

THE EMERGENCE OF INDUSTRIAL
SYMBIOSIS IN THE ROTTERDAM
HARBOR REGION; THE ROLE OF SOCIAL
PROXIMITY AND PLACE ATTACHMENT

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ABSTRACT

This research aimed at contributing to the industrial symbiosis literature evaluating whether firms' social proximity and place attachment affect their willingness to participate in a project that wants to realize an ICT tool to stimulate the shared use of resources in an already existing SMEs mixed industrial park. This problem was investigated interviewing the managers of eleven firms of the Spaanse Polder industrial park of Rotterdam in relation to the Pulsup Project. It was found that social proximity and place attachment affect firms' willingness to participate in an industrial symbiosis project. Social proximity appeared as a necessary but not sufficient element triggering firms' willingness to participate, while high degree of place attachment positively correlated with firms' willingness to participate.

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~Introduction

Industrial symbiosis is one of the tools that tend towards a sustainable management of the industry. The purpose of an industrial symbiosis network is to build collective flows among the firms of an industrial park leveraging the exchange of resources (symbiosis) and sharing of assets through the formation of a complex system of links to benefit the environment by reducing carbon footprints, minimizing landfill waste, and saving virgin resources (Cecelja et al., 2014; Grant et al, 2010; Leeuwen & Vermeulen, 2003). 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 creating virtual collaboration (Gladek et al., 2015; Hossain & Wigand, 2004; Kock 2000).

ICT tools potentially could fulfill a promising role for the emergence of industrial symbiosis because they might provide it with positive stimuli, yet, most of these tools have fallen from use having made little impact in the development of industrial symbiosis linkages (Grant et al., 2010), probably because of the under-evaluation of the human geographical sphere of such an initiative. Generally, to implement an industrial symbiosis in an already constituted small- and medium- enterprises (SMEs) industrial area is a complicated process. Almasi et al. (2011) have organized the factors that must be taken in consideration into three categories: physical, organizational, and social. Usually the social sphere, which encompasses social and human phenomenon, is undervalued even if it enhances the development of mechanisms (willingness, social interaction, trust) generating effects in favor of industrial symbiosis. In fact, 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). 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). Building trustworthy relationships among agents is dependent on the level of face-to-face communication support (Hossain & Wigand, 2003).

Focusing on the Pulsup Project for the redevelopment of the Spaanse Polder (see Studied Area and Used Methodology for more information about the project), which wants to create an ICT tool to stimulate the shared use of resources in this SMEs mixed industrial area of Rotterdam, this research investigates how two specific factors of the human geographical sphere - social proximity and place attachment - impact local firms' willingness to participate in a project like the Pulsup Project. The research question supporting this research is: *Do **social proximity** (embeddedness) and **place attachment** (belongingness) affect **firms' willingness to participate** in a project that wants to implement an industrial symbiosis through a web-based resource exchange in an already existing SMEs mixed industrial park?* The answer to this question will contribute to the literature about ICT tools for industrial symbiosis, posing the accent upon industrial symbiosis social sphere, while it will also contribute to society, which needs quick sustainable solutions to the climate change and the depletion of ecosystems.

~Social proximity, place attachment and willingness to participate in an industrial symbiosis project

To successfully implement a project that wants to realize an industrial symbiosis in an industrial park firms must be willing to participate. Christensen (2010) suggests that companies are not forced to cooperate with others. 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 enhance the chances of success of the project. Decision-makers must be willing to participate in such collaborations (Christensen, 2010). The mechanism of willingness is industrial-symbiosis oriented effect (Almasi et al. 2011). Willingness, sometimes called the 'human factor', refers to the human feeling of desire to invest into an industrial symbiosis project (Almasi et al., 2011). *Willingness* to invest in synergies with other companies is seen to be a prerequisite when implementing industrial symbiosis, since it is formed by awareness of industrial symbiosis benefits, shared technical knowledge, trust, and good communication with one another.

The realization of an industrial symbiosis through a web-based resource exchange in already existing mixed-industrial park requires firms' interaction. Social interactions are here seen as interactions between human beings as representatives of companies (managers) but also as social persons. The embeddedness literature indicates that most economic behavior is closely embedded in concrete networks of ongoing interpersonal relations. As Granovetter (1985) said "there is evidence all around us of the extent to which business relations are mixed up with social ones". Hence, social structures (social relations) influence market behavior (economic outcome).

For the realization of industrial symbiosis, social interactions constitute a pivotal mechanism. A functioning industrial symbiosis requires firms' dialogue and interaction because it consists in a collaboration and exchange of resources among firms. This implies the involvement of confidentiality issues because firms to some extent share information concerning their economic activity with other firms. In fact, having a bilateral agreement framing a synergy implies the need to know each's others production processes, waste, quantity and quality of material required, technology used, etc. These data represent sensitive information that might put companies at risk if publicly known by competitors (Christensen, 2010). Although economical profitability is a strong incentive pushing to cooperation, it does not cover risks relating to confidentiality issues (Dick Van Beers, et al. 2007). Consequently, industrial symbiosis needs trust, personal intimacy, commitments and interests between the stakeholders of an industrial symbiotic systems (Almasi et al., 2010).

