that the interviews that constitute the empirical material that support this thesis provides this research with a qualitative character, the degree of the interviewees' awareness of and interest in the concepts was initially defined with the terms: low, medium, or high. To improve the accuracy of these terms' descriptiveness it was decided to translate them into numbers. This means that to a low awareness or interest was given a score of 1, to a medium awareness or interest was given a score of 2, and to a high awareness or interest was

given a score of 3. To render the numerical representation of the firms' degree of awareness of and interest in the concepts even more accurate and closer to the reality expressed by the interviewees' answers, it was decided to also quantify their intermediate positions. Thus, it was given a value of 1.5 to a company's degree of awareness and interest between low and medium, and a value of 2.5 to company's degree of awareness and interest between medium and high. To recap, the meaning and the values that were assigned to each degree of awareness of and interest in the theoretical concepts are:

- 1_ low awareness/interest
- 1.5_ from low to medium awareness/interest
- 2_ medium awareness/interest
- 2.5_ from medium to high awareness/interest
- 3_ high awareness/interest

Table 6.1 for each firm reports the quantitative representation of the degree of awareness of and interest in each of the background concepts. The table's right column presents each company's aggregate level of awareness of and interest in this research's four background concepts. Looking at the relation between awareness of and interest in the background concepts both at the firm level and the aggregate level, as well as between firms, is useful to grasp the overall picture.

Table 6.1. The degree of awareness of and interest in the background concepts

C. N		Sustainability	Sharing economy	Circular Economy	Industrial Symbiosis	Results
1	Awareness (A)	3	3	3	2	11
	Interest (I)	3	2,5	2	2	9,5
2	A	1	1,5	1	1,5	5
	I	1	1,5	1	1,5	5
3	A	2,5	1	1,5	1	6
	I	2,5	1,5	1	2	7
4	A	3	2,5	3	3	11,5
	I	2	2	2	2	8
5	A	2	1,5	1	1,5	6
	I	2	2,5	2	2	8,5
6	A	3	3	3	2	11
	I	3	3	3	2,5	11,5
7	A	1,5	1,5	1	1	5
	I	1,5	2	1,5	1	6
8	A	2,5	1,5	1,5	1,5	7
	I	2,5	2,5	2,5	2	9,5
9	A	3	1,5	2	1,5	8
	I	3	2,5	2,5	2,5	10,5
10	A	2	2	1	1	6
	I	2	2	1,5	2	7,5
11	A	3	3	3	3	12
	I	3	2	3	3	11

First of all, reading table 6.1 from left to right one can notice that the ‘generality’ of the subjects shrinks. It was decided to order the background concepts in this way because it was assumed that awareness of a general topic, like sustainability, is probably higher and more widely spread than the awareness of a more specific topic, like industrial symbiosis. As we can observe, this assumption was confirmed by the data distribution shown by table 6.1: while in average every firm is aware of the concept of sustainability, which is a rather generic concept, only few firms are aware of the industrial symbiosis concept, which is rather specific subject. Thus, *more firms know the sustainability concept because it is wide and general, while fewer firms know the industrial symbiosis concept because it is rather specific.*

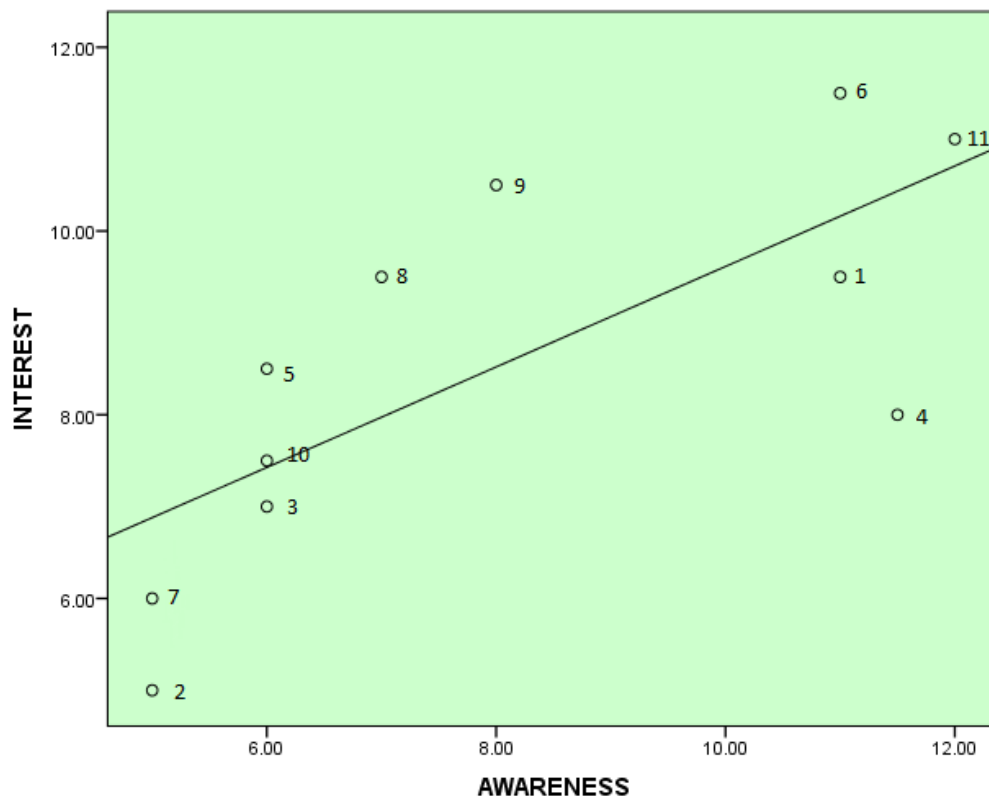
In average for each background concept a firm’s degree of interest in it is higher than the degree of awareness of it. This suggests that generally the awareness of a background concept is needed to support the development of interest in that background concept. In other words, there is a positive relation between awareness and interest: when awareness of a subject grows also the interest in the same subject grows. However, looking at table 6.1 we notice that this constitutes the general trend but not the rule in the sense that this does not always happen. In fact, firms 1 and 4 constitute outstanding cases: for more than half of the background concepts they show a higher level of awareness than of interest. In these cases, being aware of one out of the four background concepts that were taken in consideration does not constitute a sufficient explanation of these firms’ interest in it, this implies a conscious choice. However, these constitute outlying cases, which with other few exceptions do not constitute the rule. In fact, in most cases a certain degree of awareness of a background concept is accompanied by a higher degree of interest in the same background concept. Overall the *relation between awareness and interest is positive.*

Diagram 6.1 provides with a visual representation of both the relation between the aggregate degree of awareness of and the aggregate degree of interest in the background concepts, and of the relation between the firms of the sample in respect to these two factors. The XY coordinates that determines each company position on the Cartesian plane, which is represented by a dot, are provided by the last right-column of table 6.1. The X-axis stands for the aggregate degree of awareness of a firm, while the Y-axis stands for the aggregate degree of interest of a company. It was chosen to assign a company’s aggregate degree of ‘awareness’ to the X-axis because awareness was supposed to constitute the condition *sine qua non* there cannot be interest. Consequently, a company’s aggregate degree of ‘interest’ was assigned to the Y-axis. The values-range of both axis starts from 5 and ends at 15. Respectively 5 and 15 corresponds to the minimum and maximum aggregate degree of awareness of and/or interest in the background concepts that could be expressed by a company. In fact, in table 6.1 each firm scores two values - its aggregate level of awareness and its aggregate level of interest - that range in the 5-15’s interval. The two opposite and extreme cases are: 1) a firms cores 5, thus the minimum value, when it expresses a low awareness of and interest in all the 5 aspects that were taken in account; 2) a firms cores 15, thus the maximum, when a firm expresses a high awareness of and interest in each of the 5 aspects that were taken in account. Overall, the diagram 6.1 provides with an overarching and visual representation of both each company’s aggregate degree of awareness of and interest in the background concepts that inspire and support the Pulsup Project, and of the relation between the firms of the sample in this respect.

Before studying the information provided by diagram 6.1, we need to clarify two problems related to the decision of quantifying the qualitative data gathered with the interviews. When we look at the information that table 6.1 and diagram 6.1 provide we need to keep in account that:

- The number of firms that were selected is too small to realize a statistical analysis of the (co-) relation between firms' awareness and interest. It was decided to translate the interviews' qualitative data into figures only and exclusively for descriptive reasons. The intention is to provide with a useful overview of the (co-) relation between the two variables - firms' awareness and interest.
- Due to the small size of the sample – eleven firms out of hundreds that are located in the Spaanse Polder – the information provided by the table, the diagram, and the interviews cannot be generalized to the whole population of the Spaanse Polder's firms. In other words, the information here provided is not representative the Spaanse Polder. The intention is rather grasping what the firms' world looks like in relation to the topics at stake.

Diagram 6.1.: Relation between the degree of awareness and the degree of interest in the background concepts



Looking at diagram 6.1 first of all we notice that the direction of the regression line confirms that the relation between awareness of and interest in the four background concepts is mainly positive. Variables are positively correlated when the high degree of a variable tends to be associated with the high degree of the other variable, and similarly when the low degree of a variable tends to show with the low degree

of the other variable. In diagram 6.1 this is generally the case, as we can appreciate looking at the regression line's direction. However, for few firms this is not the case. For firms 1, 4 and 11 the relation between awareness and interest is negative because the degree of awareness is correlated to a lower degree of interest. However, the fact that the regression line's direction is identifiable means that *these two variables – awareness and interest - are associated*.

Secondly, we can see that the firms are slightly dispersed on the Cartesian plane because the dots are far from each other. However, while looking at diagram 6.1 we need to keep in account that the small number of cases that constitute the sample of analysis biases the visual effect of the firms' distribution on the Cartesian plane, which result more scattered on the plane for this reason.

Finally, also the inclination of the regression line tells something about the strength of the relation between awareness and interest. The slope is sharply inclined towards the right side of the Cartesian plane. This *confirms the strength and the positivity of the relation between the two variables of awareness and interest*.

Is there a relation between firms' awareness of and interest in the background concepts and their willingness to participate in the Pulsup Project? Before trying to answer this question (Section 6.3) we are going to look at firms' degree of willingness to participate in the Pulsup Project (see Section 6.2).

6.2 The willingness to participate in the Pulsup Project

During the interviews it was more or less directly asked to the interviewees whether they would like to participate in the Pulsup Project. More precisely, it was asked to the interviewees whether they would assign some of their time to the Pulsup Project, hence to participate in meetings with other Spaanse Polder firms and actors involved in the definition of the Pulsup Project. On the base of the answer that the interviewees gave to this question, it was possible to (approximately) define each company's *degree of willingness* to participate in the Pulsup Project (see table 6.2), which constitutes the dependent variable of the conceptual model behind this research (see Chapter 5). The firms of the sample can be classified as 'willing', 'maybe willing', and 'not willing' to participate in the Pulsup Project. These three categories are explained as follows:

- **Not Willing** (detached) is how a firm that was not convinced by the Pulsup Project is classified. This firm is not willing to meet neither with other firms nor with the organizers of the initiative to brainstorm in function of the realization of a sharing economy platform and of a circular economic system for the Spaanse Polder.
- **Maybe Willing** (prudent) is how a firm that was fascinated by the initiative but that also expressed hesitation and doubts about it is classified. Even if this firm is enthusiastic and cares about some aspects of the Pulsup Project, generally it needs and wants to have additional information about it before committing to it.
- **Willing** (sure) is how a firm that was convinced by the Pulsup Project is classified. This firm wants to participate in spending some time brainstorming with other firms and the organizer of the initiative in function of the realization of the Pulsup Project.

Table 6.2: Degrees of willingness of the interviewed firms to participate in a project like the Pulsup

Company's number	Not Willing company	Maybe Willing company	Willing company
1		✓	
2	✓		
3		○	
4	✓		
5			✓
6			✓
7		✓	
8			✓
9			✓
10		✓	
11		○	
Total	2	5	4

This classification was useful to build table 6.2, which for each firm shows the respective degree of willingness to participate in the Pulsup Project. Unfortunately, the opinions of firms 3 and 11 are missing because during the interview I forgot to ask them whether they would spend some time brainstorming and cooperating with other firms at the development of the Pulsup Project. However, reading between the lines of the interviews with firms 3 and 11 it was possible to develop an idea about whether and why these firms may be more or less apt to participate in the project. Based on what the interviewees said during the interviews, their degree of awareness of and interest in the background concepts that inspire and support the Pulsup Project we can classify firms 3 and 11 as 'maybe willing' companies. To keep these two cases' peculiarity in mind it was decided to sign firms 3 and 11's degree of willingness with a circle instead than with a tick in table 6.2. Overall, we observe that two firms were 'not willing', five firms were 'maybe willing', and four firms were 'willing' to participate in the Pulsup Project. Hence, the majority of the interviewed firms is 'maybe willing' to participate in the Pulsup Project.

6.3 The relation between awareness, interest, and willingness

It is interesting and useful to make a combined analysis of the information provided by table 6.2 and diagram 6.1. This combined analysis provides some interesting observations about the relation between awareness, interest, and willingness to participate in the Pulsup Project.

From diagram 6.1, one can see that the dots of the 'willing firms' – firms 5, 6, 8, and 9 - are located on the upper part of the Cartesian plane, above the slope. Their level of interest is higher than their level of awareness, thus for these firms awareness positively explains part of their interest in the Pulsup Project and its underlying concepts. Curiously, firm 11 is located in a similar position even if it is a 'maybe willing' company. About firm 11 we should recall that it was not directly asked to its interviewee whether he would like to make some time to participate in meetings with other firms to cooperate at the definition of the Pulsup Project, and that its *status* of 'maybe willing' firm was defined on the base of what he said during the interviews. In fact, the location of firm 11's dot on the Cartesian plain makes us think that this firm may want to participate in the Pulsup Project, because it is highly aware of and interested in

sustainability, sharing economy, circular economy, etc. (13 is the value scored by this firm for both indicators – awareness and interest). However, this is just a hypothesis; in fact firm 11 degree of willingness could be also explained by other factors.

Although the degree of awareness and interest of firm 2, which is ‘not willing’ and firms 7, 3, and 10, which are ‘maybe willing’, is rather low (they are located under the slope) the relation between the two variables - awareness and interest - is positive. However, it is interesting to notice that none of them was classified as being a ‘willing’ firm in table 6.2. This suggests that higher degrees of awareness are associated with higher degrees of willingness to participate in the Pulsup Project. So, awareness seems playing an important role in determining their degree of (dis-) interest to participate in the Pulsup Project.

Finally, firm 1, which is a ‘maybe willing’ firm, and firm 4, which is a ‘not willing’ firm, both constitute outlier cases. In fact, their degree of awareness of the Pulsup Project’s underlying concepts is high (<12, 5, see Table 6.1) but the respective degree of interest in them is overall lower (>11, 5, see Table 6.1). These two cases disconfirm the hypothesis that when awareness rises also interest rises, because the relation between these two variables is negative. In other words, the degree of interest is lower than the degree of awareness. Probably, in these cases other factors beyond awareness affect their degree of willingness to participate in a similar project. We will look at some of the factors that may affect a company’s degree of willingness to participate in the Pulsup Project other than awareness in the next chapters.

Beforehand we are going to analyze each firm’s willingness to participate in the Pulsup Project. The next three sections of this chapter respectively analyze the ‘not willing’, the ‘maybe willing’ and the ‘willing’ firms. To do so, we will take in consideration the answer that the interviewees gave to the question about whether they would participate in the construction process of the Pulsup Project. We are going to consider firms’ degree of awareness of and interest in sustainability, sharing economy, circular economy, and industrial symbiosis. In general, in the next three sections for each firm we are going to delineate a specific attitude towards the Pulsup Project. However, before we venture in this analysis we have to state that the organization of the firms as we see in Table 6.2 does not have to be considered categorically. Thus, it is suggested to adopt a flexible attitude while analyzing the following organization of the information concerning in the three categories ‘not willing’, ‘maybe willing’, and ‘willing’.

6.3.1 The ‘not willing’ firms

The column ‘not willing firms’ of the table 6.2 gather two firms – firm 2 and firm 4. These firms are not interested in collaborating to the realization process of the Pulsup sharing economy online platform and circular economy system for the Spaanse Polder area. However, how we are going to see now, the state of their willingness could be defined ‘latent willingness’. In fact, it may be possible that with further meetings they, and in particular the interviewee of firm 2, would change opinion. Thus, their degree of willingness may increase; this is why we talked of ‘latent willingness’.

It is necessary to start by saying that with *firm 2* conducting the interview in English may have constituted a limit to the flowing of the conversation and understanding of the questions and topics that were

discussed. This may have slowed down the creation of confidence and of trustful communication between the interviewee and me. In fact, throughout the interview and the more we were getting closer to its end the more the interviewee was opening up and becoming more willing to talk about its firm and his ideas. This makes me think that the position of this firm about its willingness to participate in the Pulsup project may change in future, with a further meeting. Keeping this observation in mind firm number 2 here is classified as 'not willing' to participate in the Pulsup Project.

What emerges from the conversation with interviewee of *firm 2* is that he seems not interested in engaging in the Pulsup Project, but that the firm may want to use the sharing economy platform resulting from it. In fact, when at a certain point I told him "*so, you don't feel the need for another website (other than those already existing to look for spaces), do you?*" he replayed "*maybe, maybe to work. But you will see in the future! Maybe in 5 or 10 years they will see if it works!*" (int. 2, co. 2, p. 3). The interviewees' attitude is here 'I may want to use the Pulsup website to find available space in the area (he was looking for space), if they make it, but I am not willing to work at it; as if he was not part of the community or as he thinks that other entities need to take care of this business. Then, again during the conversation about a hypothetical website that would allow the matching of different needs of firms in the Spaanse Polder area, the interviewee of firm 2 said that "*I do not know, but maybe if you can get the pallet, than you know where the space is for what country or what area, maybe then you can improve the situation. This is all interesting! Then you can see this truck is half-full, this is quart-full, and then you can tell this truck in this area, one pallet this price, three pallets that price. Then they can click it, and then they can order it. It's possible!*" Then I said "*so, would you be interested in something like this?*" "*Something like that I would!*" (int. 2, co. 2, p. 5). Thus, the interviewee of firm 2 may be interested a similar website, but he does not want to spend 'energies' on it.

It became clear that several firms are not aware of the concepts used in this research, like sustainability, sharing economy and circular economy. So, the language of policymakers and scientists is not always known in the field of entrepreneurs. For example, beforehand interviewee of *firm 2* seems to be neither particularly aware of nor interested in environmental and sustainable issues, or in concepts and practices that could be related to it. However, this firm is accustomed to ask and give favors to neighboring firms. So, they practice the sharing economy without knowing the concept of the sharing economy. In fact the interviewee said "*of course, we are neighbors, so if they need something from us, or if we need something from another company, we will help each other. It is not a problem. So, like machineries, or stuff... we help each other*" (int. 2, company2, p. 1). Thus, for this firm cooperating with other firms of the area is something that already happens in a spontaneous and informal way.

Overall, this interviewee's attitude could be summarized as: ***I do not know and I do not care about concepts like sustainability, circular economy, sharing economy, etc. but if there will be a website to match firms' needs I may use it, if I find it convenient. However, I already cooperate with other firms in a spontaneous way and I will not participate to the Pulsup Project creation process.***

Firm 4 as well seems to be 'not willing' to participate in the Pulsup project. In fact, about participating in the project the interviewee said "*for me it's more a negative than a positive! If I think in the idea itself it's good! To participate? I don't know if I... I don't think about it, or... no!*" (int. 5, co. 4, p. 5). Two reasons

seem constituting the main justification of this interviewee's attitude. On the one hand, the interviewee does not see how his firm could contribute to the realization of the project because of the strictly technical specialization of his company. This attitude seems contrasting with the interest that the interviewee expressed about the possibility to rent its unused space to another firm of the Spaanse Polder. In fact, conceptually he likes the idea of networking with local firms rather than with firms located far away. Furthermore, he is interested in finding a partner firm to share the purchase of a specific kind of electronic component he needs for his activity, because it is possible to buy these components only in set of 500 pieces when he needs only 20. These two are options that would be rendered available by the Pulsup project, but the need of this firm for these assets either is not strong enough to boost its willingness to participate in the Pulsup project or the interviewee is too skeptical about the possibility that the Pulsup project could eventually be realized to believe in this possibility.

On the other hand, the interviewee of the *firm 4* reserves this skeptical attitude also to the circular economy. About the circular economy he says *"the idea is always good but I am always afraid that it ends in some sort of hype! That everyone is running behind it without knowing what's happening, and... and then you wait for four years and it is gone! There is a new hype, and a new hype, and a new hype! And very slowly it evolves in the business. Yeah! So, you try to follow it, you have to do something, and it is also why you participate in this kind of initiatives! ..."* (int. 5, co. 4, p. 2). It seems that in the Spaanse Polder area other projects that want to realize a 'sustainable change' or something similar have been already discussed but that eventually firms behave independently without really committing to these projects. Usually he finds these projects interesting but that they remain unsuccessfully unapplied. This kind of vision somehow biases his willingness to participate in the Pulsup project.

Finally, the *firm 4* constitutes an interesting example because, as we noticed in Section 7.1.1, it constitutes an outlier of the sample given that the relation between its degree of awareness and interest is negative. This firm's core is one of the highest degrees of awareness of concepts like sustainability, as well as of more precise concepts like those of circular economy, sharing economy, and industrial symbiosis. In fact, during the interview it became clear that for this interviewee is important to be up-to-date about societal trends, as sharing economy and circular economy can be considered. He says that he knows about sustainability because *"it's in the general interest!"* (int. 5, co. 4, p. 1), but then he added *"...basically we are in a very technical field and there it is not a really big issue. It is not like with costumers business, so it is more...in this case... yeah, in the park it is one of the topics: sustainability!"* Again, the specific features of the firm explain part of this firm 'not willing' status.

Overall, the firm 4's attitude could be summarized as ***the project could be nice, as well as many other projects, but on the one hand, I don't think my firm could fit it because of its features, on the other hand I am skeptical about the project's concrete realization because it is inspired by concepts like circular economy and sharing economy that for me are just 'hypes', so I do not want to participate in it.***

'Not willing' means neither 'not doing' nor 'not interested'. Here, 'not doing' means not taking advantage of what the result of the Pulsup Project could be. On the other hand, 'not interested' does not mean not finding anything good in the project, but it means not being interested in committing to the Pulsup Project development process, which would require firms' desire to participate in meetings with other firms to

brainstorm and define how to proceed with the project developments. This kind of commitment would require the firms' participation in the project, thus their strong motivation and firm belief in its goodness. However, 'not willing' firms might be member of a sharing economy system, even if they do not understand this concept from a scientific point of view (e.g. firm 2), or they may know and understand the circular economy, even from a scientific point of view, without being convinced about either its logic, or their ability to contribute it, or both (e.g. firm 4). Overall, the 'not willing' firms are not categorically saying "no!" to the Pulsup Project. In fact, it is possible that asking and talking slightly more with the interviewees they could change their mind to become more interested in it, if not more willing to participate in it.

6.3.2 The 'maybe willing' firms

Five firms were classified in the column 'medium willingness' firms (table 6.2 and diagram 6.1). Generally, these are the interviewed firms that have expressed interest in the project as well as some doubts about it. In other words, the 'maybe willing' firms' degree of willingness to participate in the project is not resolute. The general impression is that these firms need more information about the Pulsup Project and its implications in order to commit to it. Interestingly, talking with them made some constraints of the project came to surface. These constraints constitute precious insights about the Spaanse Polder, its firms, and mostly about the improvements the Pulsup Project needs to work at to become more attractive for indecisive firms. We have to recall that firms 3 and 11 were defined 'maybe willing' on the base of both what they said during the interviews and their awareness of and interest in the background concepts inspiring and supporting the Pulsup Project, but not because of their answer to the question whether they would like to participate to the creation process of the Pulsup Project because, as we saw, I forgot to directly ask them this question.

The interviewee of *firm 1* is neither completely willing nor unwilling to participate in the Pulsup Project. He is a unique manager among those who were interviewed because he was the only one aware of the project, but also because of his role of chairman of the Belangenvereniging Spaanse Polder (see Chapter 4). The interviewee seems interested in some aspects of the project, but at the same time he finds it particularly complicated. The complexity of the project as it had been previously presented to him by the organizers of the initiative (Superuse Studios) constitutes a limit to his willingness to participate to its design. About it, he told the organizers of the initiative "*keep it simple!*" (int. 1, co. 1, p. 6) "*...they want to match everything. Start with one (flow)! ... So I said 'find a match and then build on from that match. Don't say, well, here we have leftovers of that, put one hundred things on the website and maybe you could use this or that. What would you change?' ... Too complicated! People don't want to, and don't have time for it... If people, let's say, are into glass business, and they could use old glass... Well! Possibilities... all over to use!*" (p. 7). Thus, he believes that to work the project should start focusing on matching just one or two flows of resources and find a simple form to present itself to firms, which eventually is the same strategy adopted by public institutions like the 'Environmental protection agency of local and regional authorities in the Rijnmond region' (DCMR) when they needed to boost environmental policies in the Schiedam area of Rotterdam to achieve certain political goals. That is because of their limited capacity, the DCMR started with a sector and then it moved on embracing another one, and then another one. In

this respect, the DCMR's environmental manager said "...so we have a limited capacity so sector by sector!" (Int. 3, Institution 2, p. 6). This is somehow the strategy that the manager of firm 1 would suggested to the organizers of the Pulsup Project to develop it. Particularly, the interviewee of firm 1 doubts about Spaanse Polder small-sized firms' awareness of and interest in the sustainable issues supporting this research, consequently about their willingness to participate in the in the project (int. 1, co. 1, p. 23).

In addition, the interviewee of *firm 1* expressed concern about the cost-benefit analysis of the project. He said "*sure!* (About the possibility of saving resources through the use of the Pulsup sharing economy and circular economy platform) *But how much effort should I put in it? How much do I win?*" (int. 1, co. 1, p. 7). However, firm 1 is evidently committed to sustainability, and interested in sharing economy practices. For example, he had thought about occasionally borrow (or rent) a machinery from a neighbor, because it would be too expensive to buy it new for the use firm 1 would make of this machinery. About this point interviewee 1 said "*it is about 2000 euro to buy it, a good one. Then we discussed that it would be good if there was somebody in our neighborhood who has something, and then we only need it for let's say a month, and then do it check, and then check what we would like to know and then give it back. So, in that way it is interesting to see the possibilities!*" (p. 6). In fact, as it is shown on the diagram, this firm is the most aware of sustainability and the related practices, as they were previously defined (chapter 5.2), but constitutes an outlier in the sample because of the degree of interest is lower than the degree of awareness.

Overall, for the interviewee of *firm 1* the Pulsup Project should become more attractive. On the one hand, it should be rendered simpler and more intuitively understandable, thus also less expensive in terms of time-cost, while on the other hand, it should be clarified what the economic gain due to the firm participation to its realization would be. Hence, the attitude of this interviewee could be summarized as ***I am aware of sharing economy and circular economy practices and I think they are good, but this project seems too costly and complicated and I am not sure I want to commit to it for how it had been presented to me.***

Firm 3 can be classified as 'maybe willing' because even if the interviewee did not express a particular degree of awareness of and interest in the sustainability issues supporting this research, certain objective aspects of the firm let us think that the firm in question is instead aware of and interest in sustainability. This firm is equipped with electric cars, solar panels, and standard and certificates that guarantee the ecological sustainability of this firm's activities. These objective aspects suggests that contrarily to the low degree of awareness of and interest in the sustainability issues expressed by the interviewee, this firm is rather interested in being a sustainable firm. For example, when I asked to the interviewee whether the company has any standard and certification, he said "*I don't know what you think but I think we have got them... on the paper we've got the emblem, but I don't know... it's not my job! I don't know how it works... but we have it! I know it!*" and then he added "*we've got some paper to show to customers... is it natural proof environment? That sort of stuff!*" (int. 4, co. 3, p. 2), because "*everyone wants 'green! Green! Green!' and we have electric cars; I think we have 4 or 5 electric cars now... we have got solar panels on the roof! And that kind of... it's very important today! 2015 is only green... It's crazy but it's true!*" (p. 3). In fact this firm has two kinds of standard and certifications about sustainability: they use FCI paper, and

they have the ISO 14001. Both these kind of certificates are expensive to get, which suggests that the firm cares about sustainability. The disinterested attitude of the interviewee contrasts with this firm's objective commitment to sustainability. Probably, the role of interviewee within the company constituted a limit to the achievement of key information about the firm internal policy and vision about the sustainability issues. In other words, given that this firm is equipped with several concrete proofs of its interest in sustainability, probably if a manager of higher rank would be interviewed this firm would score higher in awareness of and interest in the background concepts that inspire and support the Pulsup Project than now. The attitude of this interviewee can be summarized as: ***I know that this firm is committed to sustainability but I do not understand well why and what it means (but maybe if you ask to my manager this firm would be willing to participate in the Pulsup Project).***

Firm 7 is fascinated by the project and expresses curiosity about it, but it is also concerned about the cost that participating in the project may imply. The interviewed manager says "I would like to know more about this (the Pulsup project) because it looks very interesting" (int. 10, co. 7, p. 6). Then he adds "there are a lot of questions for me... how much do you have to pay for the membership? Because I think you should be a member of the project so that you can also share some of the profits and you can also make some money out of it. ... but I do not know, before we say Yes or No, and before the director has decided if he wants to participate in this project, there are a lot of questions that should be answered. But it looks for me, from an economic point of view it should be OK" (p. 7). Then to the question "would you participate?" he replayed "Yes!" In other words, this company, which is not particularly aware of sustainability and related concepts, is fascinated by the opportunity of saving resources through the use of a sharing economy platform as the Pulsup should become. It seems that this firm has been affected by the crisis, and that it has the need to save resources. This may partially explain this company's interest in the Pulsup Project. However, this firm is not completely convinced about its participation to it because it needs more information about the project. In particular, the interviewee seemed worried about a possible project participation cost. Overall, the attitude of this firm is: ***I would like to know more about this project because it seems that I could save resources with it but I definitely need more information about the project and its economic implications for the firm before I commit to it.***

The marketing and sales director of *firm 10* expresses interest in the project, but judges it as being a little bit redundant. About the Pulsup sharing economy platform he says "... I think we definitely would use it, yeah!" (int. 10, co. 13, p. 10). However, for the interview the Pulsup project seems an attempt to create a cooperative system among firms in the Spaanse Polder area when it already exists, at least for some of them, in particular for those that as *firm 13* are located in the *Groothandelsmarkt* Spaanse Polder. In fact, the interviewee says that its firm is already part of a 'system of mutual help'. However, he thinks that it would be nice to organize and regulate this spontaneous 'system of mutual help'. About this, the interviewee's words are "...so in a way it (asking and giving favors to other firms) is not regulated or coordinated – coordinated is the word, I think, yes. But as firm we are already doing by ourselves a lot of the things you are thinking of, like 'how could the Spaanse Polder work together?' ... Maybe on a small scale, but quite a few of the things we are practically doing already.... It is nice if it is regulated and organized and you know, in a proper way, you know, but individually we are doing it already. At least We,

with some of the firms ... I am not sure about the rest!" (p. 12). Eventually, it seems that this firm would appreciate a more regulated system of mutual help.

