

Tamara Oukes  
NIKOS  
School of Management and Governance  
University of Twente  
Drienerlolaan 1 7522 NB Enschede  
The Netherlands  
[t.oukes@utwente.nl](mailto:t.oukes@utwente.nl)  
+31 534894497

Ariane von Raesfeld  
NIKOS  
School of Management and Governance  
University of Twente  
[a.m.vonraesfeldmeijer@utwente.nl](mailto:a.m.vonraesfeldmeijer@utwente.nl)

## **Resource interaction in relation to power**

How startups strategize to cope with the challenges of mobilizing and leveraging resources in asymmetrical power relationships

Competitive paper

### **Abstract**

The resource interaction approach provides a set of basic principles concerning how resources interact at a network level. This paper further elaborates on the resource interaction approach by investigating the role of power in the technological development of a medical device over time. In the medical device development process resources, such as intellectual property, distribution networks and production facilities, are largely controlled by established organizations. Consequently, small start-ups often have to collaborate with these players to successfully innovate. However, when a startup is engaged in a relationship with a large, established and powerful partner it is faced with several discrete challenges. These challenges make it difficult to mobilize and leverage the necessary resources to innovate. Therefore, the question is how a startup can take deliberate strategic actions to better mobilize and leverage the resources in their asymmetrical relationships. The answer to this question is explored through an embedded case study of a small Dutch company collaborating with a few dominant organizations to develop a new medical device. Firstly, the 4R model is used to establish the power position of the startup and its counterparts in the product development network over time. Secondly, it is investigated which strategic actions the startup took to conquer the challenges it faced in its asymmetric power relationships. The findings show that the startup uses five strategies to cope with these challenges: visibility, sharing, compatibility, informality and formalization. Thirdly, it is researched how these strategies influenced the resource interaction process between the startup and the powerful partner. The first two strategies have a positive effect on the ability of the startup to mobilize and leverage the resources of an established firm. The third strategy ensures a stable flow of resources into the organization. The fourth has both of the aforementioned advantages. The last has a dual effect on resources interaction; it improves the startup's ability to mobilize and leverage resources, but makes it harder for the established organization.

### **Key words**

Resource interaction, power asymmetry, startup, strategizing

## INTRODUCTION

Innovation in startups is important both because of its effects on the success of these business and their potential to act as the initiator and catalyst for economic progress (Freel, 2000, Lind, 2012, Verhees and Meulenber, 2004, Wolff and Pett, 2006). For this reason, Lind (2012) argues that the academic world should pay more attention to the stimulation of innovation in startups. Through partnerships a startup can acquire the resources that are necessary in its path from invention to innovation (Konsti-Laakso et al., 2012). Nonetheless, startups find it difficult to develop and maintain relationships due to the challenges associated with mobilizing and leveraging resources from partners (Colombo et al., 2012). In recent years, the challenges for startups in building and maintain relationships are aggravated by their increasing power asymmetry (hereafter called asymmetry) (Hurmelinna et al., 2005, Kalaignanam et al., 2007, Mouzas and Ford, 2007). In response, there has been a growing interest in the strategies that startups use to cope with challenges of asymmetric relationships (Pérez et al., 2012, Prashantham and Birkinshaw, 2008, Johnsen and Ford, 2008). To determine asymmetry it is common to analyze the resources that are within the ownership or control of a single actor (Astley and Sachdeva, 1984, Pfeffer and Salancik, 2003). However, in a network world an actor's resources and its ability to capitalize on them are dependent on their specific interaction with other resources. The resource interaction approach provides a basic model, the 4R model, concerning how resources interact at a network level over time (Håkansson and Waluszewski, 2002). The approach permits mapping resources to identify ways for combining internal and external resources. Though it mainly concerns resources structures while ignoring actor-related concepts, like power. This overreliance on resource structure may overlook important aspects and attributes of resource interaction (Baraldi et al., 2012). One of the aspects is the ability of startups to actually mobilize and leverage the resources in asymmetrical relationships to connect them to their own. Startups are widely considered to be in the subordinate position in relationships with powerful, established organizations (Gardet and Fraiha, 2012, Vandaie and Zaheer, 2014), because they have difficulties in mobilizing and leveraging resources (Astley and Sachdeva, 1984, Anderson et al., 1994). Still, startups can improve their power position relative to the established, powerful organization by influencing the process of resource interaction (Baraldi et al., 2012). By linking the resource interaction approach to the power of actors, one can identify the power position of startups as well as research how startups influence the process of resource interaction to improve their power position. Therefore, in this paper the following three research questions are explored:

- 1) *How can the 4R model be used to identify the power position of a startup relative to other actors in the network?*
- 2) *Which deliberate strategic actions do startups take to influence the resource interaction process?*
- 3) *How do the deliberate strategic actions of the startup influence the process of resource interaction?*