This embeddedness argument stresses the role of concrete personal relations and 'networks' of such relations in generating trust and discouraging malfeasance (Granovetter, 1985). In other words, social relations and intimacy among managers and decision-makers, rather than institutional arrangements or generalized morality, are responsible for the production of trust in economic life, which benefit industrial symbiosis. Intimacy refers to the collaboration between companies, and leads managers and decision-makers to know each other better. It allows them to share information about companies' businesses and performances (Almasi et al., 2010). Intimacy helps preventing industrial symbiosis development from confidentiality issues because it participates in building up trust between actors.

When at the micro-level relations among agents involve trust based on friendship, kinship and experience means that they are socially embedded. This means that there is social proximity (Boschma, 2010). In general, the social dimension of economic relationship has a positive influence on the performance of a firm up to a certain threshold, after which this positive effects can turn negative when the embedded relationships become too closely tied, as it is shown by the Uzzi's model or by Granovetter's concept of the 'weakness of the strong ties' (Boschma, 2010; Granovetter, 1973). In other words, the adaptive capacity of actors may increase considerably when the network consists of a balance between enough social distance – keeping the firm alert, open-minded and flexible, distancing lock-in and underestimated risks of opportunism – and embedded relationships – lowering transaction costs and facilitating inter-organizational learning due to trust and commitment (Boschma, 2010). Overall, it is reasonable to presume *the higher the firms' social proximity, the higher their willingness to participate in an industrial symbiosis project like the Pulsup Project may be.*

Because of the importance of the local environment for an industrial symbiosis to be realized, there is also a geographical dimension of proximity, which is more than a matter of distance. In this study we use the concept of 'place attachment'. 'Place attachment' investigates human-place bonds (Kyle et al., 2004). It can be defined as "the affective link that people establish with specific settings, where they tend to remain and where they feel comfortable and safe" (Herandez et al., 2007). Place attachment represents not only social relations between actors like firms but also individuals' emotional bindings to geographic areas (Ram et al., 2016). This binding produces "the sense of physically being and feeling 'in place' or 'at home' and provides a sense of trust and security (Ram et al., 2016). Place attachment may develop in relation to environments of different expanses, such as a home, neighborhood, city district, or city (Lewika, 2008). As Manzo (2003) and Kyle et al. (2004) noticed that much more needs to be learned about the role and meaning of places, for example about the meaning of an industrial area for their entrepreneurs. However, the place attachment concept is not usually taken in consideration in the industrial symbiosis literature, even if it is taken in account when drivers of human action are studied. Most of this literature's attention is reserved to economic and institutional drivers (Almasi et al., 2010). In the context of the literature about ICT tools for industrial symbiosis, attention could be put upon the influence exercised by place attachment in motivating firms' willingness to start industrial symbiosis. In other words, looking at the literature the concept of place attachment seems undervalued.

Many human geographers and environmental psychologists believe that through the development of an attachment to place within the geographic landscape, people acquire a sense of belonging (Buttimer, 1980; Low&Altman, 1992; Kyle, 2003). However, belonging is a puzzling term. It is at once a feeling, a sense and set of practices. It can refer to a place – 'a place to belong', but it is also found to relationships to humans and non-humans and non-humans and things and ideas (Wright, 2015). Despite its ambiguity, it is a concept of fundamental importance to people's lives. Belonging is a deep emotional need of people (Yuval-Davis, 2004). Belonging-as-emotion creates subjectivities, collectivities, and places, because it creates bonds, bringing people together (and separating them), and so establishing the collective through a shared sentiment. Belonging is a 'circuit of action and reaction' (Stewart, 2008) but not of disparate entities. Rather, these are entities that come together in relational ways, that define and configures what it means to belong (and not belong) as they define and configure themselves. Things (or people, or places) do not pre-exist, in static ways – their belongings are made through their coming together. For Probyn (1996), attachment and fluidity are at the center of notions of belonging. Belonging is an impulse for

“some sort of attachment, be it to other people, places, or modes of being, and the ways in which individuals are caught within wanting to belong, wanting to become, a process that is fueled by yearning rather than the positing of identity as a stable state”. For Probyn, more hopeful and inclusive belongings are based on physical proximity rather than sameness, essentialism and authenticity. Thus, in industrial areas, where firms, but also people (managers, entrepreneurs, workers), interact on a daily basis with both the area and the other people belonging to the area, feelings of place attachment and belongingness develop. Thus, it is reasonable to presume that *the higher the firms’ sense of attachment to a business area like the Spaanse Polder, the higher their willingness be to participate in an industrial symbiosis project like the Pulsup Project may be.*

There also may be a mutual interdependence between social proximity and place attachment. That is social proximity may affect a firm’s willingness to participate because of place attachment, and vice versa place attachment may affect a firm’s willingness to participate because of social proximity. In other words, entertaining ‘pleasant’ relations with other firms may reinforce a firm’s place attachment, hence its willingness to participate in an industrial symbiosis project. Conversely, experiencing place attachment may boost a firm’s desire to entertain ‘pleasant’ relations with other firms, hence its willingness to participate in an industrial symbiosis project. Thus, it is reasonable to presume that *social proximity and place attachment are interdependent: when a firm’s social proximity grows, the firm’s place attachment may also grow, and consequently its willingness to participate in a project like the Pulsup Project, and vice versa.*