At the same time, the interviewee is concerned about the ability of the *firm 10* to participate in the creation process required by the Pulsup project to be realized, because it may be too costly in terms of time and it seems that time constitutes a scarce resource for them. About this, he said *"I would not say no in advance, but if it would fit my schedule, my very hectic schedule already, why not? But I would not be able to say in advance 'yes, I would go!"*, on the same style he adds *"... we would never be unwilling because... But able is another question, because we have so much on our desks already at this point in time, but... I don't say no! If we can contribute and help within our possibilities, why not?"* (p. 10). The interviewee does not feel sure about the company's availability of time for the project. Time here seems constituting the biggest limit to this company's participation to the Pulsup project; however, the interviewee doesn't feel like definitely excluding this possibility. Overall, firm 10's attitude could be summarized as ***yes, the project is nice and I am interested in it, but not so much to free some time for it because I am too busy and it seems a bit redundant, however I do not feel like exclude this possibility.***

Finally, *firm 11* could also be 'maybe willing' because of its involvement in local development activities and its high awareness of and interest in the key concepts that support the Pulsup Project. Even if had not forgot to directly ask to the manager of firm 11, who is also the chairman of the Spaanse Graave, whether they would spend some time working on and meeting with other Spaanse Polder firms, probably he would say 'maybe'. The interviewee is aware of and interested in sustainability and in the circular economy. He said that certainly they are always interested in sustainability *"because it tells something about the future and continuity is the most important thing for a company and I think that it only can be continuous when you are sustainable"* (int. 14, co. 11, p. 11). While about the circular economy he said *"I think that is a need, otherwise we would have such a mess, we live with seven billion people. That's really a lot. So, I think it is good: we should recycle products, when it is possible!"* (p. 14). However, he is skeptical about the sharing economy, he does not like it, and about it he said *"the sharing economy is ... not realistic!"* (p. 6). In addition, this firm is already involved in initiatives of local development; by the way, he said *"I think that as company we do a lot to promote, not only ourselves, but also the entire area"* (p. 11). Given this premises, the attitude of this company could be summarized as follows: ***I think that it is important to promote local development and the implementation of effective sustainable practices is needed. Let's see if the Pulsup Project is really able to convince me that it can implement sustainable practices that are effective.***

6.3.3 The 'willing' firms

Four firms were classified in the column 'willing firms' in the Table 7.1.1. This means that the interviewees are willing to spend some time brainstorming with other firms in order to create the Pulsup sharing and circular economy system. As we saw in Section 6.1.1, these firms are distributed above the regression line of the Diagram 6.1.1, which means that their level of awareness positively explains part of their interest in the project.

The manager of *firm 6* was rather sure about his willingness to participate in the Pulsup Project. This firm is aware and interested in concepts like sustainability, sharing economy and circular economy. It is clearly committed to the Rotterdam region and to sustainability in its wide sense - from ecologic sustainability to social sustainability. For example, he said *"we are also heavily investing in a lot of projects that are making the community better"* (int. 9, co. 6, p. 2) or *"the focus of the firm is not profit maximization"* and *"we would like to make social responsible profits!"* (p. 3). Furthermore, the interviewee had already thought about the possibility of applying concepts like sharing economy, circular economy, and industrial symbiosis to its firm in particular, and the Spaanse Polder in general. In fact, among other things, he said *"...but also we have five beamers here and maybe someone around the corner needs a beamer and he doesn't have one, so that you can exchange those things and... I mean the concept has to work and has to be functioning to actually be able to use it, but I think it is definitely closely needed in industrial areas like this ... Some things like that could actually work!"* (p. 6). The firm 6 has an open and confident attitude towards change. Surely, we need to keep in mind that this constitutes the only big firm of the sample. As it was suggested by interviewee 1, big firms are more aware of sustainable practices and able to contribute to society than small firms, because the latter usually dispose of lower buffer resources than the former. Here, this hypothesis finds confirmation by firm 6, which is able to invest energies, time, and money in an innovative process, and to take risks and assume social responsibility. Overall, the attitude of the interviewee can be summarized as follow: ***change, innovative and more sustainable practices are needed by society, so we should participate in the Pulsup project.***

The manager of the *firm 5* expressed interest in and enthusiasm about the project, even if with some doubts. In particular, the interviewee seems interested in the social side of the project, thus in the social and business connections that could build with other firms participating in it. He said *"I didn't know this thing would even exist. This website that you have just said, but while you were telling me I was already like thinking that his idea is something really good! Like within the SP, yes! The firms don't know each other... yes, you know which firm is here, which firm is there, but... to make them work together, that could be... Something!"* (int. 10, co. 5, p. 10). Despite this, the type of willingness he expressed was slightly hesitant. In particular, because of the specialization of his that is accounting services he could not see what kind of asset this kind of firm could share online with other firms. He said *"I would... participate, yes! Because it's... yeah! But I don't have anything to offer but I would think ... of the idea"* (int. 8, co. 5, p. 10). Overall, the interviewee is enthusiastic about innovation, new economic and societal trends, and the idea of networking with other firms of the Spaanse Polder. His attitude can be summarized as ***I am fascinated by innovation and the idea of getting to know other firms of the Spaanse Polder.***

The owner of *firm 8* is also willing to participate in the Pulsapp project. He said *"I think it would be nice to have a website for the Spaanse Polder!"* (int. 11, co. 8, p. 7). To the question whether he would be willing to meet and brainstorm with other firms of the Spaanse Polder to understand how to develop the Pulsup sharing economy website and circular economy system, he said: *"if there would be all the firms I would participate, and if there would be information, yes!"* (p. 7). Then I added *"And If not? And if you should be one of the pioneers?"* he replayed *"if not, I will not have to spend time if there's nothing... I mean I don't want to be the only firm that is there on the website... I don't want to spend much time on that"*. I said *"yes, but I guess that a website to be built needs some knowledge, and the knowledge is also based on*

*what firms discuss together, so if you ask...”, then he said “like a list of people of ... let’s say 20 firms , then you can start. I don’t know who is gonna do it, but if somebody says I do that project and I need like, maybe a 100 euro from each firm to get it started, and then you need somebody who has to find 20 firms that says ‘yes’, then I will participate!” (p. 8). For the firm 8’s owner it would make sense to be part of the Pulsup Project if a couple of conditions are satisfied: the project should be better explained and illustrated, and other firms should be part of it. Then, he would be even willing to pay a little fee to participate in the project if required. He is probably interested in the project because of his desire of networking with other firms of the Spaanse Polder: his firm was founded less than a year ago and he needs to integrate in the local context. Furthermore, he is rather satisfied about having located his firm in the Spaanse Polder, because he likes people who work in the local firms. Another reason that could explain his willingness to participate in the project is that he, with his business, performs sharing and the circular economy practices. He is not that aware of theory and concepts, but he is absolutely into sustainable practices. Overall, this company’s attitude is **yes, give me some more info and journey partners and I am on the boat.***

Finally, *firm 9* is also willing to participate in the project. The interviewee even says that she had already thought about how good a sharing economy system would be for the Spaanse Polder. Talking about a sharing economy platform where firms can let each other know about own needs and idle capacities in terms of assets, the interviewee said *“Yes, yes! So... yeah! Sometimes I thought about that but this is a small firm but... when we are closed and if you are a student and you need a space in an atelier like this, then yes, it could be that someone uses this space because it has not been used for the day, so sometimes I thought about that, that it is possible. If I know someone who needs an atelier, who needs the space...”* (int. 12, co. 9, p. 2). Firm 9 is already thinking about innovative ways of doing business. She had recently read an article that was posing a question to the firms of Rotterdam like ‘what may be new ideas to do business?’ About it she said *“I was also thinking about it like ‘what could be a good idea to work together? Yes!”* (p. 2). She desires to network with *“...tailors and creative people to teach each other and maybe that have the same ideas to go to a direction together... To develop something new, for like sustainable fashion, for different kind of fabrics, like biological fabrics... there is not much you can find right now”* (p. 2). In this case, cooperation with other firms constitutes a way to innovate, and she would like to network and find similar businesses to innovate her business. The interviewee is interested in sustainability and open to embrace new societal and economic trends. Overall this interviewee attitude could be summarized as ***I am looking for innovative ways of conducting my business and I have already thought about some sort of sharing and circular economy solutions, so why not take the chance and participate in the Pulsup project?***

6.4 Conclusions

In this Chapter we looked at firms’ degree of awareness of the Pulsup Project’s background concepts, as well as at how this awareness is related to the degree of willingness to participate in the project that was expressed by the firms. The sub-research questions supporting this Chapter are:

“To what extent the Spaanse Polder’s firms are aware of (and interested in) in the Pulsup Project’s background concepts – sustainability, circular economy, sharing economy, and industrial symbiosis?”

“Does firms’ awareness of and interest in the project’s background concepts affect their willingness to participate in the Pulsup Project?”

First of all, we saw that there is a strong correlation between being aware of the Pulsup Project’s background concepts - sustainability, circular economy, sharing economy, and industrial symbiosis – and interest in them. Thus, interest is supported by awareness. In turn, being aware of and interested in the background concepts support firm’s degree of willingness to participate in the Pulsup Project (see Section 6.3). In other words, being aware of the background concepts support firms’ interest in them that in turn supports firms’ degree of willingness to participate in the Pulsup Project. Consequently, **the initial hypothesis supporting this research is confirmed: awareness of (and interest in) the background concept positively affect willingness to participate in the Pulsup Project.** Said so, the Pulsup Project should develop a communication strategy to rise firms’ awareness of the project and its background concepts to stimulate their willingness to participate in the creation process of the ICT tool to enable web-based resource exchange in the Spaanse Polder that it promotes.

This research also found out a factor that explains why certain firms are more aware of (and interested in) the Pulsup Project’s background concepts and thus more willing to participate in the project than others. It was found that **firms that shows a socially and environmentally committed attitude tend to be more willing to participate in the Pulsup Project than those whose attitude is not particularly socially and environmentally committed** (see the ‘willing’ firms 6, 5, 9, and the ‘maybe willing’ firm 3 and 11). Thus, **it seems that awareness of/interest in the background concepts are indirectly correlated to willingness to participate because when firms’ awareness of/interest in the background concepts is higher when the *social and environmental responsibility* of firms if high, and vice versa.** However, it is not possible to define the direction of the causal relation between social responsibility and awareness of/interest in the background concepts. Which one comes before? Do firms inform themselves because they are social responsible, or because they are informed they are socially responsible?

Moreover, this research found out another couple of factors that positively explains why certain firms are more willing than others to participate in the project beyond awareness of/interest in the background concepts. Firstly, looking at the interviewees’ attitudes we see that the second trigger of a firm’s willingness to participate in the Pulsup Project resides in the possibilities to create new social and business connections with other firms of the Spaanse Polder that seem to be offered by the project (see the ‘willing’ firms 5, 8, and 9). Thus, the possibility to extend the network of acquaintances supports firms’ willingness to participate in the Pulsup Project. Secondly, another driver of firms’ willingness to participate in the Pulsup Project is their interest in the idea of becoming part of an innovative project that promotes new ways of structuring business (see the ‘willing’ firm 6 and the ‘maybe willing’ firm 10). **The possibility of both extending the network of acquaintances in the Spaanse Polder business area and participating in an innovative project constitute unexpected findings of this research.**

Finally, this research also found out some factors that constrain firms’ willingness to participate in the Pulsup Project even when they are aware of and interested in the background concepts, or when they are either socially responsible or interested in innovation. Certain interviewees showed a **skeptical attitude** towards the project and its capacity to significantly add something to the Spaanse Polder (see the ‘maybe

willing' firm 10, 11, and 1, and also the 'not willing' firm 4). The experienced or **expected complexity of the project** is the main reason for firms to be skeptical about the project (see the 'maybe willing' firms 1). For some firms, the efficiency in financial costs seems to low, while time spending seems too costly (see the 'maybe willing' firms 10, 7, and 1).

Overall, given the constraints as well as the positive relation between awareness of/interest in the Pulsup Project's background concepts – sustainability, circular economy, sharing economy, industrial symbiosis – that were found, a strategy aiming at rising the Spaanse Polder's firms willingness to participate in the Pulsup Project should adopt some tricks. The Pulsup Project should render its communication as clear and simple as possible to overcome firms' doubts in terms of complexity and scarcity of time. Furthermore, it should provide firms with a more detailed and overarching description of the project to provide firms with the necessary information about the costs and gains of their potential participation in it.

7 Firm's features and willingness ~

This chapter of the thesis investigates whether there is a more or less direct relation between a firm's features and the relative willingness to participate in the Pulsup Project. That is willingness to cooperate with other firms in the Spaanse Polder area to contribute to a more sustainable design of it, as well as willingness to participate in the creation process of an industrial symbiosis by means of ICT web-based resource exchange in the area. Keeping this understanding of the dependent variable in mind we are going to observe to what extent certain features of a firm are able to explain the degree of willingness of a firm to participate in the Pulsup Project.

The firms that were interviewed differ in several aspects. Their heterogeneity reflects the heterogeneity that characterizes the population of firms of the Spaanse Polder SMEs mixed industrial park. The firms' features that were taken in consideration constitute objective aspects of a firm. These are:

1. The industry and the sector to which the firm belongs
2. The location of the firm in the Spaanse Polder
3. The size of the firm
4. The age of the firm
5. The embeddedness of the firm
6. The quality of the firm
7. The scale of the market orientation of the firm
8. The innovativeness of the firm

Here, every aspect of a firm is related to the three degree of willingness to participate in the Pulsup Project – not willing, maybe willing, and willing. In so doing, it is possible to make a qualitative observation of the possible existence and strength of a relation between certain firms' features and degree of willingness to participate in the Pulsup project expressed by the firms. Taking in consideration the general outcomes from the previous Chapter, in this chapter we want to find an answer to the question if certain firms' features besides their awareness of and interest in background concepts (see Chapter 6) affect the willingness to participate in the Pulsup Project.

7.1 The industry and the sector of the firm

This thesis' section investigates whether there is a more or less direct relation between the industry of a firm and the relative degree of willingness to participate in the Pulsup Project. The firms of the sample were organized on the base of the major industry sector they belong to. The three main economic sectors are the primary sector (farming, mining, and fishing), the secondary sector (manufacturing), and the tertiary sector (services). The firms of the Spaanse Polder belong either to the secondary or to the tertiary sector. Firms that belong to the 'manufacturing' sector are those that produce a finished, usable product. These firms take the output of the primary sector and manufactures finished goods that are suitable for use by other businesses, for export, or sale to domestic users. This sector is often divided into light industry and heavy industry. Many of these industries consume large quantities of energy and require

factories and machinery to convert the raw materials into goods and products. They also produce waste materials and waste heat that may pose environmental problems or cause pollution. It supports both primary and tertiary sector. The manufacturing sector is wealth producing. By contrast the service sector tends to be wealth-consuming, and ‘wholesalers’ and ‘other services’ belong to the service sector. The service sector provides a service. The firms of the sample can be classified either as ‘manufacturing’ (secondary sector), ‘wholesale and retail service’ (service sector), or ‘other services’ (service sector).

It was initially assumed that firms operating in the manufacturing sector would be more willing to participate in the Pulsup Project than firms operating in the service sectors. The hypothesis behind this assumption was that manufacturing firms use and need more concrete assets and resources –e.g. machineries and raw materials- than service firms. Furthermore, manufacturing firms generally generate higher amounts of waste products than firms operating in the service sectors. Thus, it was assumed that for manufacturing firms is easier to see in the Pulsup Project a concrete tool through which establish relations with other firms and feed other firms’ economic activity in a social responsible way while gaining some money. In other words, **it was assumed that for ‘manufacturing’ firms there may be more motivation and less constraint to participate in the Pulsup Project from an assets’ need point of view, than for firms in the service sector.**

Table 7.1. Relation between industry and degree of willingness

Industry	Willingness to participate in the Pulsup Project		
	Not willing	Maybe willing	Willing
Manufacturing		1, (3)	8, 9
Wholesale and retail service	2	7, 10	
Other services	4	(11)	5, 6

From table 7.1 one can conclude that some relationship between industry sector and willingness to participate in the Pulsup Project exists. In more precise terms, the assumption that for firms that operate in the *manufacturing* sector is easier to be motivated by a project like the Pulsup than for firms that operates in the *service* sector is confirmed by the data distribution shown by the Table 7.1, because none of the *manufacturing* firms result in the ‘not willing’ column. The manufacturing ‘willing’ firms see in the participation in the Pulsup Project an opportunity to increase their chance to find the assets they are looking for and to network with other firms and realities. For example the interviewee of *firm 9*, which is a tailor-shop, said “*I was also thinking about it like ‘what could be a good idea to work together? Yes!’ She desires to network with “...tailors and creative people to teach each other, and that maybe have the same ideas to go to a direction together... To develop something new, for like sustainable fashion, for different kind of fabrics, like biological fabrics... there is not much you can find right now”* (int. 12, co. 9, p. 2). Even the interviewee of *firm 1*, which is a manufacturing ‘maybe willing’ firm, thinks that the project constitutes an opportunity to find the assets he is looking for. For example, the interviewee 1 had thought to

occasionally borrow (or rent) a specific machinery from a neighbor, because it would be too expensive to buy it new, given the salutary use that its firm would make of it. About this point interviewee 1 said *“it is about 2000 euro to buy it, a good one. Then we discussed that it would be good if there was somebody in our neighborhood who has something, and then we only need it for let’s say a month, and then do it check, and then check what we would like to know and then give it back. So, in that way it is interesting to see the possibilities!”* (int. 1, co. 1, p. 6). The Pulsup Project would facilitate this firms’ search for assets and resources. In this sense, the initial assumption is confirmed: **given the need for a wide range of assets, manufacturing firms easily spot in the Pulsup Project an opportunity to find what they are looking for.**

The initial assumption reversely holds also if we look at the *service* sector firms. The willingness to participate in a project that wants to realize a sharing economy platform can be *constrained* by the specialization of a company. For example, *firm 5* that is an accounting firm (other services) is not in the best position to exchange assets with other firms because of its abstract and intangible specialization. The respective interviewee said *“Ja! I would do it! (To participate in the Pulsup project) But I would have anything to offer, or anything to rent from other ones, because the only things we have are computers, and we cannot rent it from someone else. But yeah! Computers are the only thing that we have, that’s... everything we do actually!”* (int. 8, co. 5, p. 10). This case exemplifies how the capacity to share and or exchange assets of a firm operating in the *service* sector, which thus is less in need of assets and less able to satisfy other firms’ needs because of the lower use that this kind of firm generally makes of a wide range of assets compared to a *manufacturing* company, is constrained by this matter of fact. However, *firm 5* is willing to participate in the Pulsup Project. This means that its degree of willingness *firm 5’s* willingness to participate in the Pulsup Project must be motivated by other factors beyond the need of assets.

For example, *firm 6* is another ‘willing’ firm that was classified as belonging to the *other services* and that consequently share similar constraints with *firm 5*. Anyways the respective interviewee found something the firm could rent to another company; he said *“we have a really large call center down here which is only part of the day fully occupied. So these are, you know fully equipped spaces, or call center activities, which could also be used for other stuff...”* (int. 9, co. 6, p. 8). This example shows how the interviewee did “one’s best” to find other assets to share on a website like the Pulsup beyond the constraint posed by its condition of *service* company. That is **when motivation is high even those that seem constraints can be surmounted to a certain extent.** In this case, the desire of being part of an innovative project that positively contributes to society, thus the social responsibility of the company, can constitute a powerful trigger to the willingness to participate in the Pulsup project.

Taking this consideration in account and looking at the position of the *other services* and ‘willing’ firms on diagram 6.1, and if we also look at the manufacturing and ‘willing’ firms, we notice that most of them score rather high in terms of awareness of and interest in the concepts that supports the Pulsup Project. This suggests that part of firms’ motivation comes from their social responsibility, that is from their interest in making a more effective use of resources and contribute to a more cooperative way of doing business. Thus, a further assumption could be added to the previous one: **any kind of firm is more willing to participate in a project like the Pulsup when is motivated by social responsibility.** By contrast, as it is shown by *firm 3*, **little awareness of and interest in sustainability, sharing economy, circular economy,**

etc. that is little social responsibility, constitutes a constraint to the willingness to participate in a project like the Pulsup, even when the firm is a *manufacturing* firm that for this reason could more easily gain something from the participation in a project that potentially may provide it with some benefits.

Another way in which the features of a firm can affect a company's degree of willingness to participate in a project like the Pulsup is when a firm has a rather unique specialization. **The condition of being 'alone' because of the uniqueness of the own economic activity can constitute a constraint to the ability of the firm to find business partners and establish cooperative relations.** A firm can have a rather unique specialization in absolute terms, which means being one out of few firms in the Netherlands performing a certain economic activity, or in relative terms, which means being one out of few firms in the Spaanse Polder performing a certain economic activity. In the first case, which can be exemplified by *firm 4*, the firm can find few analogous firms in the whole country, while in the second case, which can be exemplified by *firm 9*, the firm can find a few analogous firms in the Spaanse Polder. Firm 9's interviewee said "*...there are really dissimilar firms in the Spaanse Polder, for us it is really difficult to do cooperation with...*" (int. 12, co. 9, p. 1). Both these firms find difficult to cooperate with other firms but their reaction to the Pulsup Project is completely opposite. Firm 4, which is specialized in the measurement of strains and stresses, constitutes one out of few other similar firms in the whole Netherlands, and its specific specialization is unique. The interviewee of firm 4 said: "*and in that area (measurement of strains and stresses) there are just few firms in the whole country! So, the equipment we make, our own really only equipment we are the only ones in the Netherlands! So, it's rather unique!*" (int. 5, co. 4, p. 8). Because of this peculiarity, for this firm is quite difficult to find befriended firms to cooperate with not only in the area but in the whole country. Thus, this company's specialization could partially explain its mistrust and disinterest in the possibility of cooperating with other firms that is offered by the Pulsup Project. By contrast, firm 9 is willing to participate in the Pulsup Project. In this case, it is the very uniqueness of this business that triggers its willingness to participate in the Project. This company's desire for meeting compatible firms to work with is met by the ambition of the Pulsup Project. Overall, **being a 'unique' business constrains the ability of a firm to cooperate with other firms, but while for firms which uniqueness is rather absolute their condition constitutes more a constraint to their participation in the Pulsup Project than a trigger, the other way around is true for firms which uniqueness is rather relative, participating in the Pulsup Project they can find cooperation partners thus they are motivated by the Pulsup Project.**

Conclusions: There is some correlation between industry and willingness to participate in the Pulsup Project. A company specialization within an industry can trigger the willingness of a company to participate in the Pulsup Project, however, a company's social responsibility explains more its willingness to participate in the Pulsup Project than the own industry.

7.2 The location of the firm

This thesis' section investigates whether there is a more or less direct relation between the location of a firm inside or outside the *Groothandelsmarkt Rotterdam Spaanse Polder* and the relative degree of willingness to participate in the Pulsup Project.

Image 7.2. The Groothandelsmarkt Rotterdam Spaanse Polder



The firms of the Spaanse Polder can be located inside or outside the *Groothandelsmarkt Spaanse Polder*. Recalling what was said in Chapter 8, the *Groothandelsmarkt Rotterdam Spaanse Polder*, or wholesale market (image 7.2 and table 7.2) is a closed area within the Spaanse Polder that can be accessed passing through a gate, it is kept under surveillance, and at night closes. This large trade area covers about 45.000

square meters of industrial space and hosts about 70 different firms. The *Groothandelsmarkt Rotterdam Spaanse Polder's* website says "*the Wholesale Market Spaanse Polder comprises several markets where a wide range of food products are traded*" (<http://groothandelsmarktrotterdam.nl/en>). As this quote suggests, the *Groothandelsmarkt Spaanse Polder* hosts similar firms: wholesalers of alimentary products. In other words, firms that are located within the wholesale market belong to the same industry and perform similar activities -import, export, retail of alimentary products- hence they have similar needs. Besides the similarity of needs, also the geographical proximity, which renders the contact among firms a daily life routine, creates a sense of familiarity among firms, which was assumed to facilitate their cooperation. In absolute terms, while dissimilar firms have dissimilar needs, similar firms have similar needs. Thus, it was assumed, also on the base of the literature, that **the implementation of an industrial symbiosis (cooperative system) could better take root when an industrial area is characterized by the homogeneity of the firms it homes**. This is not the case in the Spaanse Polder, with the exception of the *Groothandelsmarkt* that can be seen as an "island" within this industrial park. In other words, it was assumed that **similarity of needs and physical proximity trigger cooperation among firms**. Consequently, it was assumed that **firms located in the Groothandelsmarkt would be more positively motivated to participate in the Pulsup Project than firms located outside the Groothandelsmarkt, given their proximity in both geographical and needs terms**. This assumption explains why it was decided to take in consideration the location of a firm inside or outside the wholesale market as an important feature.

Table 7.2. Relation between location inside or outside the Groothandelsmarkt and degree of willingness

Location	Willingness to participate in the Pulsup Project		
	Not willing	Maybe willing	Willing
Groothandelsmarkt	2	7, 10	
No Groothandelsmarkt	4	1, (3), (11)	5, 6, 8, 9

The distribution of the data in the table 7.2 contradicts the initial assumption. **None of the firms that are located within the wholesale market results ‘willing’ to participate in the Pulsup Project:** out of three food wholesalers, two of them may want to participate in the project but they are not sure yet, while the other one does not want to participate in the project. By contrast, all the ‘willing’ firms are not located in the Groothandelsmarkt. How can this result be explained?

7.2.1 Firms located inside the Groothandelsmarkt Spaanse Polder

Keeping other variables constant, from the interviews emerges that **every firm hosted by the wholesale market Spaanse Polder regularly and spontaneously cooperate with neighboring firms**. Thus, it is possible that they do not need a website to ask for favors, look for assets, and find other compatible to network with other companies, because for them is normal to cooperate with the neighboring firms. In other words, **it could be that these firms do not need a project like the Pulsup to cooperate with each other**. For example, *firm 2*, which is a ‘not willing’ company, cooperates with neighboring firms in a spontaneous and informal way; the interviewee said *“of course, we are neighbors, so if they need something from us, or if we need something from another company, we will help each other. It is not a problem. So, like machineries, or stuff... we help each other”* (int. 2, co. 2, p. 1). *Firm 2* is in fact surrounded by many close businesses with which is easy to establish cooperative relations between a cup of coffee and another one *“...sometimes I go to a neighbor and we drink coffee, and then we talk!”* (int. 2, co. 2, p. 8) because of their proximity.

The same can be said about the ‘maybe willing’ firms located in the wholesale market. The interviewee of *firm 7* depicted the spontaneous system of communication and mutual help in which is involved with the neighboring firms. The interviewee depicted it as *“if a neighbor is closed, and they had purchased something, and when the supplier brings it and nobody is here, then they can bring it over here so that then we can keep it for them, or the same thing also happens with us. If the driver (supplier) arrives here and the place is close, then he leaves the products in another warehouse and leaves a note here for us in the letter box, and then... this is how it works!”* (int. 10, co. 7, p. 3, 9). *Firm 10* as well is part of this **‘system of mutual help’**. However, from the interview with *firm 10* it emerges that asking for and giving favors is something that *“we do! ...but not particularly!”* (int. 13, co. 10, p. 5). Talking with the interviewee of *firm 10* it became clear that they have a few very close relations with other firms (p. 5), but that in general, the cooperation between the wholesale market firms is based on the common interest in not disappointing the clients, or in receiving and giving each other strategic discounts and promotions (p. 5, 6, 11, 12, 13), what the interviewee calls a *“good neighbor policy”* (p. 13). In fact, as we saw in Section 7.1.3, *firm 10* finds the **Pulsup Project slightly redundant**; he said *“quite a few of the things we are practically doing*

already, as well. It is nice if it is regulated and organized, and you know, in a proper way, you know, but we individually are doing it already” (int. 13, co. 10, p. 12).