Taking a resource interaction perspective to research the asymmetric relationships between startups and established organizations, contributes to the theory in three ways. Firstly, the 4R model is used to identify the power position of the actors in the network based on their ability to mobilize and leverage resources. Secondly, the strategies of the startup used in asymmetric relationships to influence the process of resource interaction are researched. Thirdly, the 4R model is used to investigate the effects of the strategies used by the startup to influence the resource interaction process. Taken together these contributions represent a new way of looking at how resource interaction drives and is driven by startups in asymmetric

relationships with established organizations. The issue is explored in a case study of a Dutch startup that is collaborating with several organizations to develop a new medical device for the treatment of diabetes. In the medical device development process resources, such as intellectual property, distribution networks and production facilities, are largely controlled by a few dominant organizations. Consequently, small start-ups often have to collaborate with the large, established and therefore powerful players to successfully innovate (Aaboen et al., 2011). The paper proceeds first with the state-of-the-art in the literature regarding the resource interaction approach and strategizing in asymmetric relationships will be discussed. In the methodology section a brief description is provided of the research design used. This is followed by a detailed presentation of the resource interaction network and the associated power positions of the actors in respect to the startup. Drawing from the case analysis the strategies that were used by the startup are identified and the effects of these on resource interaction are explored.

## **FRAME OF REFERENCE**

### **Actor dimension in the resource interaction approach**

The 4R model was developed within the framework of the IMP research tradition to classify, map, and analyze the processes of resource interaction in inter-organizational networks (Håkansson and Waluszewski, 2002, Baraldi et al., 2012). It divides the resources represented by an organization into four categories: a) products which are the combination of goods and services that organizational units exchange, b) facilities which refer to the equipment utilized to develop, manufacture and transport products, c) organizational-units which represent the knowledge, identity and reputation of an organization, and d) inter-organizational relationships which includes the relationships between organizational-units that can be used to create more efficient and effective resource combinations (Baraldi et al., 2012, Håkansson and Waluszewski, 2002). The model assumes that resources exist in constant interaction with each other from which they develop specific resource interfaces over time (Ingemansson, 2010). The interface between two resources represents the contact points along which two resources interact and determines how resources ‘fit’ each other when they are utilized together (Baraldi et al., 2012). This stems from the concept of resource heterogeneity which implies that, by itself, a single economic resource is passive and without value (Ingemansson, 2010). It is only possible to define the nature of resource to create economic value when a resource interacts with other resources (Håkansson et al., 2009). The value of the model lies in its ability to construct maps of resource networks at both a particular point in time and of complex processes, such as the development of an innovation. In this way, it is possible to determine those resources that are crucial in that processes and which create obstacles and need to be modified or recombined (Baraldi et al., 2012).

As a consequence of the strong focus on resources, the resource interaction approach downplays agency in favor of structures and material processes. Therefore, the other central dimensions of a network, actors and activities, get less attention. Focusing solely on the structural dimension of resources may leave out important aspects and attributes of resources that derive from how actors mobilize and leverage resources (Baraldi et al., 2012). Actors play an important role in combining resources for two reasons: a) resources only have meaning in relation to actors, because it is actors that conceive, activate and use resources, and b) resources required in any combination are always to some degree distributed over and controlled by different actors in the business landscape, and accessing these requires establishing relationships with these actors (Cantu et al., 2012). As a result typical actor-related concepts, such as power, can be viewed in relation to resources (Baraldi et al., 2012). According to the IMP approach power represent a crucial dimension in interaction and

relationships (Håkansson et al., 2009). Power is viewed as the ability of actors to overcome resistance on the part of other actors to achieve desired outcomes (Dahl, 1957). Power can be explained by reference to the capacity for obtaining and controlling the supply of resources to others through processes of interaction (Astley and Sachdeva, 1984). As shown in figure 1, the role of power in resource interaction is twofold:

On the one hand, the power of actors is influenced by its ability to mobilize and leverage the resources in control of other actors (Anderson et al., 1994, Astley and Sachdeva, 1984). As actors are not self-contained or self-sufficient, the wider resource network must be relied upon to provide support. For continuing to provide the needed resources, other actors demand certain resources and activities in return. It is the actor’s dependence on the network that makes the external control of other actors both possible and almost inevitable (Pfeffer and Salancik, 2003). To identify the power position of an actor it is common to try to analyze the resources and activities that are nominally within the ownership or control of a single actor (Astley and Sachdeva, 1984, Pfeffer and Salancik, 2003). However, in a network world an actor’s resources and its ability to capitalize on them are activated by, dependent on and defined by their specific interaction with other resources, rather than being generalized properties of the actor itself. Considering the power of actors from the interaction perspective has some consequences for the way in which the power position of an actor is identified. In interaction with others an actor acquires an identity, because its behavior is a matter of concern to or affects other actors (Håkansson et al., 2009). Network identity is meant to capture the perceived attractiveness of a firm as an exchange partner due to its unique set of connected relationships with other firms, links to its activities and ties with its resources. A network identity has certain power content, because it is based on the particular resources an actor can control (Anderson et al., 1994). An organization “*will be viewed as strong in resource terms if it is seen as being able to mobilize and leverage the substantial resources of a connected partner*” (Anderson et al., 1994, p. 4). Thus, from an interaction perspective the power position of a particular actor is not identified based on the resources it can actually control, but on the basis of its ability to mobilize and leverage the resources of other actors to combine them with its own.