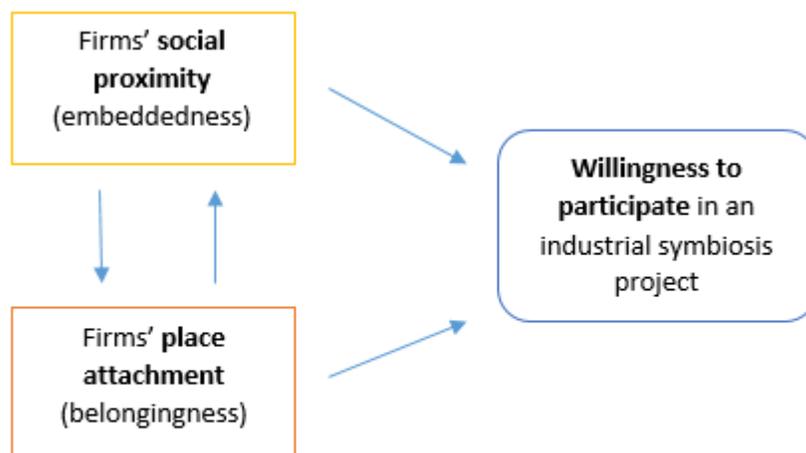


Fig. 1. Proposed model

~Study area and used methodology

The Pulsup Project constitutes a project that wants to enable an industrial symbiosis through web-based resource exchanges in the Spaanse Polder, which is a SMEs mixed industrial park (Lambert & Boons, 2002) of the city of Rotterdam (see next paragraph). Within the 'Smart City' framework, the Pulsup Project is a project independently promoted by a private local actor, but financed by a public institution interested in urban smart initiatives. The ICT tool the project wants to design should work as coordination mechanism and information sharing enabler between the local firms. This means that it should support firms' awareness of each other resources and facilitates the creation of synergies in the Spaanse Polder. Figure



2 depicts a hypothetical web-based resource exchange in this SMEs mixed industrial area of Rotterdam. The end goal is to requalify the Spaanse Polder in a sustainable and 'smart' fashion. To realize the web-based resource exchange the Pulsup Project first needs firms' participation in it. In other words, the project needs local firms' willingness to participate in it to be successfully realized.

Fig. 2. Example of web-based resource exchange among Spaanse Polder's firms

The Spaanse Polder (Fig. 4) is one of the biggest SMEs industrial areas of the Netherlands, and generates a large turnover for the entire Rotterdam region. The Spaanse Polder covers an area of about 770 km² and is located in the North-West part of Rotterdam (Fig. 3). The location of the Spaanse Polder is strategic because is close to the city center and it is easily accessible. The Spaanse Polder was set in 1935; since then the area has passed through many changes (internal composition, relation with the city, spatial design). The number of firms that are registered in the Spaanse Polder is higher than the actual number of operative firms, which are about 400. A noteworthy Spaanse Polder's feature is the heterogeneity its firms, which 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.

A specific part of these firms are concentrated in the so-called **Groothandelsmarkt** - the wholesale market – which constitutes a closed area within the Spaanse Polder which gathers about 70 alimentary products trading companies. 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. In contrast with the rest of the Spaanse Polder industrial park, whose firms are heterogeneous in terms of industry and specialization, 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 this SMEs mixed industrial area. Does this aspect affect firms' willingness to participate in the Pulsup Project? Why?



Fig. 3. The position of the Spaanse Polder in the map of Rotterdam's metropolitan area

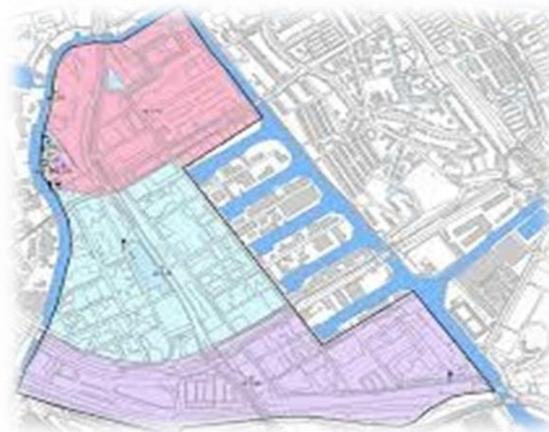


Fig. 4. A map of the Spaanse Polder

Moreover, some of the firms in the Spaanse Polder business area are member of two different business organizations: the *Belangenvereniging Spaanse Polder* and the *Spaanse Graave*. The **Belangenvereniging Spaanse Polder** is an organization meant to represent the collective interest of the firms of the Spaanse Polder in relation to public authorities. It gathers about 130 firms and it should lead to a better and more attractive business environment when it comes to issues such as accessibility, cleaning, and security. The **Spaanse Grave** is a 'business club' which aim is to enlarge each member network of acquaintances to increase their chance of doing business. The social aspect comes into play. The philosophy of this organization is that in a nice and friendly environment is easier to establish new commercial relations, 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". Does being a member of one of these organizations affect a firm's willingness to participate to the Pulsup Project?

This empirical and exploratory research was conducted adopting a qualitative strategy of research based on semi-structured interviews. Eleven firms of the Spaanse Polder were selected using a snow-ball sampling technique. The interviewees were either the managers or the owners of the selected firms; this choice was justified by the desire to provide the answers with reliability. Figure 1 shows this research conceptual model.

The *dependent variable* – willingness to participate in the Pulsup Project - was operationalized asking to the interviewees whether they would assign some of their time to participate in meetings with other Spaanse Polder firms and the actors involved in the definition of the Pulsup Project. Based on their answers to this question, firms could be classified as 'willing', 'maybe willing', and 'not willing' to participate in the Pulsup Project.