The Pulsup Project’s functions would not substitute this self-organized and informal system of communication and cooperation, but it would actually provide firms with complementing services. The project could structure and organize the existing forms of cooperation to render them more efficient and effective, but it would also propose new sustainable practices that maybe at the moment firms cannot even imagine. For *firm 7* for example the Pulsup Project may constitute an interesting alternative to the current situation. In fact *firm 7*, because of its location and the high number of competitors, finds difficult to differentiate its assortment and given that it is passing through some economic struggle is triggered by the idea of saving resources through the Pulsup Project in unforeseen and new ways.

Reflection: Probably also Groothandelsmarkt firms could need a sharing economy website to look for what they need. In other words, it could be that these firms have a lower perception of their need to cooperate because they are already part of a series of cooperative relations. However, the kind of cooperation that would be fostered by the Pulsup Project is different from the one that was described by the wholesale market firms that were interviewed, but it is possible that at a first sight they do not see that because they already cooperate.

Overall, the initial assumption is contradicted only to a certain extent, because if on the one hand, from the data distribution does not result that the Groothandelsmarkt firms are more willing to participate in the Pulsup Project than the other firms of the Spaanse Polder, on the other hand, as we have just seen, it is confirmed that for similar and neighboring firms to cooperate with each other is easier and more spontaneous than for firms that are different and located far from each other. In fact, initially it was thought that the firms of the Groothandelsmarkt would cooperate more and that because of this reason they also would be more willing to participate in the Pulsup Project. This assumption was proven wrong by the data (table 5.4), in the sense that the **wholesale market firms do cooperate more than other Spaanse Polder firms but this aspect seem constituting a constraint to their participation in the Pulsup Project rather than a trigger. The contrary seems true: firms that are located outside the Groothandelsmarkt seem more interested in participating in the Pulsup Project because for them it is more difficult to find local partners to cooperate with.** By the way the interviewee of the ‘willing’ *firm 9*, which is located outside the wholesale market, said “...*because there are really dissimilar firms in the SP, for us it is really difficult to do cooperation with” (int. 12, firm 9, p.1).*

7.2.2 Firms located outside the Groothandelsmarkt Spaanse Polder

It is useful to recall the assumption that was presented at the beginning of this section: it was expected that firms located outside of the Groothandelsmarkt Spaanse Polder would less probably cooperate with other companies because of their heterogeneity and their spatial dispersion, and that this would explain their lower degree of willingness to participate in the Pulsup Project. The qualitative data supporting this empirical research confirms this assumption: **firms located outside the Groothandelsmarkt cooperate less than the companies that are located inside the wholesale market, even if they are also involved in cooperative relations.** However, **their lower frequency of cooperative relations with other companies**

does not constraints their willingness to participate in the Pulsup Project, but it rather triggers it, as we can see by the data distribution presented by Table 7.2.2. In fact, from the interviews it became evident that also dissimilar firms, as those that are located inside the wholesale market Spaanse Polder, can share alike needs, and that they actually are interested in this practice.

However, it seems that **two aspects constrain mutual cooperation** among the companies located outside the wholesale market, thus among dissimilar or spatially dispersed (similar) firms. Firstly, **often firms whose needs are compatible and that could establish relations of mutual help and/or that could match their needs do not know about each other necessities**. It is possible that many different firms have assets and resources that they could make available for other firms, or vice versa that they could rent or borrow from other firms to satisfy a need and make a more optimal use of an asset that is already available. For example, company A may have a beamer but it is not using it, while company B exceptionally needs to give a presentation the following week but it does not have a beamer. The difficulty resides in getting to know other firms' idle capacities and needs. Thus, in this case for company B the turning point would be to know that company A wants to borrow/rent the idle capacity of the beamer it owns. Looking into the interviews, a similar situation was presented by the interviewee of company 1 who said *"if I have leftovers papers, and the fish firm needs paper to wrap up the fish, I say 'of course!'...it cannot be because of the ink, this is not possible for food, but let's say it is possible, well, ok! He buys it for 20 cents, I sell my rest products for 2 euro, he says 'I give you 5', and I say 'well, good deal!' But... FIND IT! It's hard to find!!! Maybe, as a company, we don't look; we don't put too much effort to put them up... If there is a firm and I know it is interested in... and I know where you can find it, and they are there, and maybe I go talk and make a match... Good! But if you want to leave the initiative to the firms themselves... it takes a lot of effort and time, for what?? To do a better job doesn't give the money. Right? People do not want to pay for it!"* (int. 1, co. 1, p. 6). This case exemplifies how difficult and economically and timely costly can be to find firms whose needs match the own needs, even if this is possible. Thus, **the ignorance of existing and possible matches constitutes a constraint to the development of a more sustainable, effective and circular use of the already available resources**. In this sense, building a sharing economy website makes sense because it would facilitate firms' research of assets or of users of the own idle capacities that they could borrow, rent or exchange. Thus, recovering the last example, the interviewee of company 1, just connecting to the Internet, could browse and look for the assets other firms have posted and find the useful match. **The utility of such online tool seems higher for those firms that are located outside the Groothandelsmarkt because for them it is more difficult to be close to other businesses than for the wholesale market firms**. In this sense, a sharing economy platform would constitute a bridging tool especially for firms that are distant from each other in terms industry specialization and geographical location. In fact, as we have verified, for close firms, like those located in the Groothandelsmarkt, it is easier to establish relations with other firms and be aware of shared needs.

Secondly, often firms prefer to draw from already established connections and partnerships with other firms, even if these are located far away and they could find closer matches and partnerships because of a matter of routine, time, and prices. In fact, for example for company 1 is cheaper to get the material in Latvia than in the Netherlands (int. 1, co. 1, p. 10). However, more than an interviewee expressed appreciation for the idea of having close suppliers, customers, and partners. As the interviewee of firm 5

said *“it is easy when distance is short!”* (int. 5, co. 4, p. 6). Often this is not the case. To better understand this point we can look at a situation explained by the interviewee of firm 1. Firm 1, which is a printing company, thus not located in wholesale market, would like to render its business more locally-centered. The reason is that it would like to develop the service-part of his business, because *“our firm is small so we cannot be the cost leader, and that means that we have to do the service!”* (co. 1, int. 1, p. 10). This desire explains why firm 1 is looking for closer customers and suppliers; it is difficult to develop his business’ service part because most of its customers and suppliers are located far away. Participating in the construction process of the Pulsup Project, and using the result – the sharing economy platform – this company could surprisingly find what it is looking for. Indirectly, the Pulsup Project could constitute a tool also to spread the own company and get to know new realities. In other words, often firms do not change habits, even if it would be convenient, even because they do not know where to look at. Whether for the firms that are located in the Groothandelsmarkt is easier to build relationships locally, the other firms of the Spaanse Polder have more the problems to do so for the reasons we have previously discussed.

Conclusions: There is correlation between the location and willingness to participate in the Pulsup Project. Firms that are located outside the Groothandelsmarkt seem to be more motivated to participate in the Pulsup Project than firms located within. In fact, for the firms located outside the wholesale market it is more difficult to find firms whose needs are complementary with theirs than for the firms that are located inside the wholesale market. Vice versa, for the firms located in the wholesale market to find and cooperate with firms whose needs are complementary seem constituting a constraint to their participation in the Pulsup Project rather than a trigger to their participation in it.

7.3 The size of the firm

This thesis’ section investigates whether there is a more or less direct relation between the size of a firm and the relative degree of willingness to participate in the Pulsup Project. The size of a firm is here defined in terms of number of employees. The three categories that were established are the following:

- Small firms are those that have up to 10 employees,
- Medium firms are those that have between 10 and 50 employees,
- Big firms are those that have more than 50 employees.

Generally, a firm’s size can be defined on the base of several criteria: its number of employees, its turnover, and/or its balance sheet total, and the criteria for defining the size of a firm differ from country to country, and even within a same country. Here, it was decided to use the number of employees to define the size of a firm because it was considered more practical and less intrusive to ask the interviewee about the number of employees of his or her company, rather than about the company’s turnover or balance sheet total. Thus, we should look at data that is presented in this section keeping in mind that defining the size of a firm only considering its number of employees provides with an approximate (arbitrary) appraisal of the real size of the company. By the way, the interviewee of firm 14 said *“...then you can have, especially in the trade, in the finance business, a small firm that does really a lot, a lot, of money! For example, fruit and vegetables, you can deal with two or three people lots, and lots, and lots of fruit and vegetables. So, those are small firms, but counting to the money, those are big firms”* (int. 14,

firm 11, p.2). Thus, a firm that is considered small on the base of its number of employees could be considered big on the base of its turnover. Keeping this consideration in mind, here the number of employees constitutes the criteria to define the size of a company.

7.3.1 The initial assumptions

Before conducting the field research that supports this dissertation, several assumptions about the impact that the size of a firm can have upon its willingness to participate in the Pulsup Project had been developed. Beforehand, it is useful to recall (from Chapter 4) that the Spaanse Polder constitutes one of the biggest industrial areas in the Netherlands for *small and medium-sized enterprises* (SMEs) or *small and medium-sized businesses* (SMBs). Keeping this consideration in mind, it was supposed that:

(1) Small-sized firms (<10 employees) might be willing to participate in the Pulsup Project., depending on the firm and its condition. In fact, even if their dimension is mainly local, it was supposed that their attachment to the area would probably be less reliable, thus more volatile, because of their lower economic robustness, than for bigger-sized firms. It was thought that the lower economic robustness thus could constrain small firms' ability to provide the project with a reliable participation.



(2) Medium-sized firms (10-50 employees) would be the most willing to participate in the project of local industrial re-development because of their robust and settled attachment to the Spaanse Polder. In other words, it was thought that their desire to contribute to the area would be higher than for other firms and that this would constitute their main motivator element. Furthermore, it was thought that medium-sized firms are robust enough to contribute to the project. These are the reasons that explain the assumption that medium-sized firms would be able to and interested in commit to a project, that as the Pulsup, wants to innovate local business practices.



(3) Big-sized firms (>50 employees) would be the least interested in the Pulsup Project because of their fleeting relation with a specific place. Based on the consideration that they tend to move their branches from a place to another one depending on contingent needs established by a displaced directorate, the market, or the ambition to increase the own economic profit, it was assumed that their relation with the Spaanse Polder would be 'lighter' than for smaller-sized firms. Thus, it was supposed that their detachment from the area would constitute the major constraint to their participation in a project that like the Pulsup, aims at the redevelopment and requalification of a specific area, the Spaanse Polder.



However, it was considered that big firm would have the highest ability to trigger and contribute to the project because of their major economic and persuasive power.

Table 7.3. Relation between size of the firm and degree of willingness to participate in the Pulsup Project

Size	Willingness to participate in the Pulsup Project		
	Not willing	Maybe willing	Willing
Small (<10)	2, 4		8, 9
Medium (10-50)		1, (3), 7, 10	5
Big (>50)		(11)	6

On the base of the empirical data that was gathered, the initial assumptions do not seem to be punctual even if certain aspects that were initially taken in consideration sometimes play an important role. The data in fact provides us with more general reflections about the relation between the size of a firm and its willingness to participate in the Pulsup Project. **We can start by saying that even if the size of a firm can influence the firms' position towards the Pulsup Project, it cannot completely explain it.** Then, we can look more in detail to what extent the initial assumptions are matched by the gathered data.

The Table 7.3 depicts with which frequency firms of a certain size expressed a different degree of willingness to participate in the Pulsup Project. About the small-sized firms It was assumed that they may be interested in the project, in fact out of four small-sized firms two are 'willing' and two are 'not willing' to participate in the Pulsup Project (It is useful to recall that some of the small- and medium- sized firms could be considered big-sized firms whether we would chose the turnover as criteria to define their size. In fact, firm 2, which is a wholesale of fruits and vegetables, said that they should be considered a medium-sized firm on the base of their turnover because it is higher than 2 million euro per year (int. 2, co. 2, p.6)). About the medium-sized firms, which are the majority in the sample, it was assumed that they should be rather interested in the Pulsup Project, and in fact none of them was classified as 'not willing'. However, only one out of five medium-sized firms is 'willing' to participate in the Pulsup Project, while the others are 'maybe willing'. Finally, the big-sized firms, which are only two, none rejected the possibility to participate in the Pulsup Project: firm 11 is 'maybe willing' and firm 6 is 'willing'. Thus, about big-sized firms the initial assumption that they should be less interested in participating in the project was not confirmed by the gathered data.

Overall, the qualitative data of the research partially disconfirms the initial assumption about the relation between size and willingness to participate in the project, because as we have just seen, the big firms that were interviewed tends to be 'willing' to participate, rather than 'not willing' to participate in a project like the Pulsup. Why? We are going to look at it, but **we start by saying that it seems approximate to expect to define a straight forward relation between the size of a firm and its willingness to participate in the Pulsup Project.**

About the relation between size of a firm and degree of willingness to participate in the Pulsup Project, interesting insights emerged from the interviews. We are going to look at them keeping in consideration the aspects that were taken in consideration to build the initial assumptions, which are *the attachment to*

the area and the ability and interest in engaging in project of local development, but also other aspects that emerged during interviews and that were not previously taken in account, like the *relation between firms' size and awareness of sustainable practices or the greater flexibility of small firms*. Thus, from the analysis of the interviews other interesting aspects concerning the relation between size and willingness to participate in the Pulsup Project were brought to the surface, and now we are going to analyze them.

7.3.2 The attachment to the area and size

Beyond the size of the company, generally all the firms that were interviewed are rather attached to the Spaanse Polder, in particular, and to the Rotterdam region, in general. In this sense, the assumptions that big firms are not so attached to the area, and that the roots of small firms are not so robust, are not confirmed by the gathered data. Thus, from this point of view, potentially all the firms that were interviewed, beyond their size, may be motivated to participate in projects that take care of local development.

To exemplify this finding it is enough to look at *firm 11*, which is big-sized and 'maybe willing', and at firm 6, which is big-sized and 'willing'. Both firms' managers exert, in different measure and fields, frontline roles for the local development. Maybe these two cases constitute exceptions; however these two firms are attached to and interested in the development of the Spaanse Polder. On the one hand, firm 6 expresses this interest more in the form of *social responsibility*, while firm 11 expresses it more in the form of business community development. The firm 6, which is a 'willing' company, is highly aware of concepts like sharing and circular economy, and it is engaged in activities that promote social (social projects) and environmental (electric cars) sustainability in the Rotterdam region. Probably it is the same specialization of this firm that explains its involvement in the local development. In fact, the firm 6 is the mobility director of the city of Rotterdam and surroundings, which means that it manages the local taxi mobility system and that it also provides the public service system with specialized mobility service for elderlies and disables people. On the other hand, firm 11 is also highly aware of concepts like sharing and circular economy, and its manager is locally engaged as well. In fact the manager of firm 11 is also the chairman of the Spaanse Graave, the business club of the Spaanse Polder's entrepreneurs (see Chapter 4), and as such he is engaged in the development of a friendly business environment for the local entrepreneurs. Beyond their participation or not in the Pulsup Project, the two big firms of the sample are engaged in activities concerning local development. **Thus, these cases do not support what was initially assumed, that is that big firms tends to be more detached from projects of local development. It may be a hazard that both the big-sized firms that were interviewed are engaged in activities of local development.**

It is the very firm 11's statement about the reasons of existence of the Spaanse Grave that may suggest that these two big firms constitute an exception. The manager of firm 11 and chairman of the Spaanse Graave at a certain point in fact somehow confirmed that big firms are more detached from the local dynamics. This rather seems one of the reasons that explain the existence and mission of the Spaanse Grave itself. By the way, while he was talking about the importance of making acquaintances for doing business, he said "*...to make acquaintances! That's important and that's not always possible... because the big firms, they have managers, but they don't work too much on the social context because they have*

a business to run! So you don't know exactly where they are and that's why business clubs are really nice for. Then they all come together and they are able to talk..." (int. 14, co.11, p. 18). Thus, it seems that to get in contact and build relationships with big-sized firms' managers is rather challenging because of their busy schedules. **This statement confirms the initial assumption that big firms are more detached from local dynamics and that it is difficult to hook them to project of local development. Given this is contradicted by firms 6 and 11's engagement in activities of local development; it is preferable to take this assumption with a grain of salt.**

7.3.3 The ability to engage in a project of local development and size

During the interviews the idea that the bigger a firm is, the bigger its economic power is, thus its ability to impact local development, invest, take risks, innovate, and influence the surroundings, was partially supported by one of the interviewees. However, it seems that big firms also experience some constraints in this respect, while for small- and medium-sized firms it is easier to innovate because they are more flexible.

As it was said by the interviewee of firm 1, big firms can take more risks, which in other words means that they have a greater capacity to face the risks that investing in 'something' new can imply, either this something is a new machinery, or the engagement in a project. Every time a firm innovates faces a certain margin of risk. For example, for a firm to engage in a project, as the Pulsup can be, implies an expense in terms of time and money; time constitutes a precious asset for a company. Time invested in a project is time deducted from another (profitable) activity. Thus, before undertaking a new process, whatever its nature is, a firm needs to evaluate the pros and cons of such decision. By the way, interviewee of firm 1 while was talking about investments in innovation said *"...because investments and so on are really expensive... so you have to be really careful with what you do, how you invest your money. If you do that in new machinery, it is really new, and you don't know if... It is not proven, so that is a big risk, even if it looks great! It can be powerful, but it can also be a big regret! And if you are really big and if you have a lot of money in your bank account you could take the risk..."* (int.1, co. 1, p. 20). From this quote we understand that **firms should be prudent about their investments, and that generally big-sized firms enjoy of a bigger margin of risk than smaller firms.**

However, it must be taken in consideration **that for certain big-sized firms can be more difficult to innovate than for smaller firms because they are less flexible.** In fact, the hierarchical structure of a big firm can be constraining. If this is not the case for the big firm 6, given that its headquarters are located in the Spaanse Polder, it is true for firm 11, which is a Toyota dealer. This means that the autonomy of firm 11 is limited because it does not constitute the headquarters of Toyota. This idea was well explained by firm 11's manager while he was talking about innovation, he said *"we are always interested in innovation! That's way we have started with the green motion. We invest in in our bodyshop in Tesla, the electric car. We are one of the six firms in the Netherlands that are allowed to repair them. So we invest in innovation but we are a dealer we always depend on what the factory is building. If tomorrow Toyota decides to stop building hybrid cars we are not innovating anymore, but if tomorrow they decide to build hydrogen cars then we are one of the most innovative firms. So we depend from what the fabric decides!"* (int. 14, co. 11, p. 10). Even if adhering to the Pulsup Project requires a different kind of involvement, this

expedient well-explains the **difference in decisional autonomy between a small- or medium-sized firm** whose owner probably manages the firm from the firm itself and that thus is directly involved in the day-by-day decisions the firm has to take, **and the big-sized firm** which local office constitutes a branch of a geographically distant and superior direction. Thus, **small- and medium- sized firms are more flexible and innovative; they can more easily introduce a change, like to participate in the Pulsup Project.** This concept was expressed by the interviewee of firm 11 who said *“because we have got more than a million firms in Holland...almost only small firms until hundred people, that is why you are so flexible and you make constantly new things!”* (int. 14, co. 11, p. 2). Thus, **small- and medium- sized firms enjoy of a major autonomy and freedom to undertake innovation and change than big-sized firms. From this perspective, for them it should also be easier to engage in the Pulsup Project.**

However, it is important to keep in mind that if a big-sized firm decides to introduce a change its impact can have a rather discreet relevance at the societal and economic level because of these firms’ economic and influential power. If big-sized firms become more sustainable other firms want to follow (Network Effect Theory, Almasi et al., 2011; int. 1, co. 1, p. 20). In effect, if we look at Toyota expedient that was presented in the previous paragraph, and we imagine the extent to which a decision taken by Toyota can influence society, we see that big-sized firms potentially can strongly determine changes in society. Through the promotion of hybrid-electric vehicles Toyota is branding its logo as sustainable. Doing so this multinational on the one hand exerts a real positive effect on the reduction of CO2 emissions, while on the other hand, performs a symbolic action that affects people mindset at the societal and economic level. We could say that in so doing Toyota is carrying out a social responsible action, which can be influential precisely because of its big size. The more a firm is known, the more the firm can be influential at the societal level and give example. Toyota producing hybrid electric cars promotes and establishes new practices at the societal level. Doing so Toyota, as well as other big-sized firms, behaves as role-model and slowly triggers a ‘network effect’ (Almasi et al., 2011) that eventually spreads throughout society (int. 14, co. 11, p. 11). Overall, we can say that big firms are able to carry out actions that may constitute a precedent and a source of inspiration for other firms and entities. This constitutes a point in favor to the participation of big-sized firms to the Pulsup Project.

The degree of awareness and size: During the interviews light was shed over a previously overseen aspect, which is the relation between size and degree of awareness. An interviewee’s opinion was that big-sized firms should be more aware of the sustainability issues supporting the project than smaller firms. However, the distribution of awareness among the selected firms does not support the interviewee’s opinion, which anyway deserves attention.

When interviewed, the interviewee of the firm 1 and chairman of the Belangenvereniging Spaanse Polder (see Chapter 4), said that he would expect big-sized firms to be more aware of the concepts that supports the Pulsup Project, like sustainability, sharing economy, or circular economy. As we saw, the awareness of key concepts to a certain extent explains firms’ willingness to participate in the Pulsup Project. **Awareness of the sustainable issues constitutes a motivator for firms to undertake certain risks**, as participating in the Pulsup Project could constitute to a little extent. Thus, **if a firm believes in the importance of adopting more sustainable behaviors probably will be more willing to participate in a project like the Pulsup.** What the interviewee of firm 1 suggested to me was to interview big-sized firms

because he believes that they are more aware of and into being up to date for what concern economic and societal trends, as the sharing and circular economy can be, than smaller companies. In fact, the interviewee was skeptical about small-sized firms' interest in the Pulsup Project because he thinks that small-sized firms' degree of awareness of and interest in sustainability economic and societal trends is low. He said *"most of them (the Spaanse Polder firms) are, as I am, a small company... I am curious if you can..."* (int. 1, co. 1, p. 23). This phrase should end like *"... you can talk with them!"* He considers small firms less open to discuss and interested in the concepts that, like sustainability, supports this research than big firms. Then he suggested to me to look at the firms that are bigger. When I asked him why, he replayed *"well, I think their awareness is bigger! I think so!"* As a matter of fact, **the two big firms that were interviewed expressed a high degree of awareness of the different shades of sustainability here taken in consideration: sharing economy, circular economy, industrial symbiosis. However, even medium-sized, like firm 1, and small-sized firms, like firms 8 and 9, or 4 expressed a rather high degree of awareness.**

Small- and medium- sized firms: For small- and medium-sized firms (SMEs) the size does not seem constituting a major constraint to their participation in the project. From the interviews it emerged that due to their size, for SMEs is important to differentiate themselves within their market to become more competitive; for SMEs this is possible because they are more flexible and able to innovate than bigger firms; and for SMEs to participate in the Pulsup Project could be useful to increase their acquaintances' network.

Big-sized firms: For big-sized firms their size seems to constitute neither a major constraint nor a trigger. From the interviews, it emerged that big-sized firms enjoy of less flexibility and decisional autonomy than SMEs; that their major economic power and influence can make of them role models and local development frontrunners; and that this constitute a reason to desire to have big-firms "on board".

7.3.4 The goodness of the Pulsup Project: increase social relations

Participating in the Pulsup Project, small- and medium-sized firms could extend their social and business network, also embracing big-sized firms, which usually seem more difficult to hook to the own network of acquaintances. The Interviewee of firm 8 said that for his company, which is small-sized and 'willing' to participate in the Pulsup Project, it is easy to network with neighboring firms and ask for favors -even if they are not located in the Groothandelsmarkt- because they are small as his company. The message he sent was 'small firms get along with small firms, it easier to communicate, understand and help each other' (int. 11, co. 8, p. 8). The Interviewee of firm 11 and chairman of the Spaanse Grave said that to hook the managers of the big firms is difficult, which is one of the reasons that explain the existence of the Spaanse Grave (int. 14, co. 11, p. 18). In this sense, the Pulsup project constitutes a tool that would allow the creation and support of transversal networks among different-sized firms, which could be beneficial for all of them. What firm 1 said, talking about visiting expos and fairs, is that they are good to meet with firms that are different from the own that can be inspiring and beneficial to learn new things *"...so we...talked to colleagues, but especially with no colleagues, to learn from totally different firms how to do that, because it may be interesting to learn other ways of doing things!"* (Int. 1, co. 1, p. 20). That means that confrontation with colleagues, but also with totally different firms, can be inspiring. Thus, it seems

that participating in the meetings that are functional to the realization of the Pulsup Project, as well as the use of the Pulsup sharing economy platform, would bring occasions of confrontation and contact among different firms, regardless of their size. This could be useful and beneficial for the firms of the Spaanse Polder, as well as for the diffusion of the sustainability issues' awareness in particular, and ideas in general. Whether it is true that generally small- and medium- sized firms present a lower degree of awareness of economic and societal trends, these firms participating in the Pulsup Project could have the chance to network with big-sized firms and through confrontation increase their own awareness. Overall, the willingness to participate in the Pulsup Project of firms like the 8 and 9 may reside in their same condition of small- and medium- sized firms. Small- and medium- sized firms may be motivated by the Pulsup Project because it provides them with the possibility to get to know other firms of the same or bigger size. In this respect the Pulsup Project may constitute a bridge between small- and medium- sized firms and big-sized firms. Thus, to give to firms of every size the possibility to interact with big-sized firms is another reason why big-sized firms should be involved in the Pulsup project.

Given that small- and medium- sized firms generally cannot aim at being cost-leaders in their sector they aim at differentiate themselves and define their identity in the market in an alternative way to occupy a specific niche in it. This thesis was expressed by interviewee 1 who said "*our firm is small so we cannot be the cost leader, and that means that we have to do the service!*" (int. 1, co. 1, p. 10). The interviewee was saying that given that its printing firm cannot aim at being the cost-leaders in its market, it also provides its clients with all a series of customized services. That is, small- and medium- sized firms should focus on other niches of specialization to differentiate themselves from the rest of the firms. In other words, for small- and medium- sized firms seem beneficial to invest in the development of specific services to offer to clients and so doing guarantees them a niche in the market. In this sense, businesses can benefit from the definition of a specific identity, as it happens with firms that "have sustainability in their DNA", as it could be a firm that uses only recycled resources to produce own resources. Participating in a project like the Pulsup, which aims at promoting an innovative and sustainable way of doing business, specifically promoting circular and sharing economies practices, would allow these firms to achieve such goals. Thus, investing in the Pulsup Project could be a way to define an avant-garde identity in the market.

Finally, small- and medium-sized firms whether want to achieve certain goals may need to gather with other firms to cooperate to achieve those goals. That is the reason why the Belangenvereniging (see Chapter 4) exists. In other words, if you want to change things and you're a small firm it is better you join the forces with other firms; this is 'the power of the crowd' (int. 1, p. 21). For example, big-sized firms are tough competitors for the firms of the wholesale market (int. 7, co. 7, p. 4).

Conclusions: The correlation between firm's size and willingness is not clear-cut. In other words, the size of a firm cannot exhaustively explain a firm's position towards the Pulsup Project.

7.4 The age of the firm

This thesis' section investigates whether there is a more or less direct relation between the date of foundation of a firm, the number of years it has spent in the Spaanse Polder, and the relative degree of willingness to participate in the Pulsup Project. This information was taken in consideration because it was assumed that the age of a company, as well as the length of time spent in a specific place, can influence a company's sense of belongingness to the Spaanse Polder. This could be seen as a reason for local firms to desire the Spaanse Polder's "wellbeing" and good reputation, which is seen as a triggering feeling that boost firms' willingness to commit to a project of local development, as the Pulsup Project is. Thus, it was assumed that aged firms tend to be more willing to participate in the Pulsup project because they care more about the overall "health" of the Spaanse Polder than firms that have been located there for a shorter period of time. In other words, **it was assumed that older companies that have spent more time in the Spaanse Polder feel a stronger sense of belongingness to the area which boosts their willingness to participate in projects of locale development, like the Pulsup Project.** To appraise this assumption two interrelated aspects were taken in consideration: a company's foundation date, which can be before the year 2000 or after the year 1999, and a company's length of residence in the Spaanse Polder, which can be higher or lower than 15 years. Table 7.4 and table 7.4 Bis respectively show these two aspects of a firm in correspondence with the relative degree of willingness to participate in the Pulsup Project.

Table 7.4. Relation between age of a firm and degree of willingness to participate in the Pulsup Project

Foundation date	Willingness to participate in the Pulsup Project		
	Not willing	Maybe willing	Willing
Before 2000 (>15 years)	2, 4	1, 7, 10, 11	9
After 1999 (<15 years)		(3)	5, 6, 8

Table 7.4Bis. Relation between the time that a firm has spent in the Spaanse Polder and degree of willingness to participate in the Pulsup Project

Location in the Spaanse Polder	Willingness to participate in the Pulsup Project		
	Not willing	Maybe willing	Willing
For more than 15 years	2, 4	1, (3), 7, 10, 11	9
Shorter than 15 years			5, 6, 8

From the observation of table 7.4 and table 7.4Bis the initial assumptions stand out as erroneous. A part from the fact that most of the sample's firms were founded before 2000 and that only three firms out of eleven were founded after 1999, we can see that these three firms –firms 5, 6, and 8- are the very 'willing' firms. In opposition to what was initially assumed, the gathered data suggests that firms that were founded after 1999 and that have been located in the Spaanse Polder for less than 15 years are more willing to participate in the Pulsup Project than older firms. **This observation suggests that firms that are**

relatively young and that have been residing in the Spaanse Polder for relatively little time tend to be more willing to participate in the Pulsup Project than older firms that have been located in this industrial area for a higher number of years. Does this aspect of a firm contribute to a company's degree of willingness to participate in the Pulsup Project?