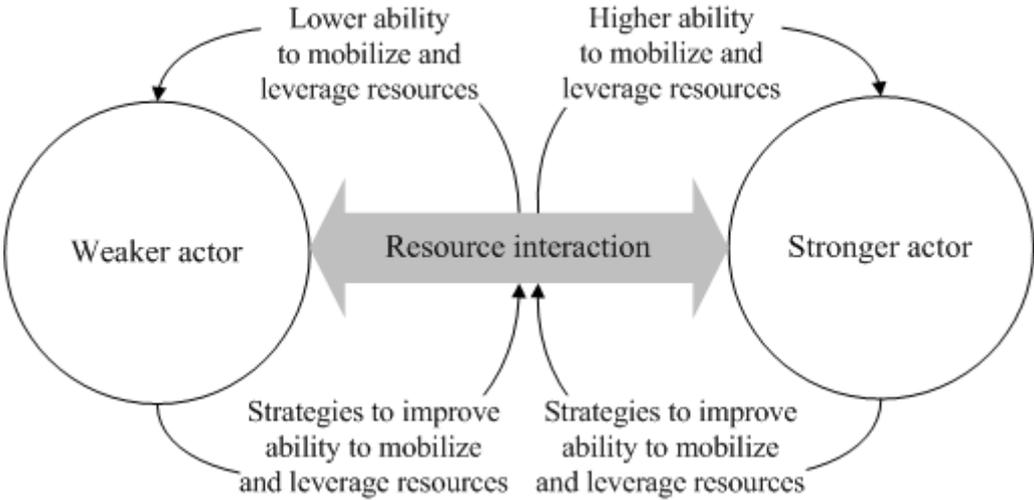


Figure 1. The two faces of power in resource interaction

On the other hand, actors can develop their power position by influencing the process of resource interaction on a network level (Baraldi et al., 2012). For instance, Forbord (2003) showed that a ‘web of purposeful actors’ conducts ‘interactive, systematic relating’ of the four resources driving the processes of interaction on a network level. Hence, it can be assumed that actors are able to engage in deliberate strategizing in inter-organizational relationships (Aaboen et al., 2013). IMP researchers argue that the ‘managing in networks’ is a matter of handling paradoxes (Håkansson et al., 2009). This implies that *“the answers to manager’s questions about their interactions will always depend on the specific situation and context. There are no neat solutions or standardized approaches to strategic network success.”* (Håkansson & Ford, 2002, p. 138). In other words, no single central actor can be in charge of strategizing in the relationship in isolation (Håkansson et al., 2009). Nevertheless, an organization is not condemned to be passive existing only at the whim of others. Each actor in the network has the willingness to act and is able to influence the resources interaction process (Håkansson et al., 2009). Thus, if the conventional assumption of independence is replaced with that of interdependency, there is still room and need for strategizing (Aaboen et al., 2013). Though, by taking a network perspective on strategizing, interdependency becomes a central aspect of how actors mobilize and leverage resources in the network (Aaboen et al., 2013). In conclusion, an enhanced 4R analysis should be conducted that clearly defines the controls attached to each resource in the network to study how actors drive and are driven by the process of mobilizing and leveraging resources in interaction (Baraldi et al., 2012).

#### **Asymmetric relationships between startups and established organizations**

In recent years mergers and acquisitions, rapid and costly technological changes, the growth of outsourcing as well as global sourcing create conditions for a growing amount of asymmetrical power relationships between organizations (Mouzas and Ford, 2007). In particular across fields with high speeds of technological change, like the biopharmaceutical and high technology industries, the number of relationships between startups and established organizations is growing (Das and He, 2006, Pérez et al., 2012). As a consequence of being small and new, startups are associated with many characteristics that are fundamentally different from established organizations. Startups have repeatedly shown to be great inventors because of their organizational flexibility (Lee et al., 2001), but they often lack key resources, external relationships and perceptions of reliability quality, and legitimacy (Stinchcombe, 1965, Lee et al., 2001). Studies on small and young firms have shown on that by building and maintaining business relationships with established organizations they can increase the odds of innovation success, survival and growth (Larson, 1992, Shan et al., 1994, Stuart, 2000, Baum et al., 2000). Nevertheless, startups are skeptical about networking and their tendency to collaborate is significantly less than that of large organizations (Hoffmann and Schlosser, 2001, Tomlinson and Fai, 2013). It may be that startups are not able to exploit the opportunities that asymmetric relationships can offer (Aaboen et al., 2011, Tomlinson and Fai, 2013), because startups are often considered to be in the subordinate position (Gardet and Fraiha, 2012, Vandaie and Zaheer, 2014). The asymmetrical power relationships between startups and established organizations are characterized by an imbalance in the resource of one actor or in the way those resource are used which enables the other actor to dominate in the relationship and determine the processes and outcomes of the relationship (Mouzas and Ford, 2007). The established organization with the stronger network identity can attract new partners to strategically mobilize and leverage particularly important resources or mix of resources (Bonner et al., 2005). This possess substantially challenges on the ability of the startup to mobilize and leverage the resource of the established organization (Aaboen et al., 2013).