Not Willing is a firm not convinced by the Pulsup Project that rejects it. This firm is not willing to meet neither with other firms nor with the initiative's organizers to brainstorm in function of the realization of the project.

Maybe Willing is a firm fascinated by and open towards the Pulsup Project, however it also expresses hesitation and doubts about it. This firm needs and wants additional information about the project before committing to it.

Willing is a firm convinced by the Pulsup Project that could play the role of project frontrunner. 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.

The two *independent variables* – social proximity and place attachment - were operationalized posing to the interviews a series of semi-structured questions.

SOCIAL PROXIMITY (EMBEDEDDNESS)

SOCIAL INTERACTION

- Whether a firm **know (many) other firms** of the area (many, some, few)
- Frequency with which a firm **dialogue** with other firms about work/not work (often, sometimes, rarely);
- Frequency with which a firm **frequent social places** in the Spaanse Polder like the few local bars and restaurants (often, sometimes, rarely);
- Whether a firm entertain **good neighborly relations** (yes, enough, no).

TRUST

- Whether a firm experience a sense of **trust** towards neighboring and local firms (yes, enough, no);
- Whether entrepreneurs and workers entertain **friendly relationships** with other firms (definitely, enough, little);
- Whether firms experience **kinship** with other firms (definitely, enough, little).

PERSONAL INTIMACY

- Frequency with which a firm participate in **social activities** (e.g. having a coffee together, meetings, workshops) with other firms of the area (often, sometimes, rarely);
- Whether a firm **know the 'needs' of another firm** (high, medium, low).

COOPERATION

- Frequency with which a firm **asks for/gives favors** to other firms, like to neighbors (often, sometimes, rarely);
- Frequency with which a firm entertains **(business) cooperative relations** with other firms of the area (often, sometimes, rarely).

PLACE ATTACHMENT (BELONGINGNESS)

FEELING BELONGINGNESS

- Whether the firm experiences a **sense of belongingness** to the Spaanse Polder (high, medium, low);

LOCATION SATISFACTION

- Whether the firm is **satisfied and happy** with being located in the Spaanse Polder (high, enough, little);
- Whether the firm **wants to stay in the Spaanse Polder** (high, enough, little).

PARTICIPATION IN ACTIVITIES CONCERNING LOCAL DEVELOPMENT

- **Interest** of a firm in contributing to the local development and in requalification's activities (high, medium, low);
- **Participation** of a firm in activities of local development (high, medium, low).

~The empirical findings

Table 1 for each firm shows the respective degree of willingness to participate in the Pulsup Project. 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.

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

Table 1. Degrees of willingness of the interviewed firms to participate in the Pulsup Project

Using table 1, and based on the analysis of the qualitative data gathered during the interviews, it was possible to build table 2 and 3. Table 2 makes a thorough analysis of the degree of social proximity (embeddedness) for each firm in relation to each aspect of social proximity that was taken in consideration - social interaction, trust, personal intimacy, cooperation. Table 3 summarizes Table 2's findings.

		WILLINGNESS			
		NOT WILLING	MAYBE WILLING	WILLING	
SOCIAL PROXIMITY	SOCIAL INTERACTION	Knowing other firms	2 many 4 some	1 many 3 some 7 many 10 many 11 many	5 few 6 some 8 some 9 some
		Often dialogue	2 often 4 rarely	1 sometimes 3 sometimes 7 often 10 often 11 often	5 little 6 sometimes 8 sometimes 9 sometimes
		Social places	2 sometimes 4 sometimes	1 rarely 3 rarely 7 sometimes 10 sometimes 11 often	5 sometimes 6 sometimes 8 rarely 9 rarely
		Good neighborly relations	2 yes 4 enough	1 yes 3 yes 7 yes 10 yes 11 yes	5 yes 6 enough 8 yes 9 yes
			2 medium/high 4 medium/low	1 medium/high 3 medium 7 medium/high 10 medium/high 11 HIGH ~	5 medium/low 6 medium 8 medium 9 medium
	TRUST	Trust	2 enough 4 yes	1 yes 3 yes 7 enough 10 yes 11 yes	5 enough 6 enough 8 yes 9 yes
		Friendly relations	2 enough 4 little	1 enough 3 enough 7 enough 10 enough 11 enough	5 enough 6 enough 8 little 9 enough
		Kinship	2 enough 4 little	1 enough 3 enough 7 enough 10 enough 11 enough	5 little 6 enough 8 little 9 little
			2 medium 4 medium/low	1 medium/high 3 medium/high 7 medium 10 medium/high 11medium/high	5 medium/low 6 medium 8 medium/low 9 medium
	PERSONAL INTIMACY	Social activities	2 often 4 little	1 often 3 rarely 7 often 10 sometimes 11 often	5 little 6 sometimes 8 sometimes 9 rarely
		Awareness of others needs	2 high 4 low	1 high 3 low 7 high	5 low 6 low 8 low