From the analysis of the interviews of the four 'willing' firms pops up that they all are happy and satisfied with the Spaanse Polder location, and that they feel belongingness to the area. This appreciation for the area of their firms' location however does not seem to exhaustively explain their willingness to participate in the Project, because a part from the firm 4 (nonetheless this firm has been located in the Spaanse Polder for almost 60 years the owner says that he does not feel a particular attachment to the area and that he would not mind to move somewhere else. Thus he is not particularly committed to the Spaanse Polder and is rather indifferent towards the Pulsup Project), **all the firms of the sample are rather happy and satisfied with their location in the Spaanse Polder.** Thus, **it seems difficult to take uniquely this aspect in consideration to explain firms' higher or lower degree of willingness to participate in the Pulsup Project.**

Instead, looking at all the firms that are 'young' and 'willing', which are the three firms that are younger than 15 years in every sense –date of foundation and length of time spent in the Spaanse Polder- and firm 9, which has been located in the Spaanse Polder for 17 years, **it stands out that a part from firm 6, the other firms give the impression to see in the Pulsup Project an opportunity to extend the own business and social network within the Spaanse Polder and maybe the Rotterdam region.** This opportunity seems constituting a trigger or a motivator of firms' willingness to participate in the Pulsup Project. In fact, it seems plausible that a firm that has spent relatively little time in the area is more willing and in need to meet other entrepreneurs and spend time to work on the own company's business and social network. A firm that is relatively young in terms of date of foundation and time spent in the Spaanse Polder on the one hand needs to grow and to extend, on the other hand, does not know many other firms of the area yet. By the way, it is interesting to notice that none of the 'willing' firms are homed by the Groothandelsmarkt Spaanse Polder. As we saw in the Chapter 7.2.2 all the firms that are homed by the wholesale market belong to a lively network of relationships with the neighboring firms. Given that for firms is rather important to entertain relationships with other firms, this observation suggests that **certain firms of the Spaanse Polder sees in the Pulsup Project an opportunity to meet with other entrepreneurs and extend the network of acquaintances in the area.** This opportunity seems triggering and motivating firms' willingness to participate in the Pulsup Project.

Conclusions: There is some correlation between the age of and length of time a firm has spent in the Spaanse Polder and willingness. The relation between age of and length of time a firm has spent in the Spaanse Polder is negative, in the sense that young firms that have spent less time in the Spaanse Polder tend to be more willing to participate in the Pulsup Project than older companies that have spent more time in the Spaanse Polder.

7.5 The embeddedness of firm

This thesis' section investigates whether there is a more or less direct relation between the embeddedness of a firm and the relative degree of willingness to participate in the Pulsup Project. Thus, it was decided to look at whether the firms of the Spaanse Polder belong to none, one, or both the firms' organizations of the Spaanse Polder because it was assumed that this feature can affect a company's degree of willingness to participate in the Pulsup Project. The membership of a firm to either the Belangenvereniging Spaanse Polder or to the Spaanse Graave, or both firms' organizations (see Chapter 4), as well as 'the age of a company' (Chapter 7.2.4) and the 'size of a company' (Chapter 7.2.3) were supposed to tell something about a company's attachment to the Spaanse Polder. **The concept of attachment could also be expressed as the interest of a firm in the wellness of the area.** On this rationale's wake, it was assumed that a firm that is a member of one or both the Spaanse Polder's firms' organizations is more inclined to be interested in initiatives of local development. Hence, it was assumed that being member of one or both Spaanse Polder's firms' organization would tend to positively affect the degree of willingness to participate in the Pulsup Project of a company.

Table 7.5. Relation between a firm's membership to the Belangenvereniging Spaanse Polder and the correspondent degree of willingness to participate in the Pulsup Project

Member Belangenvereniging Spaanse Polder	Willingness to participate in the Pulsup Project		
	Not willing	Maybe willing	Willing
Yes	2, 4	1, (3), 7	6
No		10, (11)	5, 8, 9

Table 7.5Bis. Relation between a firm's membership to the Spaanse Graave and the correspondent degree of willingness to participate in the Pulsup Project

Member Spaanse Graave	Willingness to participate in the Pulsup Project		
	Not willing	Maybe willing	Willing
Yes		(11)	6
No	4, 2	1, 7, (3), 10	5, 8, 9

Table 7.5 and table 7.5Bis respectively show whether a firm is a member or a non-member of the Belangenvereniging Spaanse Polder, and whether a firm is a member or non-member of Spaanse Graave, and the respective degree of willingness to participate in the Pulsup Project. More than half of the sample's firms belong to the Belangenvereniging Spaanse Polder, while only two firms of the sample belong to the Spaanse Graave. Said so, among the members to at least one of the organizations there is a great variety of positions, thus **it cannot be said that there is a direct relationship between the membership to one of the Spaanse Polder's organizations and the degree of willingness of a company.** In other words, **being a member of one of the organizations does not explain a company's willingness to participate in the Pulsup Project**, so the initial assumption is rejected.

However, it is interesting to notice that the *firm 6*, which is one out of the two firms that belong to both organizations, is highly 'willing' to participate in the Pulsup Project. Firm 6, as we have seen in the previous chapters, is committed to society and interested in innovation and change. To remember, firm 6 is a big-sized firm and it is the mobility director of the taxi-service of Rotterdam, but it also carries out social services of different kind. To explain what kind of social services this firm carries out we can look at what the interviewee said: *"we also have large contracts with health care institutions that run day-care for people with dementia or children with the Down syndrome and stuff like that... and all those transports move those children from their houses to the day-care, and stuff like that. That's what we organize!"* (int. 9, co. 6, p. 3). Firm 6 is socially responsible and given its features, it seems this explains a large portion of this company's willingness to participate in the Pulsup Project, as well as its participation to both the Spaanse Polder's firms' organizations. In other words, we could say that **companies that are socially responsible tend to be more committed to local development thus they more probably participate in organizations that take care of the locale development as the Belangenvereniging and the Spaanse Graave.**

Then again it is curious to see that **most of the 'willing' firms neither belong to the Belangenvereniging Spaanse Polder nor to the Spaanse Graave.** Thus, the reflection elaborated in the previous Chapter could be extended to this Chapter. This suggests that other factors explain the desire to participate in the Pulsup Project expressed by the 'willing' firms 5, 8, and 9. If we recall the Section 7.2.4, we could think that their willingness to participate in the Pulsup Project is mainly explained by the possibility of networking with other firms that this project seems providing them with, rather than because of their engagement in local development.

Conclusions: It results slightly difficult to draw a conclusion using embeddedness as indicator, because probably it was not well operationalized. In fact, embeddedness is a much more complex concept (different kinds of embeddedness exist: structural embeddedness, social embeddedness, cultural embeddedness, regional embeddedness, political embeddedness) than it seems for how it has been operationalized here. This variable here rather tells something about social embeddedness that is how social a company is, which constitutes only an aspect of this complex concept. Even if embeddedness is a much more complex concept than how it was here measured. Taking for good the way embeddedness was here operationalized - whether a firm is a member of one of the Spaanse Polder firms' organizations or not – we observe a negative relation between embeddedness and willingness. That is firms that are not members of one or both Spaanse Polder's firms' organizations tend to be more willing to participate in the Pulsup Project than those firms that are member of these organizations.

7.6 The quality of the firm

This thesis' section investigates whether there is a more or less direct relation between the quality of a firm and the relative degree of willingness to participate in the Pulsup Project. The quality of a firm is here defined by the possession or not of a certificate per part of a company. The possession of a certificate tells something about the quality of a firm because it is like a business card for the outer world. A certificate serves the need to certify and assure suppliers, clients, and customers about the company's activities' procedures, used materials, and safety. A certification tells also something about a company's features,

values, and interests. For certain kind of businesses it is compulsory to have certain standards and certifications. For example, firms that manage alimentary products must have the HACCP (Hazard Analysis Critical Control Point) certificate by law. Sometimes, the industry sector imposes some requirements to the firms belonging to it, as we have seen with the alimentary sector or how it can be for the car sector. In other cases, a firm can decide to obtain a certificate because of the own values, the image that wants to give of itself to markets, clients and institutions. For example, a firm may want to obtain the certificate ISO 14001 which certifies the environmental sustainability of a firm and its productive procedures. In this sense, a certificate tells something about the quality of a company. The quality of a firm is here generally given by two opposing categories, that is a firm can be either officially certified (or about to obtain a standard and or a certification) or not officially certified.

This Chapter investigates whether there is any telling relation between the quality of a firm and its degree of willingness to participate in the Pulsup Project. It was initially assumed that if a firm owns some kind of standards or certification should be more positively inclined towards the Pulsup Project than a firm that does not have any of them, in particular whether the standards and certifications that a firm owns are meant to guarantee the ecological and social sustainability of the firm. In fact, in this case it is reasonable to expect that the firm is aware of the sustainability issues and that is not indifferent to them. As it was seen in the Chapters 6.1 and 7.1, the awareness of a firm tends to positively impact and explain the degree of willingness of a firm to participate in a project that as the Pulsup wants to promote a more circular way of doing business through the use of a sharing economy platform. Table 7.2.6 shows the relation between being officially certified or not being officially certified and being willing to participate in the Pulsup project.

Table 7.6. Relation between a company’s membership to the Spaanse Grave and degree of willingness to participate in the Pulsup Project

Official certification	Willingness to participate in the Pulsup Project		
	Not willing	Maybe willing	Willing
Yes, or working on it	4	1, (3), 10, (11)	6, 8
No	2	7	5
?			9

Looking at the Table 7.6 we see that most of the sample’s firms have some sort of standard and certification, only three firms out of eleven do not have any, while unfortunately data is missing about firm 9. Before trying to draw any conclusions, it is useful to make some observations. For example, firm 6, which is ‘willing’, is environmentally certified because it has the ISO 14001 certification (a certificate that proves a firm is environmentally sustainable, thus in this case there may be a correlation between being officially certified and willing to participate in the Pulsup Project. However, it seems complicate to generalize such conclusion given that also firm 1 is ISO 14001 certified but it is a ‘maybe willing’ company. Otherwise, firm 8, which is a ‘willing’ company, is about to obtain the HACCP certificate but this cannot

explain its willingness to participate in the Pulsup project because for this alimentary firm by law it is strongly recommended to obtain such certificate, thus this does not constitute a 'green-choice'. Firm 5 is also a 'willing' firm but is not certified. This firm is not certified because it is an accounting firm and for this kind of specialization it is even difficult to environmentally certify the own activity because it just works with computers. Hence, for certain kind of businesses does not make sense to obtain a certification. This same reflection could be extended to firm 4, which is a 'not willing' company: because of its specialization, which measurement of strains and stresses, this firm does not need to or can acquire a certification about sustainability. In fact, this firm has an official certification in quality, the ISO 19001, "...but not on sustainability!" (int. 4, co. 3, p. 2). Consequently, only looking at the **Table 7.2.6 we cannot identify any clear relationship between having a certificate and being willing to participate in the Pulsup Project**. However, it is useful to pause upon some insights about official certifications that emerged during the interviews.

First of all, certain firms believe in the importance of being environmentally sustainable and can prove their engagement in this cause drawing upon certifications. For example, Firm 1, which is a printing company, has several certificates that prove its engagement in the environmental cause, as the ISO 14001 certification or the use FIC paper can show. The website of this firm says "*the firm ... creates beautiful printing with the environment in mind. Like other firms we are aware of the need for environmentally friendly business. We want to burden the environment as little as possible. Therefore we work since July 2008 in accordance to ISO 14001. In short, this means that we limit the use of hazardous substance to a minimum, provide an offer responsible disposal and waste recycling. And we try where possible to reduce the consumption of energy*". This tells us that this firm takes to heart the environment, consequently it characterizes its identity profile with the "sustainability flag". Sometimes firms can even decide to invest in standard and certification to give a certain image of itself to the outer world. For example firms that want to have a *green façade* can decide to invest into the ISO 14001 just to conquer certain markets; this kind of behavior is called "greenwashing". However, this objective proof of this company's interest in the sustainability issues does not completely trigger this company's willingness to participate in the Pulsup Project, and the same could be for other firms.

Another reason explains why having a certain certificate cannot be considered neither as a sufficient proof of a company's interest in sustainability or as a decisive cause in determining a company's willingness to participate in the Pulsup Project. In fact, despite their intentions, not all the firms are able to sustain the costs that obtaining a certain certificate implies. In fact, most of the time standards and certifications are rather expensive in terms of both time (usually the procedures to obtain a certificate are rather complex) and money. In this respect, the interviewee of firm 1 said "*because if you want the ISO 1499 is more expensive, it would cost you 1000 euro a year, and if you have five of those (certificates) it would cost you 5000 euro a year*" (int. 1, co. 1, p. 2) and "*It looks very nice, and I think it is good but it costs money*" (int. 1, co. 1, p. 2). Or again, he said "...if you talk to all these firms that are small... 'why don't you do the ISO 14001?' 'How much does it cost?' 'Well, it brings you something too!' 'Yes, but how much...?' '2000 euro!?' 'Oh! That's a lot of money!' End of the discussion. 'Do you know how many things I can buy with 2000 euro? A lot of things! What do I get?' Oh! OK!" (int.1, co. 1, p. 24). This quote suggests that certificates are a luxury that not all firms can afford, especially those that are small-sized.

This luxury is also explained by the fact that once a firm is officially certified, pays a certain amount of euro per year to keep the certification, and guarantees a certain product quality, and then its products become more expensive for the customers: *"...end then if you go to the outside world they are interested, they think it is fine, until they have to pay for it, and then it is more difficult!"* (int. 1, co. 1, p. 2). It is difficult because, as the interviewee of the printing firm was saying, often people just do know, so do not understand why a certain kind of paper costs more than others for example. In this respect, the interviewee said *"...maybe the buyer knows, or maybe the director knows, and in between who knows? ... So there is maybe one person whose mindset is about sustainability and the environment, but then they do not know. So you have to start all over again"* (int. 1, co. 1, p. 2, 3). That is, many people along the production column are unaware of and disinterested in the sustainability issues and the complexity surrounding the sustainability certificates. Maybe if the customers' awareness about environmental social sustainability would rise their reaction could change. The same interviewee also said *"it is just an example about how customers... because they do not know. You have to tell them, I have a very good deal for you... Because it is all about the money! It is all about the money! And it is not a good thing to hear, but... if a customer can buy cheaper, he will go there. They pass all the environmental, all the..."* (int. 1, co. 1, p. 10). It seems that for the customers of this firm a lower cost is more appealing than environmental or social sustainability issues. Overall, we see that having an official certificate requires that a firm is big enough to sustain the direct and indirect expenses that having a certificate like the ISO 14001 implies, which respectively are the certification's fees and the higher costs of the own products, thus the potential loss of clients. This latter point also explains why bigger firms can more easily deal with the expenses' increase that the acquisition of certain certificate may constitute, that is big-sized firms can distribute their costs upon a more wide range and amount of products (at least in the manufactory sector). Overall, in relation to the reduction of the industrial impact upon the environment the cost of certain certificates surely constraints the achievement of sustainable goals.

However, having certificates can also be convenient. It depends on the industry sector and the specialization of a company. For example, in the Netherlands, because of the local regulations, generally every firm that operates in the car industry has to have certain certificates that guarantee the safeguard of the environment, but this kind of certificates are for free so even small-sized firms can obtain them. In fact, the manager of firm 11 said *"no, no, no! This is absolutely not expensive. Even if you're a small firm you can get it! Especially for bodyshops it is really easy because the legislation tells you a lot about the use of paint and reuse of products and 80% of the cars is already recyclable. I think the automotive industry is far ahead to the rest of the industries. Absolutely!"* (int. 14, co. 11, p. 13). Thus, in the automotive industry seems that the economic cost of certificates does not constraint their diffusion as it is with other kind of certificates.

Finally, despite their intention, not all type of businesses can obtain a certificate that proves the sustainability of their practices. As it was said, because of their specialization, firms 4 and 8 can barely recur to a certificate that proves their sustainability even if they would be strongly committed to the preservation of the environment. Firm 8, which is an accounting company, even if cannot recur to the obtainment of an official certificate about sustainable practices because of its specialization, had decided to purchase hybrid electric cars for its dependents (quote and maybe add the same in part about

innovation). In addition, it is interesting to notice that out of three wholesalers of fruits and vegetable, which hence are located in the Groothandelsmarkt, only one is about to become officially certified. Firm 10 is working on the obtainment of the HACCP (is it about sustainability?), while the other two do not have any kind of certificate. Firm says that they only buy and sell certified products because this is what the law establishes but that they are not certified. Probably, this kind of specialization – wholesalers of fruits and vegetables – as well as others, does not need to have any kind of certification. Otherwise, they can prove their interest in sustainable practices in other ways, like feeding with their organic waste products other local actors, like organizations or farms that can either process or use this flow of organic product resource for their activities, contributing in this way to a circular system of use of the existing resources (quote?). This to say that having official certificate can be considered an index of interest in the sustainability issues only to limited extent.

Conclusions: There is no correlation between having standard and certifications and willingness. The way in which this indicator was operationalized is too broad and too many variables are at stake to identify a clear relation between having standard and certification in broad terms, and willingness to participate in the Pulsup Project.

7.7 The scale of markets of the firm

This thesis' section investigates whether there is a more or less direct relation between the scale of the market of a firm and the relative degree of willingness to participate in the Pulsup Project. As we saw in Chapter 4), the Spaanse Polder is characterized by the wide heterogeneity, in terms of size and specialization, of the firms that are located there. Depending on the specific features of a company, the scale of the market it operates in varies. Firms can have customers and suppliers locally, nationwide, in Europe or further in other continents, like in Europe, America, or Asia. In this chapter, we are going to observe whether a relation between the scales of the markets a firm operates in and its degree of willingness to participate in the Pulsup Project exists. **It was assumed that operating at the local market level would boost firms' willingness to participate in the Pulsup Project because their attention would tend to be more localized than the attention of firms that are accustomed to look far away.** Table 7.7 distributes the sample firms on the base of the scale of their market – the Netherlands, Europe, and world – and the degree of willingness to participate in the Pulsup Project thy expressed.

Table 7.7. Relation between the scale of the market of a firm and degree of willingness to participate in the Pulsup Project

Scale of the market	Willingness to participate in the Pulsup Project		
	Not willing	Maybe willing	Willing
The Netherlands		7, (11)	9, 6, 8, 5
Europe			
World	2, 4	1, (3), 10	

The observation of table 5.10 seems validating the initial assumption because the four ‘willing’ firms’ businesses focus on the Netherlands, in the sense that most of their customers and suppliers resides in the Netherlands, or even closer that is in South Holland. The firm 9 manufactures customs for different Dutch Universities, the firm 6 is the mobility director of the taxi service of the Rotterdam area, firm 8 produces beer and rent its brewery system looking at the Dutch market, and the firm 5 provides with accounting services people in the area. Hence, we can notice that the four ‘willing’ firms’ attention is locally driven. It is not sure whether this aspect positively influences firms’ willingness to participate in the Pulsup Project. However, **it is curious these firms whose business mostly develops in the local market are the same firms that are interested in participating in a project that promotes local development.** Somehow, it makes sense to think that once your attention focuses on a level then you’re also more capable to see the aspects that do not work or that you feel you want to contribute somehow.

Conclusions: There is a strong relation between scale of the market and willingness. The **localism** of a firm – local/national scale of the market - positively affects willingness to participate in the Pulsup Project.

7.8 The innovativeness of the firm

Finally, this thesis’ section investigates whether there is a more or less direct relation between the innovativeness of a firm and the relative degree of willingness to participate in the Pulsup Project. Innovativeness stands for the interest of a company in innovation. It was assumed that a firm that is interested in innovation would be more open towards the Pulsup Project because more able to understand it than those firms that are not interested in innovation. In fact, it was thought that a firm that follows the most recent societal and economic trends is more aware and also more alert and ready to introduce a change in its business, for example investing in a new technology (e.g. software, company’s organization, etc.) or starting using a sharing economy platform to borrow and rent assets from or to other Spaanse Polder’s firms. In other words, it was assumed that being interested in innovation is an essential aspect of the willingness of a firm to participate in the Pulsup Project. Compared to the other features we have been analyzing so far, the interest of a firm in innovation can be defined with minor objectivity. Whether a firm is interested or not in innovation was defined asking to the interviewees the question “is your firm interested in innovation?” In fact the categories that are shown by table 7.8 are two – yes or not. Table 7.8 was also built to visualize the relation between the sample’s firms’ interest in innovation and their degree of willingness to participate in the Pulsup Project.

Table 7.8. Relation between the interest in innovation of a firm and the correspondent degree of willingness to participate in the Pulsup Project

Interest in innovation	Willingness to participate in the Pulsup Project		
	Not willing	Maybe willing	Willing
Yes	2, 4	1, (3), 10, (11)	9, 6, 8, 5
No			

7.8.1 The wide interest in innovation & sources of inspiration

What is innovation and what does it imply for firms? Innovation concerns change and future. As we can see from Table 7.8 the entire sample is interested in innovation because, as interviewee of firm 2 said *“innovation must go on! ...you cannot stay still, if you stay still you will go down!”* (int. 2, co. 2, p. 6). Otherwise, the interviewee of firm 11 said that they are *“always!”* interested in innovation (int. 14, co. 11, p. 10) (their innovation depends on what Toyota decides, small margin of decisional freedom). And again firm 10 said *“we are always interested in innovation because you have to innovate. I mean time doesn’t stand still, and life, in general, is not static... Everything changes and moves and you have to change and move, and sometimes you have to anticipate in order to be able to grow and survive. So you have to be innovative, absolutely!”* (int. 13, co. 10, p. 4). As these quotes suggest the need for and interest in innovation was evenly spread throughout the sample. That is for firms seem fundamental to be up to date to survive in the “economic jungle”. Being updates supports the ability to foresee the future and take risks in order to anticipate the changes that concern markets and society, distinguish your firm and become more competitive. In order to foresee and anticipate future trends, it is needed to know what is going on in society, which is to be updated about societal and economic trends, and thus being able to *“...follow what is happening!”*

In this sense, being aware of the sustainable issues is somehow to be innovative. The firm 4 said *“to know about sustainability is in the general interest! ... in the park (he intends the Spaanse Polder industrial park) is one of the topics!”* (int. 5, co. 4, p. 1). Even if this interviewee cannot easily apply the concept of sustainability to its business because of its specialization he thinks that to know about it is necessary just because constitutes a burning issue nowadays. Thus, knowing about the sustainability issues is also a way to be able to confront with other firms and stay at the same level, but also to be able to satisfy the needs of customers, or at least to know and understand their requests. As firm 11’s interviewee said, to be interested in sustainability is necessary *“...because sustainability tells something about the future and the continuity is the most important thing for a firm and I think it can only be continuously when you’re sustainable. Otherwise it would be quick win, and quick loss, and then you’re not even a very stable company...”* (int. 14, co. 11, p. 11). Innovativeness and sustainability are two different concepts communed by their glance towards the future. The same interviewee also thinks that circular economy *“...is needful, otherwise we would have such mess...we live with seven billion people. That’s really a lot! So, I think it’s good! We should recycle products, when it is possible!”* (int. 14, co. 11, p. 14). Innovation and sustainability are concepts that go hand in hand.

In itself, the idea of ‘interest in innovation’ is rather generic. Firms can express their interest in innovation in different ways and recurring to different tools and/or strategies to realize it. Surely, the specialization of a firm influences the degree of need to innovate, as well as the kind of ways that a firm can adopt to innovate. Some of the firms expressed their interest in innovation in concrete ways. For example, some of the firms have invested in the purchase of electric cars (firm 3, 5, and 11) for their activities and/or employees, or of solar panels (firm 3) as source of energy, or of new software (firm 1, 2, and 5) for their production. However, given the width of the innovation-umbrella-concept, it can also be understood in other ways. The use of a sharing economy website that wants to realize a more circular way of doing

business in the Spaanse Polder for example constitutes another form of innovation. Thus, innovation can also be understood in terms of change in the organization of work and production.

7.8.2 Innovation's source of inspiration

Innovation is fed by sources of inspiration, (economic) incentives, and other tools. Innovation can be realized in different ways. A firm in order to innovate needs a source of inspiration. Sources of inspiration can be everywhere –newspaper, the Internet, dialogues- and certainly an open and receptive attitude is needed in order to capture inspiring ideas. However, certain conditions facilitate the diffusion of ideas.

Generally, to participate in context that involves many different actors constitutes a source of inspiration. For example, the interviewee of firm 6 said that even if in its big-sized company's infrastructures are big enough to host all the activities of its company, they also rent a room in a Rotterdam's center for entrepreneurship "*...just to work there... just working there on some concepts, more innovative concepts... because... we like to seat in between other start-ups and get some more innovation flowing*" (int. 9, co. 6, p. 7). That is this firm prefers to discuss certain 'innovative' topics in a space shared with other 'young' firms to find inspiration. This same firm is one of the most aware of the sustainable issues, as well as one of the 'willing' firms. This feature tells that this firm is receptive to change and innovations and the interviewee confirmed that certain heterogeneous environments play a pivotal role in the promotion of a fertile environment for the circulation of ideas and innovation. Firms 1 and 10 instead visit expos and fairs to learn about new trends and meet with different firms and realities. Interviewee of firm 1, as we have already saw, attends expos "*...to learn from totally different firms ...because it may be interesting to learn other ways of doing things!*" (int. 1, co. 1, p. 20). Firm 10 instead visits International Trade Fairs to "*see what the new trends are in the rest of the world, and we try to be the first in exporting an interesting product that is already successful outside the borders and that we might be successful with in Holland and get the agency... So, yes, absolutely (we keep eyes on new things)!*" (Int. 13, co. 4, p. 4). Even the interviewee of the Institution DCMR, while he was supporting the goodness of the Pulsup Project, said that he believes in the importance to meet with other firms. He said "*...if you are in a network where ideas stream, circulate, flow... and not only the ideas, but also the services, and then the materials... that is interesting to innovate and optimize processes within different firms ...*" (int. 3, Institution 2, p. 10). Overall, it is recognized that meeting with other firms trigger the innovativeness of a company. This constitutes a reason why the Pulsup Project potentially may help firms to meet and learn about other ways of doing business. About the Pulsup Project the international manager of the DCMR about the Pulsup Project said "*Pulsup is an additional way of sharing ideas and property, instruments, and facilities, and services...*" (int. 3, Institution 2, p. 11).

Certain firms can be inspiring because of their specific features. Inspiring firms can be called 'role-models' or 'frontrunners', and usually are innovative firms which identity is used to exert a certain influence upon a certain economy and society segment. Role-model firms can be those that challenge the ascertained way of doing business, that those that risk and specialize in something specific and new, how it can be for those firms that decides to be 'circular economy firms'. The interviewee of the DCMR defined as frontrunners "*firms that have a vision of the future, innovating making choices for improving other industries!*" (int. 3, Inst. 2, p. 7). That is this firms invest in their role of role-models or frontrunners in

certain markets and contexts. As interviewee 1 said *“to be a role model, you should really specialize! Like in the circular economy or something like that...”* (int. 1, co. 1, p. 19).

However, not every firm can decide to invest in becoming a role model. In the industry sector of firm 4, as we have previously seen, is specialized in the measurement of strain and stresses, and the interviewee was saying that for his firm is difficult to be a role model in its sector because this kind of sector difficultly changes and innovates. This interviewee said *“...the business we are is rather conservative, so our customers don't like fancy kind of fffhh! It's not in their kind of business, which is simple, basic, technical... Always technical people!”* (int. 5, co. 4, p. 10). Thus, it seems difficult to innovate in a conservative industry, which is one where it is difficult to innovate. While if we talk about branch firms, their freedom of decision and initiative is constrained by the executives' authorities of the company. In fact, as we saw in the chapter 'the size of a company' the flexibility of a big-sized company's branch is constrained compared to the flexibility of a smaller-sized firm (e.g. firm 11, p. 10).

Other times big-sized firms can play the role of role-models as well. Big-sized firms can use their fame and robustness to adopt and promote innovative practices and so become a role-model company, which is a firm that strategically uses its influence to impact society. For example, big-sized firms like corporations and multinationals, because of their economic power, can invest in innovation and use their power to strategically pursue social responsible goals that will have a major echo as major is the power of the company. For example, firm 11 whose major industry is the automotive sector, showed to me that Duurzame Reparereren and Duurzame Aircant, which are Dutch institute that release sustainability certificates in the automotive sector, on its website shows the logos of the partners to attract and motivate other firms to follow the sustainability path. The interviewee said *“they are really big firms!”* and then he added *“...which means that you don't only want to do business for the profit, but you have also your responsibility as company”* (int.14, co.11, p. 11). Given the fame of these firms, it is probable that other firms will follow.

7.8.3 Limit to innovation: scarce awareness/interest, legislation, size

Even if it is useful to be up to date, it is not always possible or necessary or smart to introduce an innovation, thus a change, in a firm. In order to realize change certain conditions need to be met. For example, Interviewee 1 said that they are interested in innovation if they have the possibility. This interviewee understands innovation as investing in new technologies, thus it implies an economic cost. In fact, about innovation in his company, he said *“if we have the possibility... but if you say ‘do you have a research and development department?’ ‘No!’ But we try to keep up with the new trends!”* (int.1, co. 1, p. 20). Then he kept saying *“...because investments and so on are very expensive... so you have to be very careful...”*, however *“we just invested into new software for our production and we are one out of the 15 firms of the Netherlands that have that!”* (int. 1, co. 1, p. 20). Also firm 2 has just innovated investing into new software (int. 2, co. 2, p. 6). A firm can be innovated for several reasons; however it seems that usually a firm innovates to grow further, given that this constitutes the *raison d'être* of most firms. Thus, if innovation serves the need to grow further, then maybe if you're already growing you do not want to invest in innovation. As firm 3 said *“we are still growing and it's good! We like how it is!”* (int. 4, co. 3, p. 6).