There are five inherent challenges in mobilizing and leverage resources in interaction with established partners for startups (Aaboen et al., 2011, Tomlinson and Fai, 2013, Colombo et al., 2012). Firstly, startups have restricted access to the attention of key decision makers in established organizations. Startups often find it very difficult to contact the right individuals in the established firm. Once there is an entrance, it is hard to build the relationship due to the established firm's egocentric and bureaucratic biases (Prashantham and Birkinshaw, 2008, Das and He, 2006). As a consequence startups have only one or a few alternative options to choose from which limits their ability to negotiate the best agreement (Mouzas and Ford, 2007). Secondly, the commitment of the established partner to turn the innovation of the startup into a success may be limited (Faems et al., 2012). Established firms are known to take advantage of the innovativeness of startups (Das and He, 2006, Raesfeld et al., 2012). They want to get access to with the new technology, but are not in a hurry to cannibalize the existing commercial activities (Faems et al., 2012, Das and He, 2006). Managers of these existing activities may see the startups innovation as a potential threat instead of a future opportunity (Faems et al., 2012, Lawton Smith et al., 1991). In this case the established firm may intend to use the relationship to control the innovation to prevent that existing profitable product will not be replaced (Das and He, 2006). Thirdly, the startup is often seen as dispensable by the established firm (Prashantham and Birkinshaw, 2008). The established firm often considers the startup as one of the available options in a wide portfolio, while for the startup the relationship is often a matter of survival (Faems et al., 2012). Fourthly, the established partner has the ability to maximize its own benefits without pursuing the common benefits by appropriating its partner's tacit knowledge and delivering below standard outcomes (Subramani and Venkatraman, 2003, Das and He, 2006, Raesfeld et al., 2012). The startup often do not have the experience or resources to safeguard their intellectually property from the opportunistic behavior of the established organization (Lawton Smith et al., 1991). Lastly, the characteristics of the relationships, such as degree of formalization, conflict resolution techniques, and degree of exclusivity, can be unilaterally determined by the powerful partner (Johnsen and Ford, 2008). As the priorities and objectives differ between startups and large firms, it is difficult for startups to build relationships that raise market value above the cost of capital needed to finance their activities (Lawton Smith et al., 1991, Prashantham and Birkinshaw, 2008, Mouzas and Ford, 2007).

The challenges associated with exploiting resources from asymmetric relationships may lead to the conclusion that startups should seek to avoid them (Mouzas and Ford, 2007). Undoubtedly, these relationships constitute significant challenges that are especially severe for startups, because they divert resources and management time of its core business, increase employee turnover, and require heavy coordination investments (Colombo et al., 2012). However, the complexity of knowledge, the convergence of technologies, and rapid changes in the environment have made it increasingly difficult for a single startup to contain and capitalize all the desired resources in isolation (Pérez et al., 2012). The lack of financial, manufacturing, and marketing resources as well as legitimacy and track record can be compensated by forming inter-organizational relationships with established organizations (Das and He, 2006). As a result a startup may seek or is even forced to seek dependence on an established partner to use the resources that can be derived from the relationship. Consequently, startups with their liabilities of newness and smallness "*need to find ways to develop their network positions in view of getting access to vital firm-external resources through interaction and networking*" (Aaboen et al., 2013, p. 1040). Hence, the critical question is not if the startup should avoid asymmetry or how to create symmetry, but how the startup can strategize in their asymmetric relationships to mobilize and leverage the necessary resources of the established partner (Mouzas and Ford, 2007, Das and He, 2006).

## METHODOLOGY

### Methodological approach

A process research approach is used to gain a better understanding of what the power position is of a startup at a certain point in time from a resource interaction perspective, which strategies it uses to develop this position and how these strategies in turn effect resource interaction. Process research involves “*the study of how and why some significant temporally evolving phenomenon unfolds over time*” (Bizzi & Langley, 2012, p. 220). The temporal dimension cannot be ignored in relationship research, because relationships are by its very nature dynamic and susceptible to change (Bizzi and Langley, 2012, Halinen et al., 2012). The process perspective also takes the complexities associated with innovation processes into account, because this process may not necessarily follow a linear sequence from idea generation to implication (Garud et al., 2013). Process research methodologies are often based on qualitative case studies (Bizzi and Langley, 2012). A case study allows researching a phenomenon that is difficult to detach from its context, but necessary to study within its context to understand the dynamics involved (Halinen and Törnroos, 2005, Yin, 1989). In-depth single case studies tend to generate a rich understanding of a particular context, but there is a risk of generating rather idiosyncratic stories where general conclusions are hard to reach. In contrast, multiple case studies offer the possibility to develop insight from cross-case comparison, but the analysis of the cases may be superficial (Bizzi & Langley, 2012). The objective of providing holistic descriptions to learn about their nature, management and evaluation is such a demanding task that a single case study is often the only option (Halinen & Törnroos, 2005). However, to be able to reap the benefits of cross-case comparison in this research a single embedded case study will be conducted. In this type of study the researcher examines a single organization, but compares a number of logical sub-units within the organization (Saunders et al., 2009).