				10 high 11high	9 low
			2 HIGH ~ 4 LOW ~	1 HIGH ~ 3 LOW ~ 7 HIGH ~ 10 medium/high 11 HIGH ~	5 LOW ~ 6 medium/low 8 medium/low 9 LOW ~
COOPERATION	Favors	2 often 4 rarely		1 sometimes 3 sometimes 7 often 10 sometimes 11 often	5 sometimes 6 rarely 8 sometimes 9 sometimes
	Cooperation	2 often 4 rarely		1 sometimes 3 sometimes 7 often 10 sometimes 11 rarely	5 rarely 6 sometimes 8 sometimes 9 rarely
		2 HIGH ~ 4 LOW ~		1 medium 3 medium 7 HIGH ~ 10 medium 11medium	5 medium/low 6 medium/low 8 medium 9 medium/low

Table 2. Social proximity (social interaction, trust, personal intimacy, cooperation) and willingness

		SOCIAL PROXIMITY / EMBEDEDNESS				
		Low	Low Medium	Medium	Medium High	High
WILLINGNESS	Not Willing	4			2	
	Maybe Willing			3	1, 7, 10, 11	
	Willing		5, 6, 8, 9			

Table 3. Social proximity and willingness

The first noteworthy information provided by Table 3 is that the most embedded firms are those located in the Groothandelsmarkt Spaanse Polder – firms 2, 7, 10 – and those whose managers also are the chairman of the Belangenvereniging Spaanse Polder and the Spaanse Graave (see Chapter 3.2) - firms 1 and 11. Given that most of them are ‘maybe willing’, embeddedness in the local social fabric correlates with openness towards the possibility to participate in the Pulsup Project.

We curiously see that between them three out of five – firms 7, 10, and 2 - are located inside the Groothandelsmarkt Spaanse Polder. As described earlier, this location constitutes a separate “ecosystem” within the Spaanse Polder where firms’ typology is homogenous: firms are food industry traders. Hence, beyond being combined by the same geographical location, these firms are also combined by the same economic specialization. Their distribution in Table 2 suggests that these two characteristics affect their social proximity. The Groothandelsmarkt Spaanse Polder’ firms daily interact and cooperate with each other, especially with neighbors; to some extent these relations are characterized by friendship and intimacy. **Firm 7** said “yes! I know all my neighbors! So, now and then we talk... this morning one came

over here in my office and so we just talked". Similarly, **firm 2** said "...sometimes I go to a neighbor and we drink coffee, and then we talk!" About cooperation with other firms firm 2 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". **Firm 7** as well cooperates with neighboring firms in a spontaneous and informal way. Firm 7 depicted the 'tacit-knowledge' communication and mutual-help-system in which is involved with the neighboring firms: "if a neighbor is closed, and they had purchased something, and when the supplier brings it and nobody is there, then they can bring it over here so that then we can keep it for them, or the same thing also happens with us. This is how it works!" Also **firm 10** is part of this mutual-help-system. Talking with firm 10 it became clear 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, what firm 10 calls a "good neighbor policy". In fact, firm 10 finds the Pulsup Project slightly redundant; it said "we are already doing quite a few of the things (those promoted by the project). It is nice if it would be regulated and organized in a proper way, but we are individually doing it already". This statement suggests that this firm perceives a web-based resource exchange as a tool that could add the systematization of the already existing resource exchanges among the wholesale market's firms. Overall, in the Groothandelsmarkt there is high social proximity.

Between the rather embedded firms, we also curiously see that the managers of both the 'maybe willing' firms 1 and 11 are respectively the chairmen of the Belangenvereniging Spaanse Polder and the Spaanse Graave. Because of their role, these firms' managers know many Spaanse Polder' firms. Hence, they are rather embedded. **Firm 1** said "we have been in the Spaanse Polder for 25 years, and let's say that in the last ten years, because of the things I do here (role of chairman of the Belangenvereniging), I know so many firms!" On the other hand, the manager of both **firm 11** and the Spaanse Graave firmly believes that cultivating social relations is really important to conduct business. In fact the mission of the Spaanse Graave is to create social proximity among local firms. By the way, the interviewee said this business club's mission is "to create a better business environment. The people know each other more, so that you can do business with your neighbor, and not with somebody at the other side of the country, and that you understand the local legislation, better, and that you can make a feast to the government". In other words, the Spaanse Graave exists with the aim of supporting interaction among its members, in fact the interviewee said "the main core is to talk together!" Interacting firms learn about the area, its firms, their practices, but also about relevant (local) social and economic issues and possibilities. In other words, the Spaanse Graave's goal is "not to work together, but to find ways to do more business with each other, that means not only business to business, but everybody do have its own network, so to keep the network open to other firms, because I know a lot of people, you know a lot of people, we all know a lot of people, and together we know lots of people. So, if can use your contact for my company, and I can use my contact for your company, that is a better fit. That is what I will try to do more than it is already". Overall, we see that both firms 1 and 11 are aware of the Spaanse Polder's firms' geography and interact with many of them, which is they are (socially) embedded.