Certain kind of innovation can be constrained by the same nation-wide legislation. During the process of definition of the Pulsup Project it was thought that a sharing economy platform for the Spaanse Polder could foster the achievement of three objectives: 1) sharing of assets among firms to realize a circular economy where the use of resources is optimized, 2) promote social responsible behaviors per part of the firms, and 3) connect the city of Rotterdam with its biggest industrial area. The second and the third objective for example could be achieved linking the idle capacities of certain Spaanse Polder firms with social and educative programs promoted by organizations of the city. A concise idea that was developed and that may be taken in consideration by the Pulsup Project is that certain firms' spaces could be rented or let in use to educative organizations of the city to give workshop to certain social segments. This would constitute an innovative practice even if in less traditional terms. Following this ideas, it was asked to the interviewee of firm 11 whether they would let use their bodyshop to an educative organization that teaches people to repair cars. The answer of the interviewee was *"I don't know. Yeah! I understand your point but I don't know if we are such modern firm that we say 'that's all right!'"*, then he added *"...there is also an opposite that is called legislation. If you work in our firm we are responsible for you. So, we try to help you and we are responsible for you because you are within our company, our building, so that's..."* and then *"the government talks about employability but they don't really mean employability. If they want to have real employability they should be easier on legislation for things like that. So I don't think we do that. Because for now you're sitting here and that's safe, but at the other side there are people working and if something happens to you, we are responsible!"* (int. 14, co. 11, p. 15). Certain innovative ideas cannot be implemented because of legislation, in this case because of the legislation on safety.

Surely, certain kind of innovation can be limited by a scarce motivation per part of the firm to introduce a change. This can be the case for what concerns the introduction of more sustainable behaviors in absence of awareness of and interest in, for example, the sustainability issues. Firm 4 believes that the circular economy is just some sort of hype. He said *"the idea is always good but I am always afraid that it ends in some sort of hype! That everybody is running behind it without knowing what's happening! And then when you wait for four years, it is gone! There is a new hype, and a new hype, and new hype! And very slowly it evolves in the business. Yeah! So you try to follow it, you have to do something, and it is also why you participate in this kind of initiatives!"* (int. 5, co. 4, p. 2). This conviction surely constrains this firm interest in committing to initiatives that aims at its realization. However, a reflection could be that the very wording an idea can constitute a hype but eventually the idea stays more or less the same. Circular economy maybe is the current wording for a concept that can be expressed also as 'cradle to cradle', 'blue economy', 'zero waste economy', 'biomimicry', etc. The point is that beyond the words there are concepts that are compatible, similar, etc. and that above all drive in the same direction. Thus, I would suggest to focus more on the intentions and the meanings of these concepts because they last more than the naming. Because their meaning is not hype but a generalized need, which is then covered by the 'hype-naming'. However, the interviewee is aware of the concepts, and beyond his skepticism he thinks that it is important to be aware of the social trends, keep up with them, and apply them into the industry.

Overall we see that innovation is change and that it requires an open attitude towards it. The 'willing' firm 6, which is highly aware of the sustainability issues, thinks that the industrial world is plenty of possibilities and that it is important to be open to explore them (int. 9, co. 6, p. 6). A similar open conception towards

the multitude of possibility that exist in the world can be also found in the interview with the firm 1, which is 'maybe willing' and highly aware of the sustainable issues supporting this research.

Despite the generalizable interest in innovation and the necessary open attitude towards change, to change things is difficult. In this respect, the interviewee of firm 1 said: *"it is always difficult to change things in a company"* (int. 1, co. 1, p. 14). Change can be either enforced or supported throughout public strategies (e.g. rules and regulations co. 10.6 – 11.12 - K.11, pressures and facilitations K.3.4.5, grants I. 7, economic incentives co. 4.5 – 11.13 – 1money always important), while other times small firms gather and cooperate to achieve a change that individually would not be able to achieve (e.g. Belangenvereniging Spaanse Polder co. 1.21, Spaanse Graave, Pulsup Project, co. 1.21).

Conclusions: it is not possible to see whether a correlation between innovativeness and willingness exists because every firm is interested in innovation, despite the degree of willingness to participate in the Pulsup Project it expresses.

7.9 Conclusions

In this Chapter we tried to verify whether the selected features of a firm to some extent explain a firm's degree of willingness to participate in the Pulsup Project. The sub-research question supporting this Chapter is:

"To what extent the features of a firm affect its willingness to participate in the Pulsup Project?"

We found that certain specific features of a firm to some extent affect and explain a firm's degree of willingness to participate in the Pulsup Project, while others are not so relevant. In other words, **the hypothesis that certain features of a firm explains a firm's willingness to participate in the Pulsup Project was confirmed by the gathered data.**

The features of a firm that are null or only in a limited way effective are: 1) the size of a firm, 2) whether a firm has standard and certifications, 3) a firm's innovativeness. We saw that the correlation between firm's size and willingness is not clear-cut. In other words, the size of a firm does not explain a firm's position towards the Pulsup Project. The same was observed looking at whether a firm has standard and certifications: whether a firm has or not standard or certifications do not say much about its degree of willingness to participate in the Pulsup Project. The effect of the innovativeness of firms could not be investigate because every firm that was interviewed is interested in innovations.

The aspects of a firm that are correlated, and that thus impact either positively or negatively the degree of willingness of a firm to participate in the Pulsup Project are: 1) the specialization and the industry of a firm, 2) the location of a firm inside or outside the Groothandelsmarkt Spaanse Polder, 3) the age and length of time a firm has spent in the Spaanse Polder, 4) the embeddedness of a firm, and 5) the scale of the market.

First of all, we saw that the economic specialization of a firm to some extent positively explain a firm's degree of willingness to participate in the Pulsup Project. **The relation between being a manufacturing**

firm and willingness is stronger than the relation between being a service oriented or a wholesale firm and willingness to participate in the Pulsup Project. Probably this due to the fact that manufacturing firms to conduct their business operations need more assets than the firms belonging to the other two industries. **Even if this constitutes the trend that was observed, it was also observed that *social and environmental responsibility* constitutes a stronger driver than economic specialization.**

Secondly, we saw that the location of a firm in the Spaanse Polder explains the higher or lower degree of willingness to participate in the Pulsup Project of a firm. Firms located outside the Groothandelsmarkt Spaanse Polder are more willing to participate in the Pulsup Project than those located inside it. This is probably explained by the different characteristics of these two areas of the Spaanse Polder. For the firms located inside the wholesale market to find fellow firms and ask for favors is part of their routine, given the homogeneity and physical proximity of these firms. Instead, for the firms that are located outside the wholesale market it is more difficult to find and 'connect' with fellow or compatible firms because of the heterogeneity and physical distance among them. This underlines the industrial symbiosis argument. Hence, generally **firms located outside the Groothandelsmarkt tend to be more willing to participate in the project than those located inside it because the former experience a *stronger need to enlarge the own network of acquaintances*.**

For a similar reason, firms that are not members of one of the Spaanse Polder firms' organizations tend to be more willing to participate in the in the Pulsup Project than those firms that are members of one or both the Spaanse Polder organizations. Hence, the *embeddedness of a firm*, which here was operationalized as belonging or not to one of the firms' organizations of the Spaanse Polder, is negatively correlated with willingness to participate in the Pulsup Project.

Thirdly, we observed a negative relation between age and length of time spent in the Spaanse Polder: the younger and shorter the time spent in the Spaanse Polder, the higher the degree of willingness to participate in the Pulsup Project. This finding could be interpreted similarly to the previous two features, which is **'younger' firms experience a *stronger need to enlarge the own network of acquaintances*.**

Finally, we observed that **the localism of a firm, which is when the scale of the market of a firm focuses on the local level (metropolitan, regional, national), positively affects the willingness of a firm to participate in the Pulsup Project.** In other words, it was observed that the wider the scale of the market of a firm the lower its willingness to participate in the Pulsup Project. Probably, when the attention of a firm constantly focuses on distant geographical dimensions the attention and the interest for the local development shades away; vice versa, it could be that when a firm focuses on a closer geographical level on a daily basis the concern for the local development rises.

So we can conclude that social responsible firms located outside the Groothandelsmarkt, that are relatively young, not members of one of the local firms' organizations, and embedded in the local economy of the Spaanse Polder are the most willing to participate in the Pulsup Project. The project should focus on this kind of firms to enlarge the group of firms that will participate in the project.

8 Interest in the collective use of resources and willingness ~

The idea behind the Pulsup Project is to realize an industrial symbiosis in the Spaanse Polder. In other words, firms can optimize the use of the resources that are already available in the area by making a collective use of them, which means sharing, exchanging, renting, selling them with/to each other. This idea is well expressed by the image 8.1, which is a map of the Spaanse Polder. The highlighted buildings are the firms involved in a network of exchange of resources. In particular, this network is constituted by three arrows of different colors that respectively represent three flows of resources: space, material, and transport. Image 8.1 provides a with an exemplar visual representation of what the exchange of resources among the firms of the Spaanse Polder may look like if a sharing economy platform would be introduced in the Spaanse Polder to support the local development of a more circular and synergic business system. In this scenario, firms would use the sharing economy website to let each other know about their needs and idle capacities in terms of resources (e.g. space, machineries) or services. As we saw in Chapter 3, this system to work firstly requires users, secondly requires compatibility among the needs of the local firms. However, the sharing economy website should be able to support firms' research of compatible needs. The resulting industrial symbiosis would eventually guarantee a more efficient and effective, thus sustainable, use of the already available resources. In addition, it would also support the extension of the



firms' communication network with other firms of the Spaanse Polder and the surrounding Rotterdam area.

Image 8.1. A representation of how the Spaanse Polder's firms could be hypothetically connected by the shared used of already available resources

First of all, this chapter analyzes different kind of flows of resources that are available in the Spaanse Polder to see how they could be matched through a sharing economy website.

By the way, during the

interviews several questions about firms' use and need of resources were asked to the interviewees. In particular, it was of interest to understand what the resources that firms need the most are and what kind of resources local firms would share with other firms, given that one of the objective of the interviews was to identify the resources that the Spaanse Polder's firms are more in need of or that are more willing

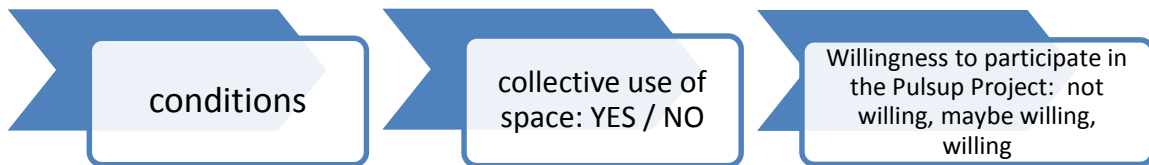
to share. Secondly, it was of interest to understand whether firms already share or make a collective use of certain resources with other local firms, whether they had ever thought about this possibility, and whether they would share or make a collective use of certain resources. Before conducting the interviews, five kind of resources and assets' categories were defined. These are 1) space; 2) transportation and deliveries; 3) machineries and equipment; 4) waste; and 5) energy.

Mainly this chapter for each selected resource analyzes what are the conditions that may support the interest of a firm in making a collective use of or share resources with other firms, and if, in this respect, the Pulsup Project can both add a value to the Spaanse Polder and positively affect a firm's willingness to participate in it. Generally, it was expected that a firm whose attitude is open and inclined towards the possibility of making a collective use of the selected resources with other firms was assumed to be more inclined to participate in this project than a firm whose attitude is closed and distant from contemplating such possibility. In other words, it was assumed that firms would tend to be more willing to cooperate with other firms, sharing, renting, and exchanging resources, if they are interested in sharing resources with other firms. However, it is not automatic that a firm that is willing to share resources with other firms would also be willing to participate in the Pulsup Project. This is what we are going to look at throughout this chapter: what are the conditions that may support the interest of a firm in making a collective use of resources with other firms and whether the Pulsup Project may lever on them to both add a value to the firms of the Spaanse Polder, and trigger their willingness in participating in it.

Before going to look at firm's interest in sharing of space, transportation and deliveries, machineries and equipment, waste and energy, we should make a couple of observations. Firstly, certain resources and assets are needed by every firm. As interviewee 1 said, and even if it seems banal, a firm first of all needs customers, because *"if you don't have any costumers you don't have any business. So, it starts with that!"* (int. 1, co. 1, p. 8). Secondly, a firm needs workers to support its activities. In this respect, most interviewees said that employees, or workers, always constitute the most expensive asset for a firm. Interviewee of firm 11 said: *"people are the most expensive part of your company! Always! (Followed by taxes!)"* (int. 14, co. 11, p. 14). About employees, an interviewee suggested that a certain category of workers, which he called *"flexible workers"*, may be exchanged and shared among firms. This idea had not taken in consideration in advance, and will not be taken in consideration either; it is here reported because it is curios and interesting to confront with this thought. Thirdly, most firms need some sort of assets and resources in order to perform their activities. By the way, interviewee 1 talking about productive firms said *"...but actually, that it is for almost any production company. A production firm needs machineries, people, and materials, and of course you need energy... no energy and everything is down..."* (int. 1, co. 1, p. 8). This quote tells us that certain resources are generally needed by almost any (productive) firm, like machineries, people, materials, and energy. In other words, every firm needs specific equipment, expertise, and materials. Secondly, in general it can be said that to realize an industrial symbiosis or a sharing and circular economy system in an industrial area the ***complementarity or affinity of needs*** among firms constitutes a condition *sine qua non* is possible to realize an industrial symbiosis. Usually, for firms that work in the same industry is easier to share similar needs. However, even if firms are different among them, they can still find resources to share, rent, borrow, exchange with other firms. The important is having and sharing similar needs in terms of resources and assets and being aware of

what other firms need. Said so, in the next five sections of this chapter we are going to look at the relation between a firm interest in making a collective use of space, transportation and deliveries, machineries and equipment, waste, and energy.

8.1 Interest in the collective use of space



During the interviews it was investigated whether firms make or would like to make a collective use of space. Looking at this aspect several conditions that boost or constrain the interest in making a collective use of space emerged. The objective was to see whether the interest in making a collective use of space affect the degree of willingness to participate in the Pulsup Project, and what could be the valued added by the Pulsup Project to the collective use of resources. Each one of the following paragraphs will be concluded with a reflection about the relation between the condition that may render the collective use of space a desirable option, whether this condition is combined or not with the interest in sharing space, and whether the Pulsup Project could support a firm’s willingness to participate in the Pulsup Project.

8.1.1 The availability of space

First of all, the **availability of space** seems constituting an issue in the Spaanse Polder. Most firms need more space, even if a few have an excess of space. The interviewee of *firm 2*, who is a ‘not willing’ company, said: “*everybody does not have space!*” (int. 2, co. 2, p. 3). It is not sure whether the interviewee meant that space constitutes a scarce resource in the Spaanse Polder in general or in the Groothandelsmarkt in particular. Given that this firm is a wholesale of fruits and vegetables it is probable that the interviewee was talking about the Groothandelsmarkt. However, abstracting from this statement it could be said that space constitutes a scarce resource in the Spaanse Polder. *Firm 2* needs more space and is looking for either space to rent or for an area to build a new warehouse. This firm uses websites to look for the space is looking for and, as we saw, it is difficult to find space in the Spaanse Polder. Given that this firm seems happy in the Spaanse Polder, probably it would prefer to keep this location. In fact, about the Groothandelsmarkt Spaanse Polder, where *firm 2* has been located for 15 years, the interviewee said “*Yes, it is a nice area. It is also safer because there are gates and not everybody can come in after we are closed*” (int. 2, co. 7, p. 6). Furthermore, the interviewee added that he feels a **sense of belongingness** to the area, and that they would prefer to remain here.

Firm 5, which is a ‘willing’ accounting firm, is also interested in acquiring more space. This firm is growing, which explains why the interviewee explained that they are thinking in extending their firm. In this respect, the interviewee said “*we are expecting a growth for next coming year... for 2015-2016 we are expecting a really big growth like 200%! And then I think we will need a bigger space!*” This firm would

prefer to remain in the Spaanse Polder because as the interviewee said *“we like it! ...people can come easily here, it’s easy, the highway is here, there is free parking, it’s like... they can stay as long as they want here! ... So, if we are moving, or staying here, we can just expand this building!”* The sense of belongingness towards the Spaanse Polder felt by this interviewee was explained with the following words: *“here is where we grew the most and the best!”* (int. 8, co. 5, p. 14). Thus the local availability of space also in this case constitute an important condition also for firm 5, given that it needs more space as well.

The availability of space constitute a condition that would render the collective use of space an interesting option also for firm 3 and 1, with the additional condition that the ***exact location of the available space*** in the Spaanse Polder plays an important role. On the one hand, the interviewee of *firm 3*, which is a ‘maybe willing’ printing firm, said that for the moment it disposes of enough space, even if they would not dislike some more space. He said *“we want to stay in this area!”* and then *“when we want to expand our fabric it is only on the left side or on the right side! That’s important for us!”* (int. 4, co. 3, p. 4). If in future this firm would need to expand, they would like this additional space to be adjacent to the firm. In this case, the location of available space constitutes a condition that would render the collective use of space an interesting option. On the other hand, *firm 1*, which is the other ‘maybe willing’ printing firm of the sample, would like to acquire a space close to its main building. The relative interviewee said *“Well... Yes, we have enough space for our production. We have another unit in the Spaanse Polder, but it is for our stock... And it would be better if we would have it altogether!”* To solve this issue firm 1 has tabled a dialogue with the neighboring firm: *“We are talking to our neighbors and they are willing to talk, so maybe in one or two years there is the possibility that we have it together with our company. They don’t have to use the space. We’d like to use it, so... it may be a possibility!”* (int. 1, co. 1, p. 12). Firm 1 is either interested in renting or buying the idle space of the neighboring firm, thus is communicating with the neighbor in a spontaneous and informal way.

By contrast, the ‘not willing’ *firm 4*, which is specialized in the measurement of strain and stresses, disposes of an ***excess of space***, and it seems that to rent part of it could be an interesting possibility. By the way the interviewee said *“something like that may a possibility! Yeah!”* (int. 5, co. 4, p. 6). Even if this firm is ‘not willing’ to participate in the Pulsup Project it may be interested in renting its idle space. Thus, as we saw in Chapter 6 ‘not willing’ does not mean ‘not use’ (check wording) a sharing economy platform when and if available.

Overall, for all these firms – firm 2, 3, 1 and 4 – either the scarce or the excessive availability of space constitute a condition that would render the collective use of space an interesting option. Particularly, the exact location of the available space within the Spaanse Polder constitutes a key-condition. For example, as we saw looking at firm 1, in absence of a sharing economy platform for the Spaanse Polder this firm has arranged a solution talking directly with the neighboring firm. However, whether the Pulsup Project would provide with the possibility to identify (the location of) the available space within the Spaanse Polder by means of a sharing economy platform, it would support firms’ search for the (closely located) space they need. In this sense, it seems that the Pulsup Project may add a value to the Spaanse Polder industrial area and its firms, and vice versa stimulate their willingness to participate in the project.

Instead, the ‘maybe willing’ *firm 11* that both sell and repair cars has enough space as well and is not interested in sharing it with other firms. The interviewee said “*we need all the space we have, because cars take a lot of space, so we need a lot of space ourselves... the Spaanse Polder is quite small*” (int. 14, co. 11, p. 15). In this case, space does not seem constituting an issue. In addition, *firm 11* is not interested in the possibility of making a collective use of space. Thus, under this perspective the Pulsup Project would not add any particular value to this firm, as well as to those firms that are fine with the space they have and that are resolutely not interested in using a sharing economy website to rent space.

8.1.2 The cost of space in the Spaanse Polder

Secondly, the **cost of space** seems constituting an issue in the Spaanse Polder as well. *Firm 2*, which is ‘not willing’, and *firm 10*, which is ‘maybe willing’, are both wholesalers of alimentary products, thus located in the Groothandelsmarkt Spaanse Polder. Furthermore, they are both interested in extending their warehouses because they are growing. Space constitutes an important asset for a firm, in particular for a firm that because of its specialization needs a lot of space for, as in these cases, storing goods. However, the price of a building or of an area to build a new infrastructure can constitute a constraint to the need of space of a firm, as well as to its freedom of decision (e.g. about the exact location). As the interviewee of *firm 2* said the real estate market of the Spaanse Polder is expensive. By the way the interviewee said “*the rent in the Spaanse Polder is high, expensive. So, if we go outside, we could save money!*” (p. 7). Something similar emerged also during the interview with *firm 10*. The relative interviewee said “*we are growing out of our skin, which is also why we are looking for another place, as either to rent or... we are thinking about building! ...So, no! Do we have enough space? No! Not yet, but space is also immediately linked to money, expensive...*” (int. 13, co. 10, p. 11). However, both these firms, as well as *firm 7*, which is also a wholesaler of alimentary products, because of their location in the wholesale market Spaanse Polder, cooperate with neighboring firms. In other words, these firms either do as *firm 10*, which cooperates with other firms, which the interviewee defines ‘*befriended*’, to rent space for a lower price when it needs it (p. 11), or do as *firm 7*, which is part of cooperative system with the neighboring firms where it can happen to borrow space from and to another firm when in need of it (see section 8.1.3 about the flexible use of space).

Overall, the high cost of space in the Spaanse Polder constitutes a condition that would render the collective use of space an interesting option. In respect to this condition it seems that the Pulsup Project may add a value to the firms located in this area. In fact, given that in the Spaanse Polder space constitutes a scarce and expensive resource, a sharing economy website that includes space among the resources to share online would be useful and interesting for firms. In other words, the collective use of space, as well as the direct bargaining of space with neighboring firms, may economically support firms’ need of space. In this sense, firms may feel motivated to participate in the Pulsup Project.

8.1.3 The flexible use of space

Thirdly, the **flexible use of space** or the **temporary rental of space** constitute another condition that would render the collective use of space desirable. This emerged talking with *firm 7*, which is a ‘maybe willing’ wholesaler of fruits and vegetables, and *firm 5*, which is the accounting ‘willing’ firm of the sample. *Firm 7*

said that they use the space adjacent to their firm in cooperation with the neighboring firms, depending on the contingency of firms' needs. As the relative interviewee said it can happen that in a certain day this firm receives more food than usual; in these cases it can use the space of a neighboring firm. In fact, with the neighboring wholesalers of alimentary products firm 7 shares a 'system of mutual help'. For example, if a firm receives a quantity of food higher than the capacity it can handle, then it can leave an inbox to another firm to let it know what time they will pick the products up the following day. In this respect the interviewee said: *"of course! Yes! Especially after the closing hours nobody is here and then I am still here or somebody else is still there and I am not... then, you know? I ask, or they ask 'can I put it there?' Then you leave the invoice at the pallets and then the next day you call and pick it up. Then, we have a box over there for the letters, and then the driver put the invoice or the delivery note into the letter box"* (int. 10, co. 7, p. 3). In other words, firm 7 with other firms of the Groothandelsmarkt Spaanse Polder, usually make a flexible use of each other space. Hence, even if firm 7 about space said that they have *"more than enough!"* (int. 10, co. 7, p. 9), they would not rent it to another firm *"because sometimes you need less space, but sometimes you need more. It depends on how much purchase there is for the next day"* (p. 9). As we have just seen the firm can share its space with another firm *"only if, as I explained to you, some close firm is closed and it has purchased something and the supplier brings it here and nobody is in the company. Then the supplier can bring it over here and we can keep it for them, and the same thing is happening also with us!"* (p. 9). The idea of firms occasionally storing other firms' products was discussed with the international and environmental manager of the DCMR that is an institution engaged in the sustainable development of Schiedam and that knew the Pulsup Project, who said that an option to develop the Pulsup Project could be promote the use of the project for *"...temporary storage or that kind of things or..."* (int. 3, Institution 2, p. 10). Even if this latter idea seems plausible given that space seems constituting a scarce resource in the Spaanse Polder, given the evidence expressed by the interviewee of firm 7 a sharing economy website would not add more to the local firms given that local firms have already self-organized themselves to flexibly use each other space. In other words, here the flexible use of space does not seem constituting a condition to exploit by the Pulsup Project.

With the interviewee of *firm 5* the possibility of using (e.g. renting) the idle space of/to another firm was discussed when we were talking about industrial synergies and the sharing economy. The interviewee was imagining a firm that surfs the Internet to find an empty space in the Spaanse Polder, and what he would do if he had idle space to rent. He said *"...now, if I have half space left I could say 'ok, I am gonna rent it to an entrepreneur until I find someone to take it for the full price!' I could say 'yeah! I am gonna rent it because it's been for one year empty, one year and a half empty, two years empty, and nobody is taking it' ... I can say like 'OK, instead of a thousand euro I am gonna rent it for 200 euro'. Like everybody can come and just stay there, but as long as... if somebody comes and wants to buy it, or rent it from me, for the following month 'you go out!' Right?"* (int. 8, co. 5, p. 8). This is the kind of reasoning of the interviewee of firm 5 while he was thinking about the hypothetical case where he would need to advertise on a sharing economy website its idle space. The solution this interviewee found was ***temporarily rent for a low price the idle space, until a long-staying renter will be found***. Once the long-staying renter will be found, the temporarily and cheap renter will need to leave the space in a short period of time. This idea seems good, and as such should be taken in consideration to develop both the Pulsup Project and a policy

recommendation. A part from this consideration, the condition here expressed is to find solutions to render the flexible use of space possible.

On the wake of the same reasoning, the interviewee expressed **concern about the practicality of temporarily renting or using the idle space of a firm**. The interviewee of *firm 5* highlighted that when a firm rents or uses a space for its activities, naturally needs to bring its machineries and equipment in such space. He said “...if I bring machineries and all those things I am gonna put in the space... is gonna be more expensive for me as entrepreneur to put all my machines inside of this place and just stay for one year, and... like you said, temporary rental, right?” (int. 8, co. 5, p. 8). Temporary rental, or flexible use of space, as we saw constitute a condition that may support the collective use of space. Here emerged that this condition is combined with the expense related to the moving of machineries inside and outside the rented space. This constitutes a price that needs to be taken in consideration and that to a certain extent may constrain the realization of the matching of the need and offer of space. However, talking with the interviewee it emerged that matching-options can be numerous. A website as the Pulsup should leave enough space to deal with the wide variety of needs of firms and realities that exists in both the Spaanse Polder itself and the Rotterdam region at wide (in fact this website could also be seen as a way to match the city of Rotterdam with its biggest industrial area, the Spaanse Polder). For example, a Rotterdam’s collective of artists or a start-up that experiment with the 3-d printing may be interested in renting a space in the Spaanse Polder. Using a sharing economy platform they could be able to find the space they look for and given that to perform their activity with the 3-d printing they do not need to move a cumbersome equipment, which would hinder the realization of such matching of needs, the concern of the interviewee should not find too much space to root. This example explains that the concerns of the interviewee are justified only in the case the firm to which a space is temporarily rented has too many and too big equipment because of its specialization.

8.1.4 Knowledge spillovers and the collective use of space

Fourthly, the possibility to get in contact with **information spillovers** also constitutes a condition that would render the collective use of space desirable. This idea emerged during the interviews with *firm 6* and *9*. The interviewee of the big-sized and ‘willing’ *firm 6*, which is the taxi mobility director of Rotterdam among other specializations, said that sometimes they need more space. By the way, the interviewee said “...we don’t always have enough space here, so we use other sights as well” (int. 9, co. 6, p. 8). As we also saw in the chapter about the innovativeness of a firm (chapter 7.8) this firm rent a space in a co-working space in the city of Rotterdam to work on some innovative concepts. The reason this firm rents a space in the city is twofold: firstly “because it was already crowded here!” and secondly because “we like to seat in between other start-ups and get some more innovation flowing!” (p. 7). About the former aspect I asked whether it had occurred to them to ask to a neighboring firm whether they had some unused space and the interviewee said “No! Actually it hasn’t! This is kind of odd because it was a really easy question! No, it hasn’t!” (p. 7). From these words, as well as from the attitude of the interviewee, it seems that this firm may be interested in asking to rent space to another firm, which in other words means that this firm seems interested in making a collective use of this resource. Knowing about neighboring firms’ unused space would be facilitated by the use of a ‘friendly’ sharing economy platform destined to the matching of needs

in the area. About the latter aspect, firm 6 seems expressed a new condition, which is that of having interest in working in shared space with other firms because of the stimulating environment and the knowledge spillover.

Similarly, *firm 9*, which the 'willing' tailor shop of the sample, would like to share its (small) space and equipment with other firms or entrepreneurs. Sharing its space and equipment, this firm could encounter interesting colleagues to connect and innovate with. In other words, this interviewee believes that making a collective use of its space and equipment would provide her firm with stimulating relations and knowledge spillover that may give birth to innovative and productive ideas.

Overall, the possibility to draw from knowledge spillovers constitute a condition that renders the collective use of space interesting for firms. In particular for those firms that, as these two, have an open attitude towards the possibility of sharing a work space. In this respect, the Pulsup Project may add a value to the firms of the Spaanse Polder facilitating their search for a stimulating collective use of space. However, the necessity of thoroughly explore this possibility should be taken in account for future developments.