The empirical data collection involved an in-depth case study of a startup in the medical device business and its powerful partners. The startup is developing a solution to improve the treatment of diabetes type 1 patients: a closed-loop bi-hormonal artificial pancreas. This breakthrough in diabetes management includes the automated administration of insulin and glucagon while the glucose level of the patient is continuously monitored. For diabetes patients maintaining glucose levels in the normal range is essential for preventing diabetes related complications which include for example blindness, heart and cerebral infraction, foot ulcer or amputations. Thus, the portable bi-hormonal artificial pancreas has the potential to improve the quality of life of patients with diabetes and decrease the financial burden for society. The principle is innovative, because it includes automatic administration of both hormones while existing diabetes treatments still require manual administration. In addition, it uses glucagon as a means to control the glucose level of the patient instead of only using it as a last resort. Moreover, the startup was able to integrate all the components into a single device while other research groups focusing on the artificial pancreas still use separate devices to administrate hormones and measure glucose levels. Developing all the required resources in-house for development, production and distribution is beyond the scope of the startup. Therefore it needs to collaborate with a wide range of partners to develop, produce and market the artificial pancreas. Additionally, in the medical device development process resources, such as intellectual property, distribution networks and production facilities are largely controlled by large, established and therefore powerful firms. As a result, startups often have to collaborate with these players to successfully innovate (Aaboen et al., 2011).

The ability to mobilize and leverage the resources of a partner in the resource network by the startup based on the 4R model was used to identify the current power position of the startup and its partners. Mobilization is defined as the ability of an organization to bring resources into use for a particular purpose, while leverage is the capability of an organization to use a resource to maximum advantage. Asymmetry is explored in a different way to many previous studies on asymmetry (Johnsen and Ford, 2008, Chen and Chen, 2002, Blomqvist, 2002). It is common to determine power asymmetry based on the importance, possession and concentration of the resources of a partner (Astley and Sachdeva, 1984, Pfeffer and Salancik, 2003). Though, in a network world an organization's resources and its ability to exploit them are not generalized properties of the actors itself. As a result considering actors from the interaction perspective requires the determination of power position based on the ability to mobilize and leverage the resources of others in the network. If an organization is able to exploit the substantial resources of a connected partner, it will be perceived as strong in resource terms (Anderson et al., 1994). Thus, the reverse also applies; the startup will be regarded as the weaker party when it experiences difficulties in mobilizing and leveraging the resources of other actors.

### **Data collection and analysis**

A retrospective analysis is conducted from the start of the project in 2004 up to point of entry into the ongoing situation in April 2013. Thereafter the startup is followed in real time until the end of April 2014. The combination of the retrospective analysis with real time longitudinal research allows both detection of substantial changes in partnership and resource interaction over large windows of time as well as capturing the ongoing development of relationships as they emerge (Bizzi and Langley, 2012, Leonard-Barton, 1990). The analysis is based on empirical data collection from three different sources to capture the complexity of the asymmetric power relationships (Bizzi and Langley, 2012). In addition, the use of 'big three' of qualitative research eliminates chance as much as possible which is essential since the research is based on a single case (Doorewaard and Verschuren, 2010, Gibbert et al., 2008). First of all nine semi-structured interviews were held with key persons from the relationships between startup and its powerful partners. The selection of interviewees was based on (1) direct interaction with the other partner(s) in the partnership and (2) the direct involvement into the innovation project. These interviews took approximately 45 minutes. The interviews were structured around the resource interaction between the actors over time, the challenges the startup faced in collaborating with powerful partners and the strategies used to deal with these challenges. However the interviews were flexible enough to leave room for discussion and enable interviewees to give examples and expand on important events and situations. The interviews involved sensitive, confidential, and political issues regarding the relationships with the startup. Consequently, it was important to maintain confidentiality. Therefore, the names of case organizations and interviewees were made anonymous. All interviews in this research were tape-recorded and transcribed. Furthermore, direct passive and active participant observations are carried out during the researcher's stay at the startup from April 2013 until April 2014. Observations were carried out to discover the discrepancies between what participants say they do and what they actually do. To reduce hindsight bias every once a week a short evaluation report was written based on the field notes taken during that week. In order to complete the 'big three' archival documents, like non-disclosure agreements, project descriptions, patents, and the like are used. In table 1 and 2 an overview can be found of the data sources divided in primary and secondary.

<b>Interviews</b>				<b>Passive observation</b>
<i>Organization</i>	<i>Interviewee</i>	<i>Date</i>	<i>Length</i>	
Teaching hospital	First PhD student	2-7-2013	29 min.	On average four days a week for six months
Startup/teaching hospital	Second PhD student	21-6-2013	34 min.	
Startup	Entrepreneur	20-6-2013	101 min.	
Startup	Informal investor	28-7-2013	54 min.	
Health fund	Head knowledge	3-7-2013	28 min.	
Teaching hospital	Project leader	2-7-2013	32 min.	
Technical university	Director	24-7-2013	55 min.	
Market leader	Head business	28-7-2013	51 min.	
Research institute	Manager SME	25-7-2013	42 min.	