The second noteworthy information provided by Table 3 is that none of the 'willing' firms show a rather high degree of social proximity. Interestingly they are located outside the Groothandelsmarkt Spaanse Polder. There could be a relation between social proximity and firms' location inside or outside the wholesale market: firms located outside the wholesale market Spaanse Polder experience less social

proximity. This could positively affect their willingness to participate in a project that provides them with the possibility to extend their network of local acquaintances. It was asked to **firm 5** whether it entertains trustful and pleasant relations with other firms of the Spaanse Polder, it said “...to be honest with you I don't know about other firms, but I know about this block!” Firm 5 just knows the neighboring firms; about them it said “we know them, they know us ... Every morning when we see each other it is ‘Good morning!’ ... This people I trust, yes! ... With the neighbor here (wholesale of chairs), when we need chairs we just go to him ‘we need some chairs!’ He gives them to us. And later in the month the invoice comes and... So we have friendly relationships!” Even if firm 5 entertains friendly neighborly relations it has never participated in meeting with other firms of the area. About the Pulsup Project firm 5 said “I didn't know this thing would even exist ... while you were telling me I was already thinking that this idea is really good! Like within the Spaanse Polder firms don't know each other... you know which firm is here, which firm is there, but... to make them work together, that could be... Something!” Firm 5, who neither knows many other firms of the area nor the Spaanse Polder firms' organizations, is enthusiastic about the project because of the possibility to meet other firms and extend its network of acquaintances. **Firm 8** does not know many firms of the Spaanse Polder, it would like to enlarge its network of local acquaintances and is willing to meet with other firms. It said “I am new so I am still opening to get to know how it all works here. But it's good!” Firm 8 does not know many other Spaanse Polder's firms yet it entails pleasant relations with neighbors based on the exchange of favors. **Firm 9** positively perceives the relations it entails with local firms (It has happened to ask a neighbor for a favor), which probably influences its appreciation for the Spaanse Polder. It said “Yes! I can trust them, and they (the other firms of the Spaanse Polder) are really nice people, yes!” Firm 9 is looking for a situation characterized by the exchange of ideas among alike enterprises: “recently I have read an article about Rotterdam and there were some questions for the Rotterdam firms to develop ideas... and then I was also thinking about it like ‘what could be a good idea to work together! ...But more like my profession for tailors or creative people to teach each other and maybe that have the same ideas to go together to a direction!” Firm 9 is satisfied of the relations it entertains with the other firms of the area, but it is also interested in enlarging the network of local acquaintances. Overall, a firm's location inside the Groothandelsmarkt renders the project more redundant to their eyes compared to those that are located in the rest of the Spaanse Polder.

The third noteworthy information provided by Table 3 is that a firm like the ‘not willing’ firm 4, which shows low social proximity (embeddedness), constitutes a case where not being embedded constitutes a conscious and motivated choice characterized by the disinterest in extending the own social proximity. **Firm 4** said “you know names of the companies, you know some people that you meet when you are here or you are at meetings, but it is really... superficial! It is not really intense, or something!” Firm 4's relations with the other Spaanse Polder's firms tend to be cold, formal, and superficial, which is they tend to be characterized by little intimacy.

Using table 1, and based on the analysis of the qualitative data gathered during the interviews, it was possible to build table 4 and 5. Table 4 makes a thorough analysis of the degree of place attachment for each firm in relation to each aspect of place attachment that was taken in consideration - belongingness, local satisfaction, participation in local development. Table 5 summarizes Table 4's findings.

			WILLINGNESS		
			NOT WILLING	MAYBE WILLING	WILLING
PLACE ATTACH MENT	BELONGINGNESS	Belongingness	2 high 4 low	1 high 3 high 7 medium 10 low 11high	5 high 6 enough 8 high 9 high
			2 HIGH ~ 4 LOW ~	1HIGH ~ 3 HIGH ~ 7 medium 10 LOW ~ 11 HIGH ~	5 HIGH ~ 6 medium 8 HIGH ~ 9 HIGH ~
	LOCATION SATISFACTION	Satisfaction Happy	2 high 4 enough	1 high 3 high 7 enough 10 high 11 high	5 high 6 enough 8 high 9 enough
		Wants to stay	2 high 4 enough	1 high 3 high 7 enough 10 high 11 high	5 high 6 enough 8 high 9 high
			2 HIGH ~ 4 medium	1 HIGH ~ 3 HIGH ~ 7 medium 10 HIGH ~ 11 HIGH ~	5 HIGH ~ 6 medium 8 HIGH ~ 9 medium/high
	PARTICIPATION IN LOCAL DEVELOPMENT	Interest	2 low 4 medium	1 high 3 medium 7 high 10 low 11 high	5 medium 6 high 8 high 9 high
		Participation	2 low 4 low	1 high 3 medium 7 high 10 low 11 high	5 low 6 high 8 low 9 medium
			2 LOW ~ 4 medium/low	1 HIGH ~ 3 medium 7 HIGH ~ 10 LOW ~ 11 HIGH ~	5 medium/low 6 HIGH ~ 8 medium 9 medium/high

Table 4. Place attachment (belongingness, local satisfaction, participation in local development) and willingness

		PLACE ATTACHMENT/BELONGINGNESS				
		Low	Low Medium	Medium	Medium High	High
WILLIN GNESS	Not Willing		4	2		
	Maybe Willing		10		3, 7	1, 11
	Willing				5, 6, 8, 9	