8.1.5 The sustainable exploitation of space and social responsibility

Fifthly, the idea of making a communal use of space can also be supported by the desire of a firm to make a more optimal, thus more sustainable, use of the available space, thus by the **social responsibility** of a firm. Here we will take again in consideration firm 9, which as we have just seen, is the 'willing' tailor shop of the sample that would like to share its space and equipment with other firms. The interviewee thinks that it would be nice to let other firms of the Spaanse Polder, but also of the Rotterdam region as wide, use its space and equipment because the interviewee is interested in sustainability and believes that the already available resources should be better exploited. Thus, also the sustainable exploitation of space constitutes a condition that may support firms' willingness to make collective use of resources. In this sense, the Pulsup Project would add a value to it.

8.1.6 ...when making a collective use of space is part of a firm's business model

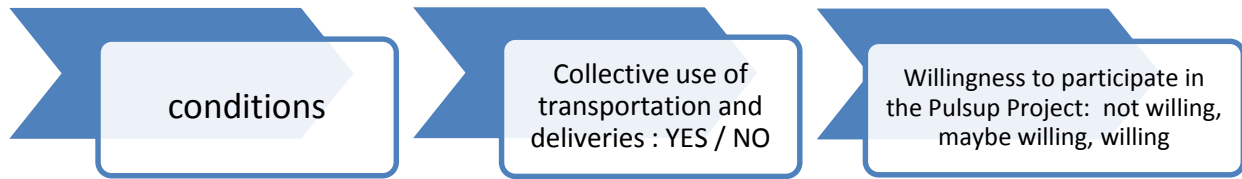
Finally, in certain cases the collective use of space is a condition determined by the same business model of a firm. *Firm 8*, which is the 'willing' start-up specialized in the brewing of beer of the sample, renting its space and equipment is part of its DNA. In fact, the business model of this firm is based on the renting of the brewing system and of the space needed by the beer-tank's renters (see Section 8.3). The interviewee said "*I tell to customers 'I can provide you with the brewing service but you have to buy your own tank', so they buy their vessel... and so they just pay the rent to use the space and they pay like a monthly fee to cover all the costs, but basically it is their tank, and what they do, any time they want to use my system. I say 'ok, you can use my system', and then they pay for that!*" (int. 11, co. 8, p. 6). This could be defined a sharing economy firm given that its profit is based on the sharing and renting of its space and equipment. In this case, the collective use of space constitutes the very feature of this firm, which in this sense constitutes a special case.

8.1.7 Conclusions about the collective use of space



Given the definition of collective use, space can either be rented, temporarily rented, flexibly use, and shared. All these forms of collective use could be promoted by the Pulsup Project and emerge from the interviews. It became clear that because of the scarcity and the high cost of available space it is not easy for firms to enlarge their property or move within the Spaanse Polder. Given these conditions, the Pulsup Project may provide the Spaanse Polder's firms with the opportunity to clearly visualize the location of available space adding a value to the area and triggering their willingness to either participate in it, or at least to become users of the sharing economy website that it will create. Secondly, we also saw that the firms of the wholesale market have already self-organized themselves in spontaneous and informal way to make a flexible and collective use of space. That means that for the firms in the wholesale market the Pulsup Project would not add much value. However, about flexibly using space the Pulsup Project may suggest a format of temporarily rental where the renter can offer a space for a cheap price while (s)he waits for renting the same space to a long-lasting renter. Finally, we saw that certain firms are interested in sharing the working space with other realities because they want to work in stimulating environment where there is knowledge spillovers, as it happens in co-working spaces. Even in this sense, the Pulsup Project may put in contact different needs and realities.

8.2 Interest in the collective use of transportation and deliveries



During the interviews it was investigated whether firms make or would like to make a collective use of transportation and deliveries. Looking at this aspect several conditions that boost or constrain the interest in making a collective use of transportation or deliveries emerged. The objective was to see whether the interest in making a collective use of transportation and deliveries affect the degree of willingness to participate in the Pulsup Project, and what could be the valued added by the Pulsup Project to the collective use of resources. Each one of the following paragraphs will be concluded with a reflection about the relation between the condition that may render the collective use of space a desirable option, whether this condition is combined or not with the interest in sharing transportation and deliveries, and whether the Pulsup Project could support a firm's willingness to participate in the Pulsup Project.

A sharing economy platform that aims at matching firms' needs and resources to realize a circular system in an industrial park like the Spaanse Polder may match firms' needs of outward and inward transport of people and goods. During the interviews several questions were posed to the interviewees to understand whether the Spaanse Polder firms need and/or want to make a collective and more optimal use of the transportation modes they use to deliver their products to (maybe) save some resources and contribute to the reduction of CO2 emissions. In practical terms, a collective and more optimal use of the transport modes means filling vans and/or trucks fully both ways in and out the Spaanse Polder while cooperating with other firms: for example, joining their deliveries. By the way, the interviewee of the DCMR, which is the Environmental Protection Agency of Local and Regional Authorities in the Rijnmond Region, about the collective use of transportations and deliveries in the Spaanse Polder said: *"...about the transport of products one of my biggest worries is truck movement going full one way, and empty back. I do not understand why this is... so..."* (int. 3, Institution 2, p. 10). The interviewee sees in the not optimal exploitation of the transportation of goods in and out the Spaanse Polder a waste of resources. Where waste is meant as both not optimal use of the available transports modes, and as unsustainable that pollute the environment. In fact, making a more optimal use if the circulating transportation would consist in a contribution to the reduction of CO2 emissions. This interviewee believes that orchestrating firms' transportation and deliveries a more optimal and sustainable use of resources would be possible. This is one of the reasons that explains the DCMR's interest in the Pulsup Project. Now we are going to look at some of the interesting insights that in respect to firms' need of transport and deliveries emerge from the interviews.

8.2.1 Specialization, size, and products' (in) tangibility of a firm

Almost every firm recurs to some kind of transport mode to support its economic activities. The firms of the sample either use the own vehicles, or external transportation firms like couriers, transfers, overnight 'groupage', or the parcel service. The typology and kind of use that a firm makes of transport modes is influenced by several conditions. Particularly, it was observed that the **specialization** and the **size** of a firm particularly influence the transport modes a firm recurs to. To make this clear it is enough to think in a wholesale of alimentary products, in a printing firm and in an accounting company. The wholesale of alimentary products tends to recur on a daily basis to vans and trucks to distribute its merchandise (e.g. firms 2, 7, 10). The printing firm needs less and smaller transport modes because printed paper is less voluminous than alimentary products; the printing firm tends to recur to vans or big cars to deliver its products (e.g. firm 1, 3). Finally, for the accounting company, which performs **abstract and intangible functions**, disposing of a car to visit the clients when it is needed tends to be enough. Then, firms can either recur to own vehicles or to transfers and or couriers, which are external firms that offer this service in change of a fee. Combinations can be numerous and vary from firm to firm, even if they perform the same activity. This to say that in general, as well as in the Spaanse Polder, firms recur to transport modes to conduct their daily economic activity. Overall, 1) the specialization, 2) the size, and 3) the tangibility of products and functions constitutes conditions that could influence a firm more or less open attitude towards the collective use of transportations and deliveries.

Narrowing down this observation we can look at how the specialization of firms constitutes an influential condition to look at to develop a system that allows the collective use of transportations and deliveries. We can look at the 'maybe willing' wholesalers of alimentary products, firms 7 (p. 9) and 10 (p. 4), which prefer to use their own trucks to deliver their products given that the transportation of goods consists in an important part of this kind of economic activity. Otherwise, we can look at firms 4, 5, 6, and 11, which do not have a particular need to save money on transportation and deliveries because of their specialization in the service industry. Firm 4 is specialized in the measurement of strain and stresses, firm 5 is an accounting firm, firm 6 is the mobility director of the taxis of Rotterdam, and firm 11 is both a bodyshop and a retailer of cars. Because of their specialization these firms do not need to deliver big orders of goods and materials. However, because firm 4 also performs some productive activity, sometimes recurs to the use of what the interviewee calls *parcel service* or *regular delivery service*. By the way he said "*they deliver all over the area...Next day, or two days delivery, even longer!*" (int. 5, co. 4, p. 7). This kind of service stops at different firms of the area to gather what firms have to deliver, but without particular hurry. By contrast, for firms 5 and 6 deliveries do not constitute a pivotal aspect of their activities. While for the 'maybe willing' firm 11 having a couple of cars to sometimes deliver parts of a car is enough (p. 14). Thus, for these firms making a collective use of transport and deliveries to save resources is not particularly interesting. In this respect, the Pulsup Project would neither trigger their willingness to participate in it, nor add a particular value to them.

8.2.2 The scale of the market and the compatibility of deliveries' destinations

Other two conditions that could influence a firm more or less open attitude towards the collective use of transportation and deliveries is the **scale of the economy of a firm** and **the compatibility of the destination of deliveries**. In other words, whether firms need to deliver in a similar area and at a similar time. This point emerged talking with the interviewees of firm 1 and firm 2.

Firm 1 is on the 'maybe willing' printing firms of the sample. It usually recurs to the service of 'overnight groupage' to deliver its products, which is performed by an external transfer company. However, depending on the need, firm 1 also uses either the own transport modes (e.g. car and van) or that offered by couriers. Talking about these different transportation options the interviewee made an interesting observation: there is a difference between couriers and transfers. By the way, the interviewee said "*if you can skip couriers is better*" (p. 11). A transfer is a firm that "*picks all the packages up in the surroundings and put them together and they say 'OK, we have 20 packages that go to Amsterdam'... It is different than I would call and say 'bring it to Amsterdam' because one courier would drive with one package to Amsterdam. It is not efficient; it is not cost efficient. But sometimes you have to do that, so sometimes we use a courier, but this mostly because the customer ordered it too late and then they say it doesn't matter how it comes, please bring to me, and then we call the courier, and then they bring it over the same day*" (int. 1, co. 1, p. 12). The use of couriers is more expensive than transfers because it performs an individual service. In this sense, it was asked to the interviewee if he would cooperate with other firms if they need a courier because they could save money making a collective use of transport with other firms. In this respect, the interviewee said "*if there was website! If there was a website where we could check and say 'OK, who is driving to Amsterdam with the courier?' and say 'could you bring also my package?' Sure, it would be good! It would be low cost! ... It would be sharing the expenses! Yeah! ... But it is a hard thing because if I have to deliver at one, and the other say it has to be there by 10 is fine! You go by 10 and then deliver it by 11. Ok, earlier is always better, later is your death-penalty*" (p. 12). As we see, the interviewee seems interested in the possibility of making a collective use of transportations and deliveries, even if express some concerns about it. He is concerned about the possibility of realizing such idea given the difference in needs among firms in terms of deliveries. In particular, the interviewee was concerned with **guarantying punctual deliveries** to customers even when making a collective use of transportations and deliveries.

The same kind of concerns were expressed by the interviewee of firm 2. *Firm 2*, which the 'not willing' wholesaler of alimentary products, recurs to different transport modes as well. This firm both uses external and internal transportation. The interviewee said "*our truck is usually full, and the external transport firm has every time space!*" (int. 2, co. 2, p. 4). It is not clear whether the external transport firm he refers to is a transfer or a courier, however it comes from Rotterdam. About the possibility to cooperate with other Spaanse Polder firms to assure that the trucks are always full, the interviewee replayed "*of course, that would be better for us. Then you would have better prices!*" However, also this interviewee highlighted the difficulty to find firms whose need is compatible; he said "*I don't know if this would be possible here, because I am sending to Belgium, another is sending to France, and another to Germany. You cannot get the truck full with these three countries! That's not possible!*" (p. 4). Anyways if there would

be a website to exactly find another firm that needs to deliver in Belgium “*maybe then you can improve the situation! This is all interesting! Then you can see ‘this truck is half-full, this is quart-full, and then you can tell this truck in this area, one pallet this price, three pallets this price. Then, they can click it and then order it. It’s possible!’*” (p. 5). In other words, also this interviewee thinks that cooperating with other firms to make a more optimal use of transportation and deliveries may be useful and interesting. However, this firm, as well as firm 1, thinks that constitutes a delicate issue because it is complex to coordinate different firms’ needs in terms of deliveries.

Overall, the **scale of the market** and the **compatibility of the destination of deliveries** which determines the destinations of a firm’s deliveries, constitute the conditions that can influence the interest of a firm in making a collective use of transport and deliveries. Given that for firms is fundamental to be able to guarantee punctual deliveries to clients, timing constitutes a delicate issue that needs to be managed with precision. In this sense, the Pulsup Project may trigger the willingness of firms to participate in it if it provides them with the possibility to use the sharing economy website to find firms whose deliveries’ needs are compatible, especially in terms of destination and time of arrival.

8.2.3 Triggers and constraints of the collective use of transportations and deliveries

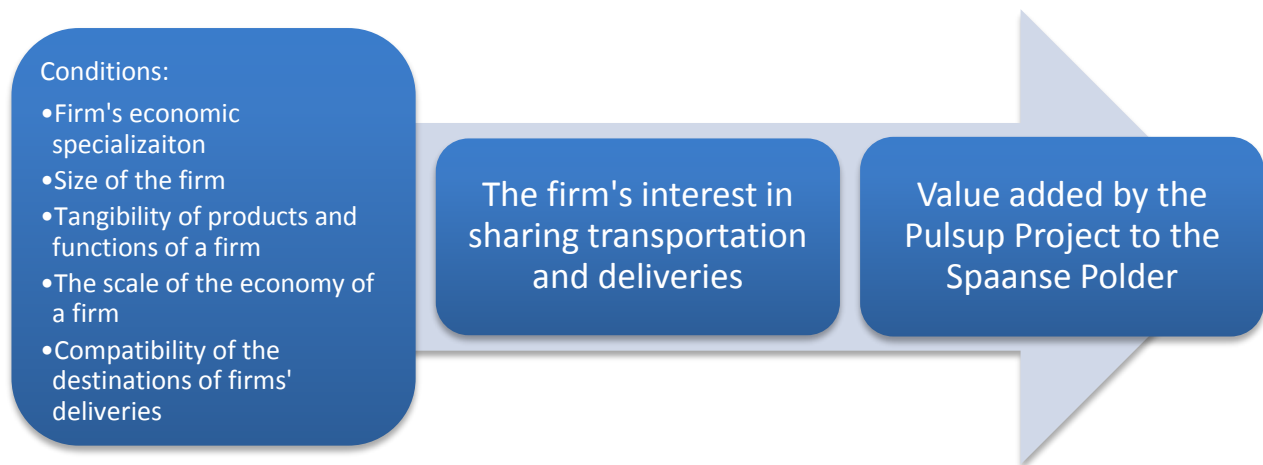
As we saw, several firms recur to **external transport firms**. As we are going to see analyzing the case expressed by firm 1, sometimes the form of external transportation can **constrain** firms’ interest in making a collective use of transportation. *Firm 1* usually uses the ‘overnight groupage’ service, which is performed by a transfer firm. By the way, the interviewee of firm 1 said “*...they (the transfer firm) come here every day and then they pick it (firm 1’s products) up and then they deliver it the next day to the customers, if possible*” (int. 1, co. 1, p. 11). An external transfer firm comes to the Spaanse Polder to gather several firms’ products overnight. The following day, these products are distributed to those they may concern. Being this service performed by an external firm whose profit rises when its transport mode is filled completely, we can imagine that this firm is incentivized to optimally fill its vehicles drawing from several firms of the area. Hence, recurring to external transfers could disincentive the Pulsup Project to promote the collective use of transportations and deliveries. In other words, the Pulsup Project should verify to what extent the Spaanse Polder firms recur to external transfers before developing this aspect. If most firms that needs to deliver goods on a daily basis make use of transfers, which already take care of making an optimal use of their vehicles it may result useless and counterproductive for the Pulsup Project to focus on this aspect.

The spread use of **the Internet** and online applications may be seen as **both a constraint and a trigger** for making a collective use of transportation and deliveries. With the interviewee of *firm 3*, which is the other ‘maybe willing’ printing firm of the sample, we also talked about how its suppliers bring the products and goods it orders and needs. The interviewee said that having close suppliers would be easier but that this does not constitute a huge problem because nowadays many orders are done directly by the Internet for the following day. On the one hand, this means that transfer firms not only deliver goods from the Spaanse Polder to other places, but that also bring goods into the Spaanse Polder from other places, and firm 3 uses transfers in both directions. On the other hand, this also means that with the Internet and the related

logistic system, the transport of goods is easy and fast and discourages the need of having close suppliers. Anyways, the fact that the internet is used on a daily basis suggests that firms that are familiar with its use would have fewer problems to switch to a sharing economy platform that boost the matching of goods' transport.

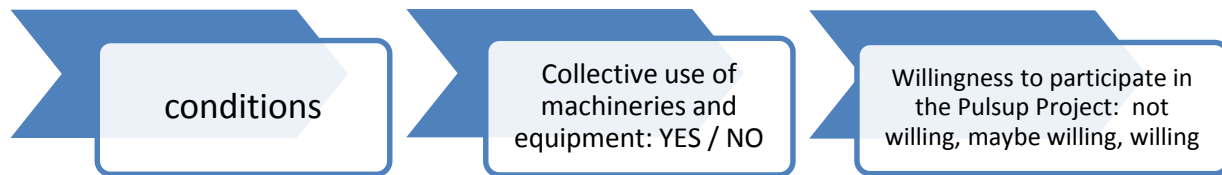
Finally, in certain cases it seems that the Pulsup Project may add a value to the firms of the Spaanse Polder. It is interesting to notice that the interviewee of *firm 6*, while we were talking about the concept of industrial symbiosis, curiously mentioned a service that this 'willing' firm offers to the workers of the Spaanse Polder. The interviewee explained "*what we are doing here is that we had a service...which basically is a transportation service to transport people from the train station to their job here in the Spaanse Polder because public transportation was really bad here. So we basically introduced this service for our own people, but we said to up open up to the wider service as well!*" (Int. 9, co. 6, p. 5). This service was recently introduced but if firm 6's workers use it regularly it seems difficult to involve other firms' workers. However, this fact let us imagine that a sharing economy platform could boost the diffusion of this service in the Spaanse Polder, which seems rather useful for the workers of this industrial area of Rotterdam.

8.2.4 Conclusions about the collective use of transportation and deliveries



The need of transporting and delivering goods depends on the typology and the size of a firm, and on whether its functions and products are abstract and intangible. Hence, those features of firms should be taken in account by the Pulsup Project. The main point to take in consideration is the fundamental need of firms to be punctual in their deliveries. Thus, for the Pulsup Project it would make sense to develop this industrial symbiosis only if it would be able to guarantee to firms the ability to find other firms that have compatible needs in terms deliveries' destinations and time. About the organization of transportation and deliveries to make a more optimal use of vehicles and reduce traffic and CO2 emissions the Pulsup Project may be constrained by the frequent use of 'external transfers' made by the Spaanse Polder firms. Hence, for a sharing economy platform is more difficult to orchestrate the collective use of transportation and deliveries than that of space. In this respect, it is difficult whether the Pulsup Project would add a value to the Spaanse Polder.

8.3 Interest in the collective use machineries and equipment



A sharing economy platform that aims at matching firms' needs and resources to realize a circular system in an industrial park like the Spaanse Polder may boost the sharing of the machineries and equipment used by firms. During the interviews several questions were posed to the interviewees to understand whether firms make or would like to make a collective use and more optimal use of machineries and equipment they use to perform their business activities to save money and make a more sustainable use of the already available resources. Looking at this aspect several conditions that boost or constrain the interest in making a collective use of transportation or deliveries emerged. The objective was to see whether the interest in making a collective use of transportation and deliveries affect the degree of willingness to participate in the Pulsup Project, and what could be the valued added by the Pulsup Project to the collective use of resources. The following paragraphs will reflect upon the relation between the condition that may render the collective use of machineries and equipment a desirable option, whether this condition is combined or not with the interest in sharing machineries and equipment, and whether the Pulsup Project could support a firm's willingness to participate in the Pulsup Project.

8.3.1 The specialization of a firm

Every firm uses some machineries and equipment to perform the own business activity, however the economic specialization of a firm influences the quality and the quantity of machineries and equipment that a firm needs to perform its functions. Thus, the **economic specialization** of a firm can either trigger or constraint the interest of a firm in sharing certain machineries and equipment, hence constitutes a condition that needs to be taken in consideration. Indicatively, we could say that the firms that work in the service sector use and need less machineries and equipment (for which a set of computers may well constitutes the basic equipment they need), than firms that work in the manufacturer industry (which need all a series of specific machineries to perform their activities). For example, *firm 5*, the sample's accounting 'willing' company, beyond software and computers does not particularly need to use other machineries. The same could be said about the 'not willing' *firm 4*, the firm that is specialized in the measurement of strain and stresses, whose interviewee said "...we do not have that much machinery!" (int. 5, co. 4, p. 6). Thus, we see that there is a relation between the economic specialization of a firm and the need of machineries and equipment. Thus, the economic specialization is a condition that determines the major or minor degree of a firm's interest in collectively use machineries and equipment.

8.3.2 Why optimize the use of machineries and equipment

In several cases, the idea of **making a more optimal use of machineries and equipment** constitutes a condition that boost the interest of firms in the collective use of resources. Usually, this condition is intermingled with that of **costs' efficiency** and **social responsibility**. Firstly, we can look at *firm 1*, which with *firm 3*, is a 'maybe willing' printing firm. The essential equipment for this kind of firm is constituted by computers and printers. However, to execute its printing functions *firm 1* needs a heterogeneous set of tools and machineries. As the interviewee said during the interview, to this heterogeneous set of tools and machineries, it would be useful to add a pick-up tractor that weighs the cargo of the pallets while it moves them. By the way, the interviewee of *firm 1* said "*...we (firm 1) have actually discussed something: if we send something, we send it using a pallet... Sometimes it is 20 kg, sometimes it is 50, or 500. But we don't know exactly how much we put on the pallet in kg. It doesn't matter because we say it is about 100 kg and then the transport comes and then it takes it away and says it was 90 kg. So Ok, sometimes it is 110kg. We say, ok, so we don't mind actually. But sometimes it is interesting to know. So we thought about a pick-up tractor to move up the pallets with balance. It is about 2000 euro to buy it, a good one. Then we discussed that it would be good if there was something in our neighborhood who has something, and then we only need it for, let's say, a month, and then do it check, and then check what we would like to know and then give it back. So, in that way it is interesting to see the possibilities*" (int. 1, co. 1, p. 6). The interviewee of *firm 1* is interested in borrowing the pick-up tractor that weighs the cargo of the pallets from another firm because even if it is not essential, it would be useful to sometimes be able to weigh the pallets. Unfortunately, given the scarce use this firm would make of this machinery, to buy it new would be too expensive. Thus, for this firm it would be ideal to sometimes borrow or rent another firm's pick-up tractor with balance. Overall, we could say that this 'maybe willing' firm, which is familiar with the concept of the sharing economy, takes in consideration the possibility of renting or borrowing from another firm this machinery by means of a sharing economy website to make a more optimal use of its resources.

Secondly, we can look at both the two 'willing' firms 9 and 6 have thought about the possibility of letting another firm or group of people use their equipped space to make a more **optimal use** of it. In particular, these two firms are motivated by their **social responsibility** and **costs' efficiency**. On the one hand, *firm 9*, which is the small-sized 'willing' tailor-shop of the sample, would let students use its equipment and space when it is not occupied by its activities. By the way, the interviewee said "*sometimes I have thought about that (to let other firms or people use this firms' machineries and equipment) but this is a small company... when we are closed and if you are a student and you need a space in an atelier like this, then yes, it could be that someone uses this space because it has not being used for the day. So, sometimes I thought about that, it is possible! If I know someone who needs the space...*" (int. 12, co. 11, p. 2). On the other hands, the 'willing' *firm 6*, which is the mobility director of the taxis of Rotterdam, about the possibility of sharing online unused or underused equipment, said "*Yeah! We do have beamers we don't use all the time, but what we also do have is... we have a really large call center down here which is only part of the day fully occupied. So, these are, you know, fully equipped spaces, or call center activities, which could also be used for other stuff...*" (int. 9, co. 6, p. 8). Then, I asked him whether they would let a start-up use this space for half-a-day and he said "*I think that it wouldn't be a problem!*" (p. 8). Both these firms are interested in making a collective use of their equipped space letting another firm or group of people

use either the tailor shop, the beamers or the call-center. Thus, trust and confidentiality issues do not constrain this possibility. In fact, the interviewees had thought by themselves about the possibility of making a more optimal use of some of their resources. In addition, in this case we see that the sharing economy platform could be seen as tool that beyond matching firms' needs of assets and resources within the Spaanse Polder, matches them also between the Spaanse Polder and the city of Rotterdam and surroundings. In fact, she had thought about giving its atelier in use to students. Thus, the Pulsup Project could also points its attention towards not only firms but also towards certain citizens' categories as that of the students can be.

Finally, we can look at the 'not willing' *firm 4*, which is specialized in the measurement of strain and stresses. It also seems interested in making a more optimal use of a particular resource it needs to execute its functions. The interviewee of firm 4 said *"we have some sort of components that are expensive and the biggest issue that we have that... for example we know a place where we can find 500 pieces, but we only need, maybe, 20! But you cannot buy smaller charge than 500! Well! That's a pity!"* Then, I asked him whether he would share this purchase with another firm it is the same situation, and he said *"if someone else would need it also then..."* (int. 5, co. 4, p. 6). Even if this firm is 'not willing' it is attracted by the possibility of saving money and make a more optimal use of this resource.

Overall, the condition of making a more optimal use of resources supports these firms' interest in making a collective use of certain machineries and equipment. Hence, the Pulsup Project would both add a value to these firms, and trigger these firms interest in using the sharing economy platform.

8.3.3 Triggers and constraints to the collective use of machineries and equipment

For certain firms is 'normal' to make a collective use of certain resources, otherwise it seems an 'impossible' idea. Hence, it is a matter of **attitude** towards the idea of sharing or making a collective use of resources. In other words, for certain firms cooperating with and asking for favors to other firms is part of their routine, while others do not see how they could share their machineries and equipment with other firms. The 'not willing' *firm 2*, which is a wholesaler of alimentary products, said that usually asks for favors to other firms of the area when it needs something, and that the same happens the other way around. In this sense, this firm does not seem particularly necessary or relevant to dispose of a sharing economy website. Asking for favors to the neighbors is also part of the routine of the 'maybe willing' *printing firm 3*. Furthermore, this firm's machineries run almost continuously. By the way the interviewee said *"our machineries run five days a week, almost 24 hours per day!"* (int. 4, co. 3, p. 3). Given this statement, it seems that this firm would not be able to make a collective use of its machineries or equipment. However, the interviewee was fascinated by the idea behind the sharing economy website proposed by the Pulsup Project. Consequently, we could expect that this firm's opinion could change in time; particularly, if this firm would understand that this website is meant to share not only big machineries, but also small equipment, for example a beamer to give presentations (see firm 6). The same reflection could be also extended to firm 11. This 'maybe willing' firm is the car dealer and bodyshop of the sample. The interviewee of this firm said that they have under-used machineries, in the sense that their productivity could be higher than it is at the moment. However, the interviewee said that it is not

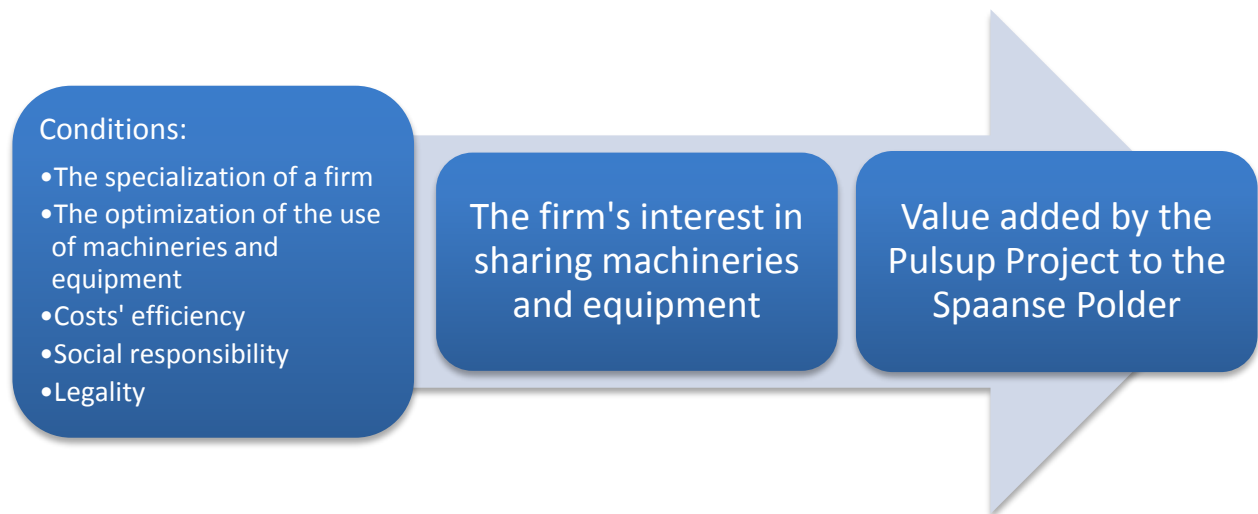
possible to rent their idle capacity “because lots of those things are big and heavy; for example, the bridge to put the cars on, you can’t tell to somebody else you wanna rent it because it is mounted to the floor. So... and heavy tools, small tools, that’s not interesting, so we don’t rent...” (int. 14, co. 11, p. 14).