**Table 1. Primary data sources**

<b>Internal data</b>	<b>External data</b>
63 pages of interviews	9 articles about the innovation project
72 pages of project description	15 web pages of partners
15 pages of observation diary	
120 pages of presentations and reports	
2 contracts	

**Table 2. Secondary data sources**

To analyze the recorded interviews as well as the diary reports and archival documents, ATLAS software was employed. The data were coded using content analysis techniques. In step one the resource interaction over time was mapped based on the 4R model. During this process four periods could be distinguished each of them covering the development of a new prototype. In the second step the power position of the actors in the network of the artificial pancreas was determined in respect to the startup. For this purpose the ability of the startup to mobilize and leverage the resources of a particular partner was assessed. In step three the challenges that the startup faced in collaborating with powerful partners were identified. The challenges closely resembled the ones identified in earlier work (Johnsen and Ford, 2008, Mouzas and Ford, 2007, Das and He, 2006, Faems et al., 2012, Prashantham and Birkinshaw, 2008). In the fourth step was explored how the startup strategized in its asymmetric relationships to handle these challenges. The last step involved researching how the strategies of the startup influenced the resource interaction process.

## **CASE ANALYSIS**

The 4R model is used to map, classify and analyze the processes of resource interaction in the network around the development of the artificial pancreas. The 4R model for the different phases of the innovation process can be found in appendix A until D. Below the resource interaction between the inter-organizational units is described in detail.

### **Development of prototype 1 from 2003 till 2005**

In 2003 the entrepreneur paid a visit to his diabetes nurse for his yearly checkup. Over the years he became more and more dissatisfied with available treatment methods for this disease. That evening he decided to do something about it, and invented the working principle of a new system: a bi-hormonal artificial pancreas. The algorithm is the most essential component of the device, because it calculates the required amount of insulin or glucagon based on the glucose values send to the device. However, the entrepreneur lacked the necessary knowledge

to develop and program a control algorithm. As shown in appendix A, he mobilized the support of two friends. The first is a diabetes nurse with in-depth knowledge about the effects of insulin and glucagon on future glucose levels. By connecting their medical skills and practical experience, the entrepreneur and his friend were able to develop an algorithm. However, neither of them had the skills to translate the algorithm in computer code. Therefore, the entrepreneur asked a second friend of him, an experienced software developer, to program the algorithm for the administration of insulin and glucagon in standard laptops bought from a computer supplier. Furthermore, the diabetes nurse provided some essential components of the device, such as the sensors and infusion sets. These components were readily available in the market. To not reinvent the wheel and spill valuable resources, the artificial pancreas was designed to be compatible with existing components as much as possible. The entrepreneur himself designed the internal mechanics of the device. He left the production at a supplier of mechanics that he had done business with in the past. In the 4R model presented in appendix A is demonstrated that by combining the laptops with algorithm code, the mechanics and the existing components, the first artificial pancreas prototype with the size of small closet was developed. As early as 2004, they were able to test the artificial pancreas on the entrepreneur. When it seemed to work well the entrepreneur was able to test the device on few more diabetic patients via his own treating physician in the local hospital. The local hospital did not only have the facilities needed to conduct a small scale test, but also the medical knowledge required when something might go wrong. In addition, the hospital provided some insulin, glucagon, infusion sets and sensors. The findings of the experiment were promising, and the friends decided to start the development of a second prototype.

#### **Development of prototype 2 from 2005 till 2011**

The three friends wanted to substantially reduce the size of the device. To be able to do that they could not use standard laptops any longer. Consequently, they had to design and develop parts of the electronics themselves, but neither one of them had the right expertise in this field. As shown in appendix B, the entrepreneur hired a self-employed electronic engineer on a project basis for this purpose. The developer had worked with the entrepreneur in previous projects. The electric engineer designed the electronics based on regular software and in turn assembled into the artificial pancreas. In 2007, the entrepreneur decided that it would be worthwhile to patent a part of their invention. According to the informal investor a patent simplifies cooperation, *“because otherwise you can be swallowed up by large firms or your own partners.”* The algorithm it was decided to keep it a trade secret, since it is difficult to imitate even when the product is re-engineered. Nevertheless, the progress stagnated between 2006 and 2008 for two reasons. Firstly, the previous prototype was developed out of private funds of the entrepreneur, software developer and diabetes nurse. However, this was not sufficient to finance the next stage of the development process. In 2008, this problem was solved as the entrepreneur found the husband of a befriended couple, an informal investor, willing to invest financial resources in the newly founded startup. Secondly, the startup lacked an appropriate partner to carry out official clinical trials. Proving the performance of the artificial pancreas in official trials was of crucial importance to be able to attract additional resources and gain the attention of new partners. Because the local hospital was not affiliated with a university, it did not have the resources to take the risk of setting up official clinical trials nor had the knowledge of how to perform medical research. It took the startup two long years of effort to mobilize the teaching hospital to conduct official clinical pilot trials. In 2007 there appeared an article about the test result accomplished in the local hospital with the artificial pancreas in a diabetes magazine. Via the publication the entrepreneur got in touch with a physician specialized in diabetes. Regrettably, he did not have an interest in the techniques behind diabetes treatment nor had his hospital the required testing facilities.