Table 5. Place attachment and willingness

Generally, to some extent all the firms of the sample are attached to the Spaanse Polder, and contrarily to what was observed in relation to social proximity it seems that for place attachment a firm's specific location within the Spaanse Polder does not constitute a particularly relevant aspect. The first noteworthy information provided by Table 5 is that the 'willing' firms - 5, 6, 8, and 9 - and the 'maybe willing' firms - 3, 7, 1, and 11 - are rather attached to the Spaanse Polder. **Firm 5** expresses a strong sense of belongingness to the Spaanse Polder because it constitutes the place "*where we grew the most and the best! ...When we came here we become like 'now, it is serious business!' This is a feeling we still have about the Spaanse Polder!*" This is why the interviewee shows a thankful attitude towards the Spaanse Polder, however so far it has not been particularly engaged in activities of local development. **Firm 6** is rather attached to both the Spaanse Polder and the Rotterdam region. In fact, this firm is strongly committed to the improvement of the area. By the way, firm 6 implements "*...various initiatives here in the city to basically make it better livable for people with disabilities, because it is also a large part of our customers group*", and then it added that their focus "*is not on profit maximization! ... We would like to make social responsibility profit! ...We can do a lot about good give back to the city, and we think we should, I mean our larger contract comes from the city and its people, so we should also give something back*". Furthermore, this firm is also a member of both the Spaanse Polder firms' organizations, which further indicates this firm's interest in activities of local development. **Firms 8** is happy in the Spaanse Polder, and in particular it is rather satisfied about its specific location. By the way, it said "*I'd like to gradually extend in the area, because I like the Spaanse Polder ... because it is like very quiet and comfortable here. So, it's a little off the main road and I like it because there is no traffic here*". On the same wake, it added "*so far I think this is a nice industrial site because it is like older, and it is really nearby the city. I mean you can just take a bike and you're in Delfshaven... and so for my beer thing is also good. It is not like you are really far from the city center, people can join and... So I am feeling comfortable here!*" **Firm 3 and 7** are 'maybe willing' firms that express a rather high degree of attachment to the Spaanse Polder. **Firm 7** is interested in activities of local development and is happy in the Spaanse Polder. In fact, it participates in meeting with other firms because of its role of member of the "*special commission*" of the Belangenvereniging Spaanse Polder, which explains why it has "*twice a month a meeting with them!*" Then, firm 7 added "*Yeah! It's very nice to be in the Spaanse Polder!*" Overall, place attachment seems to correlate with both 'willing' and 'maybe willing' firms, hence with an open attitude towards the industrial symbiosis Pulsup Project.

The second noteworthy information provided by Table 5 is that the 'not willing' firms - 4 and 2 - are not particularly attached to the Spaanse Polder. **Firm 4** knows the Spaanse Polder's firms geography, is aware of the two firms' organizations' activities, and is also member of the Belangenvereniging, but not actively. In fact, firm 4 does not seem particularly interested in local development's issues. In this respect, curiously firm 4 does not feel attached to the Spaanse Polder; it said: "*Yeah! I have never had those kinds of real feelings... not with my house or anything! Ok, you're there... I think when you move you think 'aah!' That would be the idea! Yeah!*" Furthermore, when it was asked to firm 4 whether it would mind moving from the Spaanse Polder the answer was "*Nnnyeah! Not really but I don't mind...let's say in that way*". Overall, firm 4 neither feel belongingness or attachment to the area, nor interest in activities that aims at the local development of the Spaanse Polder.

The third noteworthy information provided by Table 5 is that the place attachment of the 'willing' firms 1 and 11, whose managers are also the chairmen of the Spaanse Polder's firms' organizations, is particularly

high. Interestingly, this information seems confirming the relation between place attachment and interest in activities of local development. **Firm 1** feels belongingness to the Spaanse Polder, and its interest in matters that concerns local development is shown by its engagement in the Belangenvereniging Spaanse Polder. When it was asked to firm 1 whether it feels a sense of belongingness to the Spaanse Polder it said that it does and immediately it started talking about how the Belangenvereniging Spaanse Polder was born. The connection between place attachment and local engagement made by the interviewee supports the initial assumption this chapter is based upon. As we have already seen, **firm 11**'s manger is also the chairman of the Spaanse Graave 'business club', which already tells something about this firm's interest in activities of local development. Firm 11 is proud to belong to belong to the Spaanse Polder and believes in the necessity to take care of the local development. In fact, when it was asked whether firm 11 is interested in contributing to the Spaanse Polder's the answer was *"well, I think yes because we are members of the Spaanse Graave... Then we do a lot of activities as firms within the Spaanse Polder. I talked to a lot of people within the Spaanse Polder. So, I think as firm we do a lot to promote, not only ourselves, but also the entire area!"*, then it was added *"...you don't only want to do business for the profit, but you have also your responsibility as a company"*. In addition, firm 11 feels a strong sense of belongingness to the Spaanse Polder; by the way the interviewee said *"yeah! We belong there! Absolutely!"* We notice that feeling of belongingness to the area and interest in participating in activities of local development go hand in hand. Overall, it seems that a relation between place attachment and willingness to participate in the Pulsup Project exists.

		SOCIAL PROXIMITY				
		Low	Low Medium	Medium	Medium High	High
PLACE ATTACHMENT	Low					
	Low	4			10	
	Medium				2	
	Medium		5, 6, 8, 9	3	7	
	High				1, 11	

Table 6. Social proximity and place attachment

Finally, Table 6 merging table 3 and 5 makes a reflection about the mutual interdependence between social proximity and place attachment in relation to willingness to participate in the Pulsup Project. It is difficult to say whether social proximity affects willingness through place attachment, or vice versa. What the data distributions suggest is that social proximity has more impact on place attachment than place attachment on social proximity. In fact, more than a half of the firms with high social proximity also scores high place attachment. The same cannot be said for the firms with high place attachment in respect to high social proximity.