Last but not least, the interviewee of firm 11 expressed a doubt about the legality of making a collective use of equipped space. As we saw in section 8.3.2 certain firms like 9 and 6 are interested in renting (some of) their equipped space to an external part. The interviewee of firm 11 said that a firm that lets external people use its space is legally responsible for them. Hence, it is recommendable that with a touch of caution, before undertaking such kind of sharing and circular economy practice, the parts involved investigate the legal aspects of their initiative. Thus, **legality** constitutes a condition that needs to be taken in consideration.

8.3.4 Sharing the production line

To conclude this section about the matching of firms’ machineries and/or equipment, a further matching possibility needs to be taken in consideration. This possibility was suggested by the interviewee of the DCMR. About the sharing economy website that the Pulsup Project aims at realizing he said “well, even maybe using production lines... If one firm has a larger assignment and they do not have the production capacity while the neighbor does, they can rent the machineries instead than buying it” (int. 3, Institution 2, p. 10). This could also constitute an interesting option to take in consideration. Thinking for example in firm 3 and firm 1, which both are specialized in printing, this option would maybe be feasible.

8.3.5 Conclusions about the collective use of machineries and equipment



The economic specialization of a firm influences the kind of machineries and the equipment that a firm needs. Firms need to be similar if they have to share (e.g. renting) big machineries, for example in the case that a firm needs to borrow the production line of another firm to realize an order bigger than usual, but if a firm needs a beamer this condition is not required. The Pulsup Project may provide with this service to the firms of the Spaanse Polder adding a value to it. The value that the Pulsup Project may add to the

Spaanse Polder is also that it could perform a bridging function between this industrial area and the rest of Rotterdam Region. In fact, we saw that firms are interested in this possibility and that sometimes their interest could be better realized also extending the use of the sharing economy platform to other users that do not have to necessarily be firms, but that could be organizations and groups of any kind, if not individuals. Another reason why the Pulsup Project may add a value to the area is that it may support firms' cost efficiency strategies as well as their social responsibility. However, the Pulsup Project should check the legality of sharing certain machineries and equipment.

8.4 Interest in the collective use of waste flows materials



A sharing economy platform that aims at matching firms' needs and resources to realize a circular system in an industrial park like the Spaanse Polder may boost the sharing of the waste flows materials used by firms. The attention was put upon the waste flows materials that circulate in the Spaanse Polder because the waste material of a firm can become the input material of another one. This constitutes one of the basic sustainable practices inspired and promoted by concepts like industrial symbiosis, circular economy, and blue economy, among others. During the interviews several questions were posed to the interviewees to understand whether their firms upcycle, reuse, repurpose, and reinvent their waste material or whether they would like to do so cooperating with other firms. In other words, it was investigated whether the firms may need or want to use a sharing economy website to acquire, buy, give, or sell waste materials to or from another firm and make a more optimal and sustainable use of the waste flows materials produced in the area. Looking at this aspects several conditions that boost or constrain the interest in making a collective use of waste flows materials emerged. The objective was to see whether the interest in making a collective use of waste flows materials affects the degree of willingness to participate in the Pulsup Project, and what could be the value added by the Pulsup Project to the collective use of this resource. The following paragraphs will reflect upon the relation between the conditions that may render the collective use of waste flows materials a desirable option, whether this condition is combined or not with the interest in sharing waste flows materials, and whether the Pulsup Project could support a firm's willingness to participate in the Pulsup Project.

8.4.1 Regulations, standards, certifications, knowledge and economic incentives

First of all, the **standards and certifications** owned by a firm, as well as certain *rules and regulations*, constitute a condition that may support firms' interest in making a collective use of flows of waste materials. For example, both the printing firms of the sample have the ISO 14001 certification, which both

prove their interest in making a sustainable use of resources and determine their behavior in terms of management of resources and waste flows materials. This explains why the 'willing' *firm 1* recycles its waste materials as much as possible. About it the interviewee said "*what we did in the 14001 Cycles is that we looked at every single product that we use here to see what we do buy and how we do get rid of it, how much it does cost to buy and how much it does cost to get rid of it*" (int. 1, co. 1, p. 13). The ISO 14001 acquisition's process helps understanding how a firm's production system impacts the environment. To obtain the ISO 14001 thus implies a thorough analysis of the production practices of a firm. The institution that provides with this certificate teaches to the firms that decide to undertake the path that conducts to the acquisition of the certificate the implications of overlooking environmentally unsustainable behaviors and how to behave to become environmentally friendly. About this process, the interviewee said "...and then they (the institute that gives the ISO 14001) say... 'Why do you have only one basket here, when you could have all kind of big baskets for your paper?' 'Why do you throw your paper in the leftover container!?' And they said "Good! Do it (recycle)! That will bring you money!' So, not recycling is not that clever to do. So, they totally changed our minds! They brainwashed us saying 'why do you do this, and why do you do that?'" (p. 13). Then, the interviewee said "*it is always difficult to change things in a company, but this is one of the most fun things to change because also the people in your company... because you say 'well, this would cost you money and that would bring you money!' 'So, this is better for all of us! I will do that!' ... So you have to change your behavior and tell them why! And they say 'why do you do this or do you do that?' So we've made a lot of changes. We had 1.100 liters of a container and now we have 500.000 liters of a container. So, what we have still to do... it is better! It is more than half!*" (p. 13). In other words, the interviewee said that it is difficult to change the routines of a firm, and that this is easier to do when an exhaustive explanation is given to the workers, and when there are economic incentives. This means that two conditions support the transition to a more sustainable use of resources. On the one hand, people and firms need to be informed, acquire *knowledge* and become aware of their behaviors and understand why they should change it. On the other hand, people and firms would more easily change behaviors whether their effort is supported by an *economic incentive*.

In particular, *firm 1's* main waste flows are constituted by paper, ink, general waste, and aluminum plates. By the way, the interviewee said that disposing ink "*is kind of expensive*" not because is harmful for the environment, but "*because it is dirty and sticky*". However, the interviewee surprisingly finds that "*the most expensive thing to get rid of is the general leftover container... That kind of waste is mostly the most expensive waste that you have in a company!*" (p. 13). Then, given that to perform its printing activity this firm needs aluminum plates, he mentioned them and he said that aluminum plates are expensive to buy, but not to dispose. About this he said "*to dispose aluminum I get a lot of money back because if you dispose it they (it is not clear 'who') could use it again*" (int. 1, co. 1, p. 13). The waste-flows materials of the other printing firm, the 'maybe willing' *firm 3*, are similar to those of firm 1. Firm 3 is also engaged into the recycling and the up-cycling of wasted materials, in particular of metals. The interviewee of firm 3 said "*it's all recycled! Everything! Paper is recycled, the aluminum is recycled, the paint is recyclable, what else... the iron! We've got some old stuff, from old machines, we strip them and we bring the pieces to the special firms ... They buy our old iron and they recycle it!*" (int. 4, co. 3, p. 5). We see that metals as aluminum and iron can be easily sold to and upcycled by metal processing firms, which means that these materials are reintroduced in the production circuit. For these two firms there is an *economic incentive* to

behave in a sustainable way because parts of the costs due to the purchase of aluminum or iron are compensated by the gain due to its sale.

A similar case is constituted by the 'maybe willing' *firm 11*, which is the car dealer and bodyshop of the sample. This firm belongs to the automotive industry and this, as emerged from the interview, explains why it recycles as much as possible. The **regulations** that concern the automotive industry determines that the firms operating in this industry have already undertaken the recycling and upcycling path. In fact, the interviewee interestingly said that *"...Especially for bodyshops it is really easy because the legislation tells you a lot about the use of paint and reuse of products and 80% of a car is already recyclable. I think the automotive industry is far ahead to the rest of the industries, absolutely!"* (int. 14, co. 11, p. 13). Thus, also in this case the kind of regulations ruling firm 11 constitutes a condition that boosts its interest in making a collective use of waste flow materials (more about firm 11 in the next section 8.4.2).

The fact that these firms either have the ISO 14001 certification or that are subject of specific regulations explain why they are already part of a network of exchange of waste flow materials. In this case, making a collective use of waste flows materials implies a business kind of cooperation among firms, given that there is a seller and a purchaser; this circular practice implies the production of money and the optimization of the used materials. Overall, we can say that **having standard and certifications** constitutes a condition that can boost firms' interest in making a collective use of flows of waste resource. However, we saw that other two conditions that are **knowledge** and **economic incentives** (see section 8.4.2) boost firms' interest in sharing resources. In fact, these two conditions, and in particular the possibility of directly or indirectly optimize the costs (by selling waste, or avoiding taxes on waste), are intermingled with that of having standard and certifications. In fact, the three 'maybe willing' firms that we have just mentioned if on the one hand are committed to the implementation, maintenance, and improvement of their sustainable practices because of certifications and regulations, on the other hand are incentivized in doing so by the economic incentives that goes with it (see section 8.4.2). Said so, a sharing economy website like the Pulsup could contribute to the matching of different firms' waste flows, and become an organizing tool that boost firms interest in disposing and acquiring waste materials in a both cost-efficient and material optimization fashion. In this sense, the Pulsup Project may add a value to the firms of the Spaanse Polder whether it is able to lever on firms that have standard and certification about sustainable practices, provide firms with an exhaustive justification of its existence, and with economic incentives.

8.4.2 Cost efficiency and circular economy practices

As we have seen in the previous section (section 8.4.1) of this chapter **economic incentives**, or **cost efficiency**, constitute a condition that may support firms' interest in making a collective use of flows of waste materials. In fact, during the interviews several firms noticed that discarding waste material is very expensive. This fact incentivize firms' adoption of recycling and upcycling routines. By the way, we can look again at the 'maybe willing' *firm 11* that as other firms tries to keep the amount of waste at the minimum level. The interviewee said *"that (waste) is what we try to do as small as possible. And recycle! Because waste costs a lot of money! You have to pay for your oil, you have to pay for your paint, you have to pay (the disposal) for your thinners, and you have to pay for your filters, so it's quite expensive! So we try to do that (waste) as little as possible. For example, all those bumpers, bumpers on cars, damaged*

bumpers... when they are damaged they will be collected, and when they are possibly a hundred or two hundred, there will be one guy that pick up all those and those bumpers will be recycled, instead than wasting them!" (p. 15). Then, it was asked to the interviewee whether they pay 'the guy' that pick up the waste materials and he said *"it depends... Sometimes they pay us, and sometimes we have to pay them. That's the same with iron, and batteries, and things like that. They will all be collected and recycled. Like I said 80% of a car is probably already being recycled. Because the glasses are recycled, the metals are recycled, the tires are recycled, and the wheels are recycled... everything would be recycled!"* (p. 16). Even if this firm, which is a bodyshop and a retailer of cars, provides with its waste material other firms because of its certifications and the regulations that rule the automotive industry, we understand that another reason to behave this way is to reduce the firm's costs. In this respect, this firm's cost efficiency strategy is to sell its waste materials in change of money, which a direct strategy.

Instead, the 'maybe willing' *firm 10*, which is one the wholesaler of alimentary products of the sample, brings an indirect cost efficiency strategy. A part that the interviewee of firm 10 said that they hardly have waste, however he added *"every now and then of course you have products that have passed the expiry date and then, of course, Holland has also rules and regulations: how to dispose waste products in a proper way, an environmentally friendly way. The majority of our waste is from the fresh produce, so organic, to put it like that, so it is not really dangerous for the environment... then we have a special container for that outside... we have like a million seagull, and birds... that et it... and sometimes with purpose we leave the container open for them because instead of it being thrown away too much we can feed the hungry birds, why not? So, sometimes we leave the container open and they know there is something they can eat"* (int. 13, co. 10, p. 7). Most of this firm waste comes from fresh produce, and probably they prefer to let birds to reduce its volume instead than paying for the waste collection service. About the waste collection service the interviewee said *"yeah! You pay for the service that is being picked-up and taken... Especially if we have products that have passed the expiry date or that we cannot sell for whatever reason anymore, and when we have to dump soft drinks and so on, you have to pay! There are special rules in Holland and special firms you have to contact to do it in a proper way so it stays environmental... I mean I cannot just open every bottle and throw the liquid outside. I would get a big fine for dirtying, and thanks God that they are doing that: polluting the environment because as I said we are very aware of the fact that we also want to leave a world as clean as possible for next generations to come. So no, and it costs a lot of money. Yeah! It costs a lot of money to dispose!"* (p. 70). Here again we see that regulations and economic incentives are intermingled. Fines constitute a powerful economic incentive to obtain a more sustainable behavior from firms. However, fine are meant to make firms pay taxes to the State besides to foster firms' sustainable behaviors. Firm 10 tends to reduce the costs related to the disposal of alimentary products leaving the containers of wasted fruits and vegetables open for birds to eat from it. This firm could also sell or give this organic waste product to a firm or famer that could upcycle this material. However, this constitutes the indirect cost efficiency strategy of this firm. It shows that economic incentives constitute the condition that boost this firm's interest in saving money on waste flows materials.

Overall, we see that **economic incentives**, or **costs' efficiency** strategy, support firms interest in saving money on waste materials. The Pulsup Project could add a value to the area because developing a sharing economy website could boost both firms' cost efficiency strategy and the sustainable upcycling of waste

flows materials. Said so, a website that matches a firm waste output with a firm waste input could be useful, even if further research, but also real world attempts would be useful to see how to integrate the already existing system of waste exchanges among (local and non-local) firms, with new participants.

8.4.3 Mutual support and awareness

A third condition that may support firms interest in making a collective use of waste flows materials is the **mutual support** firms can provide each other with, which goes hand in hand (again) with *cost efficiency* and **awareness of and interest in sustainability**. To understand better this point we are going to analyze firms 8 and 4. The 'willing' *firm 8*, which is the brewery of the sample, gives its organic waste away in a circular economy fashion because if on the one hand in this way saves money on the other hand support another economic activity and behave in a sustainable way. By the way, while the interviewee was talking about sustainability, said *"the barley when is used is called 'bostel' in Dutch. There's one guy that here nearby keeps his sheep. I found him when I started. We were looking for... 'Ok, how is it going?', and we found him. My friend talked to him, and now he comes every time that we have brewed, then he comes on Friday, he picks it up with his trailer, like that, and all the used barley goes to the sheep. So they eat it and we are planning now a festivity with the lamb. So, it is like... like that!"* (int. 11, co. 8, p. 2). This firm provides a perfect example of a circular economy and recycling practice: the beer waste becomes sheep's food. The fact that the interviewee replayed to a question about whether he is interested in sustainability with this practical and circular example tells something about his awareness of sustainable practices and its interest in it, in other words about the social responsibility of his firm. That this firm is socially responsible was confirmed when the interviewee said *"I use the bags (of the packaging material) for other things"* (p. 3). Probably, to this firm's choice of discarding its activity *"main waste"* (p. 3) giving it to a farmer also contribute also the economic savings that it can make on waste disposal. As we have seen, cost efficiency constitutes a condition that plays an important role in determining firms' disposal choices, and not only this.

The 'not willing' *firm 4*, which is specialized in measurement of strain and stresses, among other materials it uses electronics to conduct its business. This firm is aware of firms that have circular economy in their DNA like those that make carpet out of old carpets, as well as of the importance of safeguarding the environment. This firm recycles paper, and chemical materials, but it is not clear whether it recycle the electronic components it uses. About the disposal of old and non-functioning electronic components it became clear that a small firm like this needs the support of another specialized firm to recycle or upcycle these electronic components. It was suggested whether this would be possible cooperating with other firms and he said *"...and then they say 'ok', make one big contract for all the small firms, and then hand it over to a firm that does it for you, and that is the way. So we appear more in the recycling phase then we lead the reuse phase. Because once it is broken you cannot use it anymore!"* (int. 5, co. 4, p. 3). In other words, to extract the still usable materials from old or broken electronic parts this firm would need to engage a specialized firm. As the interviewee said, several similar firms (that produce electronic waste and that are not able to process and upcycle it) could contract a firm specialized in the collection, recycle and upcycle of wasted electronic parts. In this way it would be possible to extract, upcycle and reuse precious materials from these firms' electronic waste and realize the blue or circular economy 'cascade

model' where the waste product of a firm becomes the input of another one. These *mutually helpful business relations* to exist requires on the one hand firms' interest in sustainable practices and awareness of this possibility, as well as of this possibility. All the parts that are involved could gain in terms of cost efficiency (savings on waste, and cheap prices on inputs) and social responsibility (contribution to the environment through the optimization of the use of resources). Thus, here again the *economic incentives* constitutes an important condition that could boost firms' interest making a collective use of waste flow materials, together with firms' *awareness of the social responsible contribution* that they could make to society cooperating with other firms whose needs are compatible.

In terms of social responsibility and sustainability awareness we could also look at what the interviewee of the 'willing' tailor shop firm 9 said. This firm said that it saves textile scraps to give them to a hobby club where people can use them to tailor.

Overall, we can say that the awareness of the environmental issues and of the mutual support that firms can give each other, besides social responsibility and cost efficiency, constitutes conditions that can boost firms' interest in making a collective use of waste flows materials. The Pulsup Project taking in consideration these conditions may add a value to the firms of the Spaanse Polder, as well as boost their willingness in using the sharing economy platform it wants to realize. For example, even if firm 4 is 'not willing', its interest in sustainability could support its interest in making a collective use of waste flows materials whether the Pulsup Project would provide it with the possibility of easily find firms interested in the purchase of its electronic waste. Through the sharing economy website waste flows resources could be matched within the Spaanse Polder and between this industrial area and the Rotterdam region at large. Sharing economy website could support the creation and the maintenance of such circular network for what concerns the recycling, upcycling, and reuse of electronic materials putting in contact different firms' needs

8.4.4 Clean image

Finally, another condition that may boost the interest of a firm in making a collective use of waste flows resources is the desire of giving a *clean image* of itself to the outer world. *Firm 7*, which is a 'maybe willing' wholesaler of alimentary products and in particular of fruits and vegetables, depicted another circular waste disposal practice. This is "*for example here the agriculture food stuff which we are not selling we can do two things with it... We can leave it to a farmer who gives it to its animals, but we can also give it or sell it to another firm which is making ... I think they process it and then it becomes gas so that you can cook on it, or something like that. We are doing this!*" (int. 10, co. 7, p. 5). In fact, for this firm the main waste is constituted by "*unsold products!*" (p. 9). In other words, this firm supports other economic activities providing them with its waste material. This constitutes a circular and sustainable practice. Even if looking at it we could say that this firm does so because of its interest in sustainability, or to help another firm, this is not the case. In fact, when it was asked to the interviewee of firm 7 whether they behave this way to be sustainable or to make money, his answer was that they give their waste flows resources to thirds parts "*just to clean up the place! Hahaha! We have not thought about the environment because for us the place has to be clean otherwise the customers... Or we are gonna get penalized by the Gemeente of Rotterdam*" (p. 5). This firm is motivated to undertake the circular waste disposal practice that was

depicted by practical reasons. On the one hand, the firm needs to keep clean the area surrounding its establishment to please customers and avoid a municipality's fine; while on the other hand, it can gain some money selling unsold agricultural products to either peasants or firms that process it to produce non-fossil and organic gas. This case suggests that keeping clean the area surrounding its firm, thus acquiring a *clean image*, and *cost efficiency* constitute the main conditions that support this firm interest in making a collective use of waste material. Thus, the Pulsup Project may add a value to and motivate the firms of the Spaanse Polder with the sharing economy platform it wants to realize.

8.4.5 Conclusions about the collective use of waste flows materials



In general waste disposal constitutes an expense that firms would like to reduce. Those firms whose waste can be given or sold to another firm because it could be potentially up-cycled may gain by the sharing economy website that the Pulsup Project wants to realize. While the economic incentives to embrace this initiative are not missing, the knowledge or the awareness that it is possible to upcycle a wasted material contributing to the economy of another firm is an aspect the Pulsup Project should work at. In fact, awareness of the environment, as well as of these kind of sustainable practices, constitute an important condition to involve local firms in a similar system. This is way it would be smart for the Pulsup Project to lever on firms that have standard and certification about sustainable practices. About the other firms, the project should provide them with an exhaustive justification about its existence and meaning, in addition that about the economic incentives.

8.5 Interest in the collective use of energy

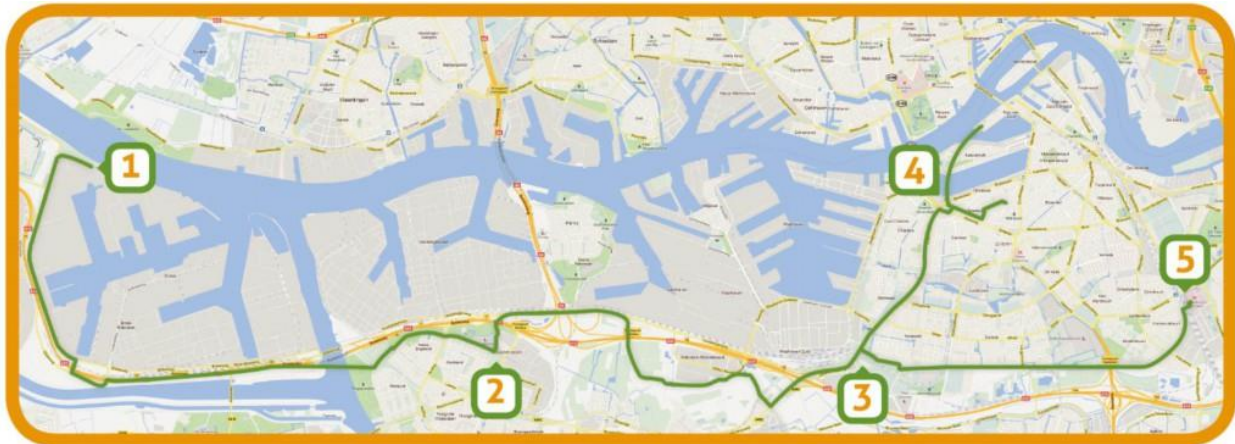


Given the particularity of energy and power as resource, this section requires a slightly different approach compared to the other sections of this chapter. A sharing economy platform that aims at matching firms' needs and resources to realize a circular system in an industrial park like the Spaanse Polder CANNOT boost the sharing of energy and power among firms. Firstly, even if energy and power can be shared among firms, this cannot happen using a sharing economy website. Secondly, energy and power in order to be shared requires bulky and highly expensive infrastructures, like the Rotterdam Heat Network. However, it is interesting to look at the conditions that can constraint or support the development of a combined heat power system in an industrial symbiosis fashion among the firms of an industrial area. These conditions, as we will see, are especially influenced by the physical design of an area. In addition, given that during the interviews it was asked to the interviewees to understand whether firms make or would like to make a collective use and more optimal use of energy and power they use to perform their business activities to save money and make a more sustainable use of the already available resources also this aspect will be briefly analyzed.

8.5.1 The Rotterdam Heat Network: a brief introduction

A brief introduction to the Rotterdam Heat Network is required given that this constitutes an inspiring element for this section of the thesis at hand. What does the Rotterdam Heat Network is? And in what sense is it inspiring in this context? In 2012 the works that have brought to the realization of the Rotterdam Heat Network, or New Heatway, started. Today, a network of pipes enable reuse of residual heat released during industrial processes in the Rotterdam port. In fact, the industrial activities that take place in the port of Rotterdam produce an enormous amount of excess heat. Until 2012, that heat was simply released into the atmosphere or the Mass River. But today more than 100,000 households are heated by the port's residual warmth. Through this industrial synergic solutions CO2 emissions are sharply reduced, while heating and energy cost supply to households cost about the same. The heat is transported to Rotterdam-Zuid along a route that is 26 kilometers long. This is network of pipes is shown by image 8.2. As we can see the Heatway does not reach the Spaanse Polder given that it crosses Rotterdam-Zuid. This condition constrains the possibility of extending it to the firms of the Spaanse Polder. During the interviews, to talk about industrial synergies the Rotterdam Heat Network was brought to the firms as example. It was of interest to observe whether the interviewees know the rather academic concept of industrial symbiosis and/or more in concrete the Rotterdam Heat Network.

Image 8.2. The Rotterdam Heat Network



8.5.2 Realizing a heat network in the Spaanse Polder? Nee!

The interviewee of the ‘maybe willing’ *firm 1*, which is one of the printing firms of the sample, is aware of the Rotterdam Heat Network, about it he said “yes, it is possible to use the rest of warmth of the production for different possibilities... to have salmons, or shrimps... Yes! I have heard of it and they put the whole system here in the surroundings!” (int. 1, co. 1, p. 4). Then, about extending the heat network to the Spaanse Polder he added “I think in the Spaanse Polder is really difficult because we have a lot a lot of different firms over here. There is another system. The system was built about the 1940 so there are all the kind of structures here... if there was nothing we could build a different Spaanse Polder. So, everything is possible, but I think that if you look at things like that it is also about costs. Let’s say if you have a very complex building and you want to have new cables you have to do any kind of tricks, you have to put them under the ceilings and then under the ground, and after the wall, and if you start all over you say, ok we start here and from there we take one thing, and from there we could use all the cables. It is more efficient! But I don’t think... well, maybe for an incidental firm that may be really close to the heat network that passes by it is possible to use it, but not to make a system and then put all the firms here in the Spaanse Polder” (int. 1, co. 1, p. 5). In other words, **a heat network requires a kind of infrastructure that is (almost) impossible to build in the Spaanse Polder because of the already settled design of this area**. In addition, even if the already existing Spaanse Polder infrastructure design would allow the passage of the heat network infrastructure “there has to be a lot of subsidies to get it done! Sure! But still then I think it would be a hard and big project!” (p. 5). The difference between the Spaanse Polder and the harbor area is that “first of all the firms (of the Spaanse Polder) are different. There (in the harbor of Rotterdam), if you put one line there is one fabric, while here you have to talk with 200 firms instead of one. So this is the difference: it is a bigger scale here!” (p. 5). The infrastructural design, the various composition of firms of the Spaanse Polder, and the incredibly expensive cost of building or extending the heat network of Rotterdam constitute a condition that constrains the possibility of introducing an infrastructure that, as well as the Heat Network of Rotterdam, allows the reintroduction of firms’ overproduction of heat in the energetic circuit.

8.5.3 When realizing a heat network is possible

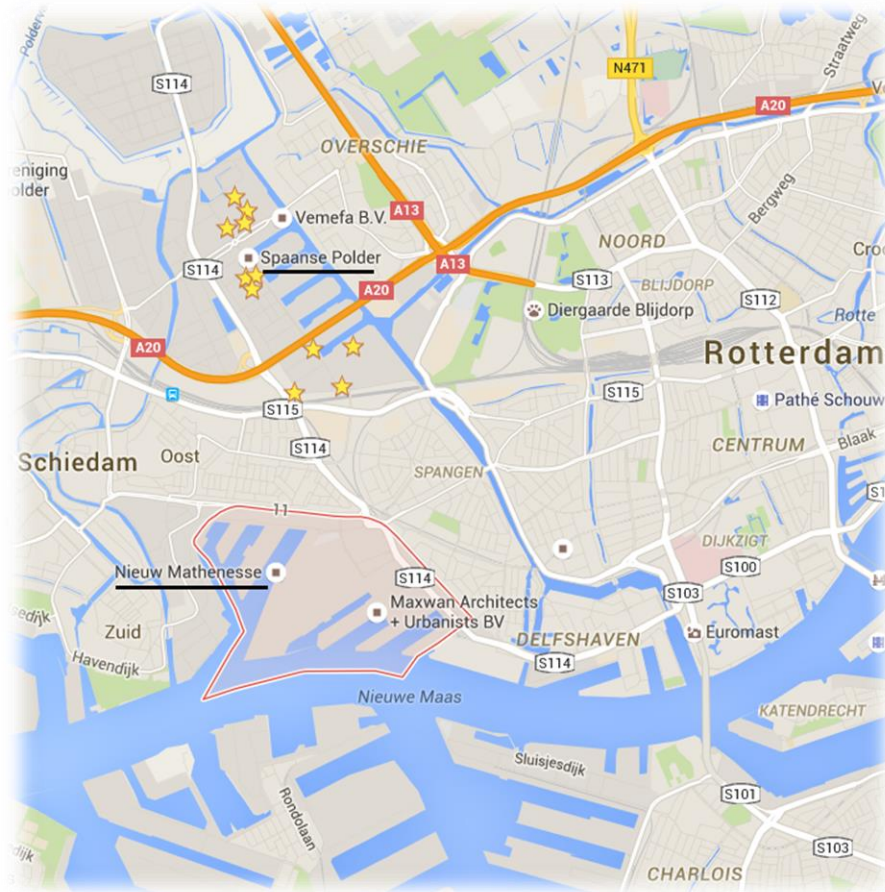


Image 8.3. A map of the Nieuw Mathenesse and of the Spaanse Polder.

The situation is different in the Nieuw Mathenesse. This is an industrial area located on the river side in South Schiedam, not far from the Spaanse Polder (Image 8.5.2.1). This area was brought as example by the interviewee of the Environmental Protection Agency of Local and Regional Authorities in the Rijnmond Region (DCMR). The interviewee said that the Nieuw Mathenesse in 2008 was selected as an area of interest for the realization of one of the DCMR's projects for the

regional sustainable development, and that some of the elements of the Schiedam South's plan would be relevant also for the Spaanse Polder (int. 3, Institution 2, p. 1). However, what it is here of interest follows. The Nieuw Mathenesse industrial estate, as the interviewee named it, is different from the Spaanse Polder because of the homogeneity and complementarity of the firms that characterize it, which predominantly produce glass and gin - the liquor. In this site, there is one of the most important firms of gin "which produces 50% of all the Vodkas of the United States. Or maybe 40%... and connected to that there is a lot of glass, in fact here there is a glass factory, which makes glass from recovered glass, producing directly in this place. Then, there is another gin factory... because Schiedam is an old gin factory, originally. So, there used to be 30 gin breweries, distilleries, but now they are 5 left, I think... and they produce here. So, that is the idea that they co-produce. There is only one glass factory and they produce for all others. Then, there is combined hit-power, and more of those kinds of things" (p. 3). In other words, the **homogeneity** and **complementarity** of the firms homed by the Nieuw Mathenesse constitute the conditions that facilitate the realization of an industrial symbiosis: firms co-produce and the heat-power is combined. Hence, we see that the two industrial areas – the Nieuw Mathenesse and the Spaanse Polder – present different features and characteristics that make the difference in terms of realization of industrial synergies in general, and of a combined used of energy in particular.

8.5.4 The features of the Spaanse Polder's firms as a limit

In addition, most firms of the Spaanse Polder are not such big-sized productive firms that could be able to feed a heat network's infrastructure with their over-production of heat. As the interviewee of the 'not willing' firm 2 said "*...you don't have a similar production in the Spaanse Polder. The products are coming in and going out! No production*" (int. 2, co. 2, p. 4). Something similar was also said by the interviewee of the 'willing' firm 5: "*here is more like... what I can see, the Spaanse Polder is more groethandel, wholesalers; this is what it is here! Like service and wholesale! ...they don't produce stuff here, a part from the place here next to us...*" (int. 8, co. 5, p. 7). However this information it is not precise because in the Spaanse Polder there are some firms that belong to the manufacturer sector, or that whose machineries or technologies however need and produce substantial quantities of energy. For example, the printing activity of firms 1 and 3 consumes high amounts of energy, which is fundamental to run their printing machineries, but it also generates heat that is probably wasted, but probably these firms are not big-sized enough to feed a hypothetical heat network infrastructure. However, this should be evaluated by experts. Overall, the typology of the Spaanse Polder firms constitutes another condition that constrains the realization of a heat network in the area. If the heat network would hypothetically be extended to the area probably should be fed by the over-production of heat generated by big-sized productive firms located in other zones of the Rotterdam region because of the absence of this kind of firm in the Spaanse Polder. However, this kind of conclusion requires further specialized research to be taken for good.

8.5.5 Maybe alternative solutions exist

However, the interviewee of the DCMR expressed a more open and positive attitude towards the possibility of realizing some sort of combined heat-power in the Spaanse Polder. In fact, he said "*...we have the potential to supply from one roof the electricity to another roof... So, how does it work? Well, this is something that is interesting to innovate and optimize process within different firms ...*" (int. 3, Institution 2, p. 10). Also the interviewee of the 'not willing' firm 4, which is specialized in the measurement of strain and stresses, is aware of the Rotterdam Heat Network. He thinks that it would be nice to have something like that in the Spaanse Polder. By the way he said: "*Oh yeah! We could have it! Why not?*" (int. 5, co. 4, p. 5). As well as the interviewee of 'willing' firm 6, which is the mobility director of taxis of Rotterdam, is aware of the Rotterdam Heat Network. He said "*what we have here in Rotterdam is the waste of the big firms in the harbor producing a lot of heat and the energy firms transporting this heat to the houses to warm them up*" (int. 9, co. 6, p. 5). In this sense, it seems that this energy could be brought also transported to the firms of the Spaanse Polder. The technical aspect of these kinds of technologies should be thoroughly studied to dispose of an accurate picture of what it is and it is not possible to realize in this respect in the Spaanse Polder. In fact, it is possible that technologies that are suitable for the Spaanse Polder exists.

8.5.6 Energy and costs' efficiency

As it repeatedly emerges from the interviews the opportunity to realize economic savings constitutes a powerful incentive for firms to undertake sustainable practices, like the practice of trying to optimize the use of heat generated by the own machineries. By the way, firms 11 and 8 can be brought as examples.

On the one hand, firm 8, which is a 'willing' brewing firm of the sample, said that its brewing activity requires much energy, produces much heat, and that lot of it goes lost. Thus, he tries to save the heat produced by the brewing system as much as possible to make a more optimal use of it, reducing its waste (int. 11, co. 8, p. 2, 3) but also the economic cost related to the additional use of natural gas. Similarly, also the 'maybe willing' firm 11, which is the car dealer and bodyshop of the sample, tries to use frugally the heat generated by the *paint spray booth*, which is used by the bodyshop to spray and dry the paint when (parts of) cars are repainted. In fact, most of its energy expenses are due to the high quantity of natural gas that is required by this technology. The interviewee said "*...in the paint booth cars are baked to 60 degrees because of the drying process of the paint. That's a lot of gas! We try to do that as good as possible, for example not backing the last car, but to spray the car, put the door on a small side, and wait until it is dry for the next morning. Then you win one bake!*" (int. 14, co. 11, p. 16). In other words, it is part of the costs' efficiency strategy of firms to arrange solutions to save energy as much as possible.

8.5.7 Conclusions about the collective use of energy

To develop a Heat Network in the Spaanse Polder would be particularly difficult and costly. The main reasons reside in the old design of the area, in the heterogeneous composition of the local firms, in the small quantity of firms that because of their specialization overproduce heat, and in the high cost of realizing the necessary infrastructures.

8.6 Conclusions

In this Chapter we looked at the relation between firms' interest in making a collective use of certain resources (space, transports and deliveries, machineries and equipment, waste flows materials, and energy), which means interest in sharing, exchanging, lending, borrowing and renting resources already available locally and firms' willingness to participate in the Pulsup Project. The sub-research questions supporting this Chapter are: "*To what extent the Spaanse Polder's firms' interest in making a collective use of the locally available resources (e.g. space, deliveries and transportation, equipment and machineries, waste products, and energy) affect their willingness to participate in the Pulsup Project?*" "*What do affect firms' interest in making a collective use of locally available resources?*"

On the one hand, It is difficult to evaluate whether firms' interest in making a collective use of resources affect their willingness to participate in the Pulsup Project (first hypothesis). Generally, it seems that the possibility to make a collective use of resources triggers firms' willingness to participate in the project, however it is difficult to appraise the extent to which the interest in making a collective use of resources affects firms' willingness to participate in the Pulsup Project.

On the other hand, it was possible to detect what affect firms' interest in making a collective use of locally available resources. In fact, for each category of resources that was taken in consideration, it was possible to define the conditions that trigger firms' interest in making a collective use of them. This is useful to understand how to trigger firms' willingness to participate in the Pulsup Project.

- 1) The possibility to (temporarily) rent, flexibly use, and share space especially triggers the willingness of firms located outside the Groothandelsmarkt. Hence, again the *location* of a firm affects firms' willingness to participate in the Pulsup Project. The temporarily rental of space, and the shared use of space, resulted particularly interesting respectively because of the *flexibility* offered by the former options, and the *knowledge spillovers* offered by the latter option.
- 2) The possibility to make a shared use of transport and deliveries triggers firms' interest in making a collective use of resources. However, the web-based matching of transportation and deliveries needs of different firms is difficult to realize because it constitutes a delicate issue.
- 3) The possibility to make a shared use of machineries and equipment affect firms' willingness to participate in the Pulsup Project. The interest of firms in making a collective use of machineries and equipment is triggered by the *possibility of reducing costs*, and in some cases by the *social responsibility* of the firms as well as by the *possibility to enlarge the network of local acquaintances*.
- 4) The possibility to exchange, give, and sell waste material with/to other firms affect firms' willingness to participate in the Pulsup Project. The interest of firms in making a collective use of waste flows materials is triggered by the *possibility of reducing costs*, and in some cases by the *social responsibility* of the firms as well as by the *possibility to enlarge the network of local acquaintances*.
- 5) The Pulsup Project cannot aim at organizing the collective use of energy.

Overall, it was observed that the Spaanse Polder has the potentiality to develop industrial symbiosis through web-based resource exchange to realize a more circular business system in the Spaanse Polder because, as it was observed, the firms that were interviewed expressed interest in the possibility of making a collective use of resources, but also because complementarity of needs among local firms was noticed. Between the categories of resources that were selected, space, machineries and equipment, and waste flows of resources are those that the Pulsup Project would be more successful in orchestrating by means of a web-based resource exchange. The Pulsup Project should point at rendering easily understandable the interface of the sharing economy website to facilitate firms' use of it. **In particular, the Pulsup Project should leverage the factors that triggers firms' interest in making a collective use of resources.** As we saw, these are **the possibility of: 1) making a flexible use of resources, 2) have access to knowledge spillovers, 3) enlarge the network of (local) acquaintances, 4) reducing costs, and 5) social and environmental responsibility.** Especially, the project should highlight the economic benefits that firms could obtain by making a collective use of resources, given that *costs' efficiency* for firms constitutes the most interesting aspect of the project. In addition, the project should provide with a clear explanation of what is the meaning of the project to increase and leverage firms' social responsibility.

9 Discussion ~

9.1 The research

The climate change, the depletion of the ecosystems, and the population growth constitute some of the burning issues of the current time that ask for a quick change in the human models of industrial development to guarantee a sustainable future to the human kind in balance with nature (Sijmons, 2014, Pauli 2010). With the scientific support, it has been noticed that the current linear model of development cannot keep running because it is based on an assumption that is both unrealistic, the basins of resources are not infinite, and noxious, as it is shown by the depletion of the ecosystems or the global warming. This explains the scientific and societal interest reserved to the development of new and more sustainable models of industrial and economic development, like those proposed by the 'natural systems perspectives', like the urban metabolism, the circular economy, and the industrial symbiosis. These are characterized by the holistic and organic idea of reproducing society on the base of the 'flow approach', taking inspiration from natural ecosystems. This approach suggests that waste does not exist because by design each waste material produced by a part of the system becomes the 'food' for another part of the system; it believes that efficiency, efficacy and sufficiency constitute complementary strategies of development that should be applied to industry, economy, and cities.

Recently, given the growing diffusion of ICT tool, scientists as well as citizens, are exploring how they could be used to support the adoption of more sustainable modes of development, for example within the Smart City framework. The Pulsup Project, which constitutes the case study of this research, is a product of this scenario. This project wants to constitute a precedent to draw from to develop industrial symbiosis through web-based resource exchange in other SMEs mixed industrial areas than the Spaanse Polder of Rotterdam. In other words, this project aims at realizing a circular and symbiotic resource exchange by means of an ICT tool that resemble sharing economy platforms. This research contributes to this mission exploring some of the factors that affect the willingness to participate in a similar project of firms. Given that to realize symbiosis in an already constituted industrial area a change in the firms' routine is required, and that it has been observed that imposing a change is counterproductive, a project that wants to enable industrial symbiosis through a web-based resource exchange needs to be able to trigger firms' willingness to participate in it in order to successfully be realized. Knowing the factors that trigger firms' willingness to participate in the Pulsup Project was considered relevant to design a communication strategy that successfully involve firms in the creation process of the project, as well as to realize an ICT tool that fits the local context and firms' needs.

In particular, this research explored the role played by firms' awareness of (and interest in) the background concepts (sustainability, circular economy, sharing economy, industrial symbiosis), firms' features, and firms' interest in making a collective use of resources in relation to firms' willingness to participate in the Pulsup Project. Using a qualitative research strategy and semi-structured interviews as method of research, fifteen interviews were realized with firms and local stakeholders. It was observed a positive causal relation between awareness of/interest in the background concepts and willingness to

participate in the Pulsup Project. This finding confirm what had been already stated by other studies conducted in the most disparate fields, from health studies, to mobility, and sustainable development studies. Being aware, informed, thus acknowledge the current critical environmental status, but also being updated about societal trends and topics of discussion (e.g. sharing and circular economy) positively affect interest in this topics, which in turn facilitate the comprehension of a project like the Pulsup Project, and boost firms' willingness to participate in such kind of project. Reversely, the firms that ignore for example the Pulsup Project's background concepts lack of important interpretative tools that constraint their willingness to participate to the creation process of a project like the Pulsup Project.

Then, it was observed that certain features of a firm positively explains a firm's willingness to participate in the Pulsup Project, while others in this respect are not so relevant. It was observed that manufacturing firms tend to be more willing than firms that operate in the service-oriented or wholesale industry, probably because for this kind of firms the web-based resource exchange is more desirable than for other firms given their major need of several assets and resources. Then, it was observed that the firms located outside the Groothandelsmarkt, the firms that are not members of one of the Spaanse Polder's firms' organization, as well as 'young' firms tend to be more willing to participate in the Pulsup Project than those that are located inside the Groothandelsmarkt, members of one or both firms' organizations, and that have spent more than 15 years in the Spaanse Polder. A sound interpretation of these finding could be that these firms see in the participation in the project the possibility to enlarge their network of acquaintances and become more 'embedded' in the local business and social environment. Finally, it was also observed that firms whose market is local tend to be more willing to participate in the Pulsup Project. Probably, this is the case because this kind of firms focusing their attention locally are more motivated in participating in projects of local development.

Finally, it was difficult to appraise the extent to which firms' interest a making a collective use of resources affect willingness to participate in the project, however it was observed what affect firms' interest in making a collective use of locally available resources. In fact, for each category of resources that was taken in consideration it was possible to define the conditions that trigger firms' interest in making a collective use of them. This is useful to understand how to trigger firms' willingness to participate in the Pulsup Project.

It was found out that the main elements that constrain firms' willingness are a skeptical attitude towards the project, as well as the need for more detailed information about the project. Skeptical attitudes to some extent could be shaded providing firms with a thorough cost-benefit analysis of their participation in the project.

Several unexpected finding appear from this thesis research. In other words, while analyzing the effect of each independent variable upon willingness to participate in the Pulsup Project it was observed that social and environmental responsibility, as well as the possibility to enlarge the network of acquaintances constitute pivotal factors triggering firms' willingness to participate in the Pulsup Project. It was also observed that participating in the Pulsup Project by certain firms was seen as an opportunity to realize cost efficiency. In certain cases, these factors seem to be more motivating than the three taken in consideration as drivers of firms' willingness to participate in the Pulsup Project. In other words, social

responsibility, the possibility to enlarge the own network of acquaintances, and in a minor size the possibility to save resources, constitute independent variables that affect firms' awareness of the background concepts as well as the interest in making a collective use of resources. Social responsibility probably constitute a driver of firms' willingness because it assumes awareness of society and the environment, but also an aware position towards generally relevant issues. It was observed that firms that are socially responsible could better understand the Pulsup Project, its aim, and they tended to be more willing to participate. On the other hand, it was also noticed the importance for firms to network and enlarge the network of (local) acquaintances. It was observed that this need is higher when firms are more 'detached' from other firms, which is less locally and socially embedded. The most noteworthy reasons that explain lower local and social embeddedness of certain firms resides in the following features of a firm are their location within the Spaanse Polder, 'young' age, or detachment from local firms' organizations.

9.2 Points of improvement

In the light of the results of this research and with hindsight, several limitations, weaknesses, and points of improvement of this research were identified. First of all, the research design supporting this research lacked of theoretical support. This caused that after having conducted, transcribed and analyzed the interviews, it was difficult to analyze the gathered data through the lenses of a specific theoretical framework. Beforehand I had noticed that not much literature about the factors that affect firms' willingness to participate in an industrial symbiosis project had been produced. I felt both discouraged and motivated by this fact: discouraged because of the lack of theoretical support, and motivated by the belief of exploring a new topic from a new perspective. To overcome the immobility that followed I decided to start with the exploratory fieldwork supporting this research. When the writing moment arrived, I realized that preparing a thorough theoretical scheme beforehand would simplify the interpretation of the findings in a wider theoretical context. Moreover, the choice of investigating the factors that affect firms' willingness to participate in the creation process of an industrial symbiosis through a web-based resource exchange when the ICT tool, or sharing economy platform, does not exist yet, rendered the subject of research abstract, intangible, difficult to grasp. I recognize that, for how I set the research, my ambition was slightly unrealistic, which in turn somehow affect its reliability. In this respect as well I realized that preparing a clear structure of the research beforehand is useful to design a precise research question(s) and research's methodology, which in turn is useful to avoid energy spillovers while acquiring the support of high degree of awareness about what has been and it is debated in the literature.

Secondly, about the methodology and the conduction of the interviews, several observations could be made. Initially, I wanted to select the sample of respondents but when I faced reality and I realized that it was particularly difficult to obtain an appointment with the entrepreneurs of the area I had selected to conduct the interviews I decided to adopt a snowball sampling technique. In future, it would be smart to check beforehand the feasibility of the selected sampling technique. Moreover, the use of the English language to conduct the interviews in the Netherlands, which national language is Dutch, may have limited the chance to obtain an interview with certain firms, the flowing of the conversation with the

interviewees, as well as a deep understanding of the interviews. Thus this language issue probably partially affect the validity of the findings. Furthermore, the small size of the sample limits the generalizability of the findings. Even if the scope of adopting a qualitative strategy of research implies that the research's aims is not the generalizability but the understanding of issue at hand, I wonder whether using also a quantitative strategy of research would not be more useful to study the factors that affect firms' willingness to participate in a project like the Pulsup. Here, the findings are treated as they were generalizable however the sample of the interviewed firms is not representative the firms of the Spaanse Polder hence this is not the case. What is good is that using the qualitative method of research I acquired in depth knowledge about the Spaanse Polder firms and their routines. It would be nice to conduct the same research with more theoretical support and a different methodology. Finally, it should be also noticed that the information provided by the interviewees about the 'own' firm is not a hundred percent reliable because it could be biased by several factors, like the role within the firm of the respondent, its subjectivity, the mood of the day.

9.3 Research's contribution

Even if this research only partially answer to the research question supporting this research and requires some adjustment, it shades light upon the Spaanse Polder and what triggers firms' willingness to participate in a project like the Pulsup Project. This research fund out that to successfully involve local firms in the creation process of an industrial symbiosis supported by an ICT tool it is smart to rise firms' awareness of the possibilities and benefits of making a more optimal use of resources exchanging them (in a wide sense: sharing, renting, borrowing) with other firms. To do so, the project should leverage firms' interest in enlarging their network of acquaintances, which appeared as a winning argument to involve them in the project. Thus, the project should look for firms that are less locally and socially embedded, thus more in need of meeting other firms. To do so, the project could help itself contacting those firms that do not belong to any of the Spaanse Polder firms' organizations, as well as those that are located outside the Groothandelsmarkt. Then, the project should ask to some of the local firms to become project partners and play the role of frontrunners, otherwise that give example to other firms. Given the results of this research, it would be convenient to ask to become frontrunners to those firms that are particularly socially and environmentally responsible, given that their level of awareness of the societal and environmental issues as well as their motivation to commit to society is higher than for other firms. As it is suggested by the Network effect theory as the number of firms is growing, the number of possible synergies grows in a geometrical way (Almasi et al., 2011). Consequently, forming a first group of motivated firms could constitute a good 'domino-strategy'. However, it is important to render the communication strategy (e.g. workshops, websites, flyers) easily understandable, friendly and transparent. To do so, it is recommendable to conduct a thorough study of the opportunities and constraints to show firms what are the costs and benefits of participating at the construction of the Pulsup Project.

This research provides with points of reflection for further research. In fact, each independent variable contemplated by this study, as well as the unexpected findings, contain a universe that could be explored. In respect to the studies concerning ICT tools for industrial symbiosis the role of (environmental)

awareness could be further analyzed, as well as that of social responsibility. Otherwise, the typical research method characterizing the urban metabolism approach, which is Material Flow Analysis (Gladek et al., 2015), could be applied to identify in a detailed way all the possible synergies, for example, in the context of the Spaanse Polder. Otherwise, it could be particularly interesting to study a project like the Pulsup Project through the lenses of the proximities framework elaborated by Boschma (2005) to verify in a kaleidoscopic and holistic way how the five different proximities interact in a specific context (geographical, social, cognitive, organizational, institutional proximity).

10 Conclusions ~

Keeping in consideration that mixed industrial parks have been overlooked by science (Lambert & Boons, 2001) and that the results of previous research about ICT tool for industrial symbiosis are unclear (Grant et al., 2010), this research contributes to the scientifically elaborated 'natural system perspectives' as well as to society. In particular, this research contributes to the literature about ICTs for industrial symbiosis in SMEs mixed industrial parks because it focuses on a project that aims at involving firms in the creation process of an ICT tool for industrial symbiosis to realize the transition of a SMEs mixed industrial park towards more circular and metabolic ways of conducting local industrial activities. So doing, this research bridges compatible concepts coming from different scientific specialization. Sharing economy, circular economy, and industrial symbiosis are complementary and can be combined to realize a sustainable change at both industrial level and societal level. In this sense, the Pulsup Project constitutes an avant-garde project that stimulates several reflections. How can be used sharing economy to stimulate the transition towards more sustainable and circular practices? ICT-tools can be truly used to realize industrial symbiosis in SMEs mixed industrial parks? What are the triggers and the constraints?

In particular, this research studying the factors that affect firms' willingness to participate in a project that like the Pulsup Project wants to enable industrial symbiosis through a web-based resource exchange resulted useful to better understand the 'conditions' of the firms in the Spaanse Polder SMEs mixed industrial park. Because of this research a deeper understanding of what are the favorable and constraining aspects to engage firms in the participatory process like the Pulsup were (partially) identified. In particular, the approach here adopted, which is exploring the drivers of firms willingness to participate in such kind of project, is rather unexplored in the specific literature concerning ICTs for industrial symbiosis. It was seen that awareness of concepts like sustainability, circular economy, sharing economy, industrial symbiosis, as well as of what they imply, constitute a powerful tool to boost firms' interest in changing the way they do business. However, to implement an industrial symbiosis through a web-based resource exchange in a SMEs mixed industrial park like the Spaanse Polder requires much more than this. To trigger firms willingness to embrace a change in their practices and render them more efficient, effective, and sufficient many others factors must be taken in consideration. For example, we have just seen that their cost efficiency strategy or their need to connect with other local firms constitute key incentives to take in consideration to leverage their willingness to embrace the circular and the sharing economy. Despite this research's downsides, the idea supporting this research's approach has potentials

that need to be developed further, drawing from different disciplines. Furthermore, these findings are useful to develop projects similar to the Pulsup Project. The Pulsup Project and similar projects can draw from this study to deepen the understanding about what are the favorable and constraining aspects. In fact, deepening the knowledge about the formation of the willingness of the firms to engage in an industrial symbiosis and assets sharing project is useful to define successful communication strategies for this and other similar projects.

In the current worldwide context, characterized by a wider diffusion of ICTs tools and the urgency of stopping the growing climate change the implementation of policies and industrial paradigms that adopts not only efficient, but also effective and sufficient strategies of development seems an opportunity that should not be missed and that needs further research and action. Hence, to attain a sustainable development in line with the goals established at the Conference of Paris (December, 2015), the industry must change to become less aggressive towards the natural environment. Implementing industrial symbiosis in already established industrial park requires a costly change in mindset, but whose gains are much higher than the costs. It is like when a person wants to change an insane habit. It is not easy, it costs efforts, but when the goal is achieved (s)he thinks “why didn’t I do this before?”. Societal gains will be clear when humanity will render society in balance with nature. To achieve this goal numerous initiative of change must be undertaken. Realizing industrial symbiosis is an option among them. And boosting industrial symbiosis through the use of ICT tools like sharing economy online website constitute an opportunity whose potentials need to be studied further. Industrial countries benefit from the wide diffusion of the Internet so why do not take advantage from it also to realize more circular industrial and business systems? From an academic point of view this means building multidisciplinary research approaches that draw from economic geography, industrial ecology, sustainable development, but also (social) psychology to go beyond the boundaries and adopt a holistic approach to design communication strategies that foster stakeholders and shareholders willingness to embrace a change.

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Annex

Dependent variable	Observation	Data source(s)
AWARENESS OF AND INTEREST IN THE PULSUP PROJECT		
Awareness of and interest in the Pulsapp Project	1x) Have you heard about the Pulsup Project? 2x) What do you know about the project? If there is no knowledge about the Pulsapp, give a short introduction of the project. Then, ask: 3x) What are to your opinion the strong and weak points of the project? 4x) Under which conditions are you willing to participate in the Pulsapp project? 5x) Are you willing to participate in it?	Qualitative interview with key informants.

Independent Variable	observation	Data source(s)
AWARENESS OF AND INTEREST IN THE BACKGROUND CONCEPTS		
Interest in sustainability	1a) Is your company interested in sustainability? 1.1a) Can you give me some example of this interest? 2a) Do your costumers ask your company for sustainable products? 2.1a) Which kind of products? 3a) Have your company participated to sustainability events? 3.1a) What kind of event?	Secondary data: sustainability standards and certifications Qualitative interview with key informants.
Awareness of the Dutch political agenda. NL=hotspot circular economy . Global and European interest in the circular economy	4a) Have you ever heard about the concept of the circular economy? 4.1a) <i>Do you know some famous authors of books about this concept?</i> 4.2a) <i>Have you visit meetings about this concept?</i> 5a) <i>Under which conditions is the concept of circular economy useful for your company?</i> 6a) <i>Did your company already implement the concept of circular economy in the business process?</i> 7a) Do you know that the Netherlands as well as Europe support the transition to a circular economy?	Secondary data: look for policies that support sust./circular initiative and tax reductions and regulations in matter of sustainability and waste disposal. Qualitative interview with key informants.

	8a) Do you want to use this kind of subsidies, or do you want to make use of the concept by your own or in cooperation with other firms?	
Awareness of industrial symbiosis and eco-industrial parks	9a) Have you ever heard about companies that cooperate to reduce their expenses in industrial parks? <i>10a) Do you think that there should be more use of the concept of circular economy in the harbor economy of Rotterdam? (Why, yes, no?)</i> 11a) Have you heard of the heat network in the Rotterdam's harbor? 11.1a) What do you know about it?	Qualitative interview with key informants.
Awareness about sharing economy	12a) There is a lot of discussion about the so-called sharing economy. What do you know about it? <i>12.1a) Do you think that the sharing economy is a real economy?</i> <i>13a) What are the weak and strong points of a sharing economy?</i> <i>14a) Is it possible to introduce a kind of sharing economy in the markets in which your firm operates?</i> 15a) Have you ever used online platforms like BlaBlacar, Peerby, Floow2, Airbnb? 15.1a) What do you think about them?	Qualitative interview with key informants.
Awareness of the Pulsapp project	16a) Have you heard about the Pulsapp project? 17a) What do you know about the project? If there is no knowledge about the Pulsapp, Agnese should give a short introduction about the project. 18a) What are to your opinion the strong and weak points of the project? 19a) Under which conditions are you willing to participate in the Pulsapp project? 20a) Are you willing to participate in it?	Qualitative interview with key informants.

Independent Variable	Observation	Data source(s)
(COMPLEMENTARITY OF) NEEDS		
General / Inputs	1n) Can you give an overview of the kind of inputs of your company according to the following groups of assets: - materials - energy - services	Qualitative interview with key informants.

	<ul style="list-style-type: none"> - money (finance) - people (human capital) - space <p>2n) Does the company have suppliers in the SP, in the region of Rotterdam, in the Netherlands or abroad?</p> <p>3n) Is it possible for your company to borrow or rent from another company a necessary asset?</p> <p>3.1n) What (materials, machinery, human capital, space)?</p>	
Space	<p>4n) Does the company have enough space? (little, enough, too much).</p> <p>5n) If it's too little or too much: did you even tried to use space in cooperation with other companies?</p>	Qualitative interview with key informants.
Deliveries (couriers)	<p>6n) How does the company deliver its products?</p> <p>7n) Does the company have a courier or does it relay on a third part?</p> <p>7.1n) Is the courier filled completely?</p> <p>8n) Would the company like to save money on deliveries (maybe sharing it with another company)?</p>	Qualitative interview with key informants.
Machineries	<p>9n) Do the company have unused or underused (expensive) machineries?</p> <p>10n) Would the company borrow/rent a machinery that you need just sometimes from/to another company?</p>	Qualitative interview with key informants.
Energy	<p>11n) What is the company's main source of energy?</p>	Qualitative interview with key informants.
Waste	<p>12n) What is the main waste of the company?</p> <p>13n) What is the most expensive kind of waste to get rid of?</p> <p>14n) Do you dispose of the waste by your own or there is a third part that takes care of the waste disposal?</p> <p>15n) Would you like to share the expenses related to the waste disposal?</p> <p>16n) Do you recycle your waste (within your company)? Why? How?</p>	<p>Secondary data: check regulation about waste disposal.</p> <p>Qualitative interview with key informants.</p>

Independent variables	observation	Data source(s)
COMPANIES SPECIFIC FEATURES		
Company features	1f) What is the sector of the company, its main specialization and production? 2f) Is this a family business? 3f) How many employees are there? 4f) When was the company born? 5f) Since when is the company located in the SP? 6f) What are the five main suppliers of the company? 7f) Where are located your five main suppliers? 8f) What are your five main customers? 9f) Where do your five main costumers come from?	Secondary data: company's website analysis. Qualitative interview with key informants.
Confidentiality	10f) Is the info about your input/output/space confidential? 10.1f) What is the most confidential?	Qualitative interview with key informants.
Values / Interest in innovation	11f) What are the standards and certification you have or that you would like to obtain? 12f) Do you want to be a role model for other companies (and/or in your sector)? 13f) How often do you invest in innovation?	Secondary data: find standards and certifications about 'sustainability' et al. Look into the academic research to find a list of companies' values and confront the answers with the list of values Qualitative interview with key informants.
Satisfaction with the SP	14f) Do you have plans to move the company or do your company wants to remain in the SP? (Yes/no/why) 15f) Do feel sense of belongingness to SP? 15.1f) And to the region of Rotterdam? 16f) Does your company wan to contribute to the community at the SP? 16.1f) To the community of the region of Rotterdam?	Qualitative interview with key informants.