Nonetheless he referred the startup to the head of the clinical diabetology research group of the teaching hospital. This group appeared to be the only one with expertise in the field of testing medical devices in the Netherlands. The hospital was according to the head of the group willing to collaborate, *“because we do not have technical engineers that can develop diabetes technology in-house. However, we have access to patients and clinical expertise.”* In addition, they saw potential in the further development of the artificial pancreas based on the test results of the first prototype. Although the teaching hospital received shares of the startup in exchange for their services, the agreement to collaborate did not smoothly result in a clinical trial. It took until 2010 for the first official pilot trials were carried out. The effort of the teaching hospital was limited, because besides the innovation project of the startup it was also involved in another European project with a much larger budget. In the words of the entrepreneur the startup is for the center just *“a drop in the ocean”*. As a consequence the startup had to put a lot of effort in setting up and carrying out the trials itself. As the entrepreneur explains the PhD student was *“the driving force, but she could not have done it on her own without our support. You have to monitor patients continuously for 60 hours; you cannot do that on your own... We did it we the four of us [the entrepreneur, diabetes nurse, software developer and informal investor] and the PhD student”*. By the end of 2011 two clinical trials were conducted that both showed encouraging results. Therefore, the startup started to further reduce the size of the artificial pancreas.

### **Development of prototype 3 from 2011 till 2012**

The two official clinical trials that were carried out by the teaching hospital had two important functions. Firstly, the results of the trial were published in scientific medical journals. In turn the startup presented the findings of the research in initial meetings with potential partners. As shown in appendix C, the startup came into contact with the health foundation for diabetes in the Netherlands in this period. As the head of research department recalled, the inventor *“was at a donor meeting that we organized. There I got involved in a conversation with him in which he told me what he was doing. Then we arranged a meeting, and he showed us what he had developed.”* The health foundation is the largest financier of diabetes related research in the Netherlands. Consequently, the informal investor of the startup expected *“that you may have received funding from them, but that failed”*. It was difficult to leverage the financial resources of the health foundation, because it had a strong emphasis on research focused at curing diabetes at universities and teaching hospitals. As a result the head of the research department, who would have liked to finance the startup’s project, experienced strong opposition from the internal scientific auditing committees. Anyhow, according to the head of research the health foundation does not only provide financial support. The organization can *“also help by getting them in touch with other parties and researchers... We often can help people in other ways to find solutions for diabetes.”* For example, the health foundation brought the startup into contact with a Dutch research institute. The foundation organized a meeting for research institutes and industry centered around the development of new glucose sensors. During the pilot trials it appeared that the existing sensors used were not accurate enough. Unfortunately, the development of a new sensor would delay the market introduction of the device with at least two years. The startup believed this was not a reasonable solution due to the stiff competition from other research groups. Nonetheless, the entrepreneur discovered that by altering the electronics that allow for the communication between the sensor and the artificial pancreas the accuracy could be improved. Therefore, a new sensor transmitter compatible with existing sensors was designed. Although new sensor development was not feasible on the short-term, the startup desired to develop a new sensor that could be used in next generations. The research institute had initial ideas about the working principle of a sensor that would not only based on more accurate technology, but also could be produced

at lower costs. However the institute lacked the opportunity for a practical application in the market, while the startup did not have the required knowledge to design the sensor. So, quickly after the meeting the startup and research institute started a four year research project to develop the new sensor, see appendix C. The informal investor explained *“we now have co-financing project in which you have steps from 10, 25, 50, and 100 percent that you have to fund yourself. The steps develop from scientific research to market authorization resulting in the exclusive rights.”* During the first stage of the project the startup was able to take advantage of the knowledge of the research institute regarding the technology used in the new sensor. Secondly, the results of the first two clinical pilot trials carried out with the artificial pancreas formed the basis of the improvements made in the third prototype. The startup still used as much existing components as possible which were mainly provided by the teaching hospital, see appendix C. Nevertheless they optimized the parts of the device that were developed in house, like the design of the mechanics and the algorithm code. However, the most important change was in the size of the device. The startup made an artificial pancreas about the size of a laptop. As a consequence the startup and the teaching hospital were able to test the product in a home-situation. Before the artificial pancreas could only be tested in a hospital setting, because it was not wearable. The results of the two day test showed that the device performed as well as the regular diabetes treatment on day one and better on day two. The promising results gave the startup reason to take the project to a next level.

#### **Development of prototype 4 from 2012 till 2014**

When the first pilot trial in a home situation demonstrated good results, the project was given a substantial boost in three ways. Firstly, the startup won the audience award of the diabetes health foundation. The audience award generated a lot of attention from the media for the artificial pancreas. In this way, the project was picked up by the international business leader CGM of one of the market leaders in the diabetes device market, see appendix D. He recalled that *“once we organized a meeting in our head quarter, and they showed us their concept. The progress of the development of the device exceeded the expectations of our technicians.”* The relationship is still in an exploratory phase. According to the inventor they are *“just cuddling... The underlying rationale is that they want more if it is successful, but not yet in this phase”*. The market leader said that it want to invest more resources as soon as the results of the three trails carried out in the European project are positive. At this moment, the partners just exchange some resources, such as knowledge about the device, pumps and raw data from the clinical tests, to maintain the relationship. Secondly, as shown in appendix D, the startup started a trajectory at a Dutch notifying body to acquire the CE mark for its product. Without the marking the device will not be allowed on the European market. However, as long as the startup meets the specifications of the notifying body and pay the fees, it will be able to acquire the CE mark. Lastly, the startup and the teaching hospital decided to apply for funding from the Seventh Framework Programme for Research and Technological Development from the European Commission. As shown in appendix D, the project involves five other organizations: a medical university (AT), an established industry player (DK), a clinical research institute (DE), a software firm (TR), and an technical university (NL). The first three were partners of the teaching hospital in parallel project, while the latter two were attracted via personal relationships of the informal investor. The head of the diabetology group explained that cooperating with existing partners is a great advantage in the early stages of the project. As a result the partners could write a good proposal for the subsidy call relatively quickly and were granted the funding. The funding allowed the startup to build a fourth, even smaller, prototype that would be suitable to introduce in the market. In addition, the project would cover the cost of three additional clinical trials. This substantially encouraged of the teaching hospital to invest time, money and knowledge in the project. For example, a new

PhD student was hired that would be specifically responsible to design and conduct all three trials. The student is located at the startup to enhance the knowledge exchange between the partners. The startup recognized that starting such a formal project, like any other relationship, does not automatically result in exchange of resources. The startup motivated and gained the trust of the other project partners by sharing the results of their achievements. The partner lacked motivation for the innovation project, because in large organizations as well as government funded projects people are not directly responsible for relationship or project successes. The SME manager of the research institute acknowledged that *“you can just do research according to plan. Of course, there is a European Commission that requires that the plan is implemented. However, there is nobody that is knocking on your door because you are too late or because it does not work... On the other hand with large companies you have a totally different culture. Sometimes the involved employees of a company are less committed, because it is not their own money.”*

The development of the artificial pancreas was not only boosted, but also delayed by a conflict with the research institute. The research institute wants to involve the startup in one of their multiple party research programs. However, the conditions of the research program are quite different. It will enable the startup to divide the costs of the project among multiple project members, but all members will be entitled to use the patent without paying a license fee. For that reason the startup hesitates to become involved. First the startup wants that exclusive rights to the patent are guaranteed, but until now the research institute has refused to do so. Nevertheless, the research institute is obliged to comply with the current contract as long as the SME does not agree to suspend it. The re-negotiations now take about a year, and since that time the progress of the joint project slowed down substantially. Although the delay is not risking the development of the fourth prototype, the renegotiations cost the startup precious resources. Furthermore, the startup puts time and effort in attracting finance from the health foundation. After four years of negotiating, the partners found a way to circumvent the assessment committee. The startup, health foundation, teaching hospital, and technical university applied for a funding program of the Dutch government. Regrettably, the funding was not granted mainly because the fourth prototype of the artificial pancreas was not yet fully developed. The failure emphasized the importance of achieving short-term results quickly and sharing them with potential and existing partners. Another crucial aspect in the development of the artificial pancreas is the lack of a stable and cheap glucagon. Currently, glucagon is only used as a last resort in case of extremely low blood glucose values. As a result glucagon is, in its current form, only stable for 24 hours and then has to be thrown away. In contrast the startup wants to use glucagon on a continuous basis. If patients have to throw away the unused glucagon every day, the costs for treatment with the artificial pancreas will skyrocket. Thus, the development of a new glucagon is crucial for the success of the artificial pancreas. However, as a report of the startup states *“for the development of the glucagon dependent on external partners which makes it difficult to control... It [the industry player] is a very trusted partner. The company will deliver the glucagon in the near future, but takes its time to develop the best possible solution. Therefore, we need an alternative when its glucagon development is delayed.”* Having an alternative for every single relationship is important strategy of the startup. As the entrepreneur explains *“we carry out plan A, but we always have a plan B may plan A not work out as expected”*. In conclusion, the startup interacts with a growing amount of organizational-units over the years to acquire the necessary resources for the development of the artificial pancreas. A few of the partners could be considered as powerful. In these relationships it experienced had to conquer several challenges. This issue is further explored in the next section.

## DISCUSSION

This paper started off with the research questions how can you determine the power position of a startup based on the 4R model, which strategies does a startup use to develop its position and how does this influence the resource interaction process. Based on the analysis of the 4R model surrounding the artificial pancreas, the power position of the startups partners relative to the startup was determined. In table 3, a specification of the startups ability to mobilize and leverage resources can be found. In appendix A until D, the bold line around an inter-organizational unit suggests that it was difficult for the startup to mobilize and leverage the resources of that unit. The results show that the startup faced challenges in mobilizing and leveraging the resources of eight partners: teaching hospital, technical university, health fund, industry player, market leader, medical university, research university and software firm. In the next part, the challenges the startup faced in these relationships are explained, what strategies it used to conquer these challenges and how this effected the resource interaction. The results are briefly summarized in table 4.

	Phase 1		Phase 2		Phase 3		Phase 4	
	<i>Mobilze</i>	<i>Leverage</i>	<i>Mobilze</i>	<i>Leverage</i>	<i>Mobilze</i>	<i>Leverage</i>	<i>Mobilze</i>	<i>Leverage</i>
Teaching hospital			<b>Hard</