~Conclusions

At a theoretical level the idea of exploiting the possibilities delivered by the Internet to implement industrial symbiosis seems logical. However, as this research shows, the transition of an existing (mixed) industrial park to a new way of conducting business, according to the principles of industrial symbiosis, constitutes a complicate and tricky issue. Firms are required to adopt a change in their daily business practices and accept the idea of letting other firms know about them, their needs, and practices. This transition concerns delicate confidentiality issues. Furthermore, it also requires firms' positive predisposition towards local development initiatives, which may be reasonably influenced by the experienced sense of place attachment. Generally, related studies overlook the social side of this kind of transitions. Nevertheless, this research shows that firms' social proximity and place attachment is clearly relevant for the successful involvement of firms in projects that wants to realize an industrial symbiosis through a web-based resource exchange.

Although this research is based on a small number of interviews, three conclusions can be drawn.

Firstly, the data (Table 3) does not support the hypothesis that high social proximity correlates with high willingness, however it suggests that social proximity and willingness are correlated. The 'maybe willing' firms, which do not exclude the possibility to participate in the Pulsup Project, show a rather high degree of social proximity, while the 'willing' firms show a rather low degree of social proximity. This suggests that social proximity may constitute a necessary but not sufficient condition to participate in the project. For the formers, other factors than social proximity may be at stake in affecting their degree of willingness to participate in the project. For the latter, the Pulsup Project may constitute a possibility to extend their social proximity or network of acquaintances boosting their high willingness to participate in the project.

Secondly, the hypothesis that higher degree of place attachment correlates to higher degree of willingness to participate in the Pulsup Project was supported by the data (Table 5): the 'willing' firms express high degree of place attachment, as well as the 'maybe willing' firms. Thus, it seems that when firms experience place attachment tend to be more interested in initiatives of local development.

Finally, there is no evidence that social proximity affect willingness through place attachment, or vice versa (Table 6).

This research supports the hypothesis that social proximity (embeddedness) and place attachment (belongingness) affect firms' willingness to participate in a project that wants to implement an industrial symbiosis through a web-based resource exchange in an already existing SMEs mixed industrial park.

Hence, the role played by social proximity and place attachment in relation to industrial symbiosis projects need to be better valued and explored by both science and society. Future research could further investigate these relations using a larger sample of firms and a purely random sampling technique to reduce the weight of the outliers and to increase the generalizability of the outcomes.

~References

- Almasi, A.M., Soque, c., Strandgaard, C., K., Sacchi, R. (2011). Industrial Symbiosis. Modelling industrial symbiosis to find the potentials and barriers in Aalborg, Denmark. Master's project promoted by Alborg University.
- Atzema, O.A.L.C., Visser, E. J. (2008). With or without clusters: Facilitating innovation through a differentiated and combined network approach. *European Planning Studies*, 16, 9, pp. 1169-1188
- Boschma, R. A. (2005). Proximity and innovation: a critical assessment. *Regional Studies* 39, 1, pp. 61-74.
- Desrochers, P. (2014). Industrial symbiosis: the case for market coordination. *Journal of Cleaner Production*, 12, pp. 1099–1110. Elsevier.
- Gladek, E., van Odijk, S., Theuws, P., Herder, A. (2015). Transitioning Amsterdam to a Circular City. Circular Buiksloterham. Vision and Ambition. Report commissioned by DeAlliantie, Waternet, Ontwikkelingsbedrijf Geemente Amsterdam (OGA)
- Granovetter, M. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *AJS*, 91, 3, pp. 481-510.
- Granovetter, M. (1973). The Strength of the Weak Ties. *AJS*, 78, 6.
- Grant, G. B., Seager, T.P., Massard, G., Nies, L. (2010). Information and Communication Technology for industrial symbiosis. *Journal of Industrial Ecology*, 14, 5, pp. 740-753.
- Hossain, L., Wigand, R. T. (2003). Understanding virtual collaboration through structuration. Proceedings of the 4th European Conference on Knowledge Management, 475–484.
- Hossain, L., Wigand, R.T. (2004) ICT enabled virtual collaboration through trust. *Journal of computer mediated communication*, 10, 1, pp. 00.
- Kyle, G., Graefe, A., Manningc, R., Baconc, J. (2004). Effects of place attachment on users' perceptions of social and environmental conditions in a natural setting. *Journal of Environmental Psychology*, 24, pp. 213–225. Elsevier.
- Kogut, B., and Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3, 3.
- Lambert, A.J.D., Boons, F.A. (2002). Eco-industrial parks: stimulating sustainable development in mixed industrial parks. *Technovation*, 22, 8, pp. 471-484
- Leeuwen, M.G., Vermeulen, W.J.V., Glasbergen, P. (2003). Planning eco-industrial parks: an analysis of Dutch planning methods. *Business Strategy and the Environment*, 12, pp. 147-162
- Mentink, B. (2014). Circular business model innovation. Msc thesis Industrial Ecology promoted by Delft University of Technology.
- Ram, Y., Bjork, P., Weidenfeld, A. (2016) Authenticity and place attachment of major visitor attractions. *Tourism management*, 52, pp. 110-122. Elsevier.
- Wigand, R. T. & Imamura, T. (1997). Virtual organization: Enablers and boundaries of an emerging organizational form. *Proceedings of the Americas Conference on Information Systems*, 423–425.
- Wright, S. (2015) More-than-human, emergent belongings: A weak theory approach. *Progress in Human Geography*, 39, 4, pp. 391-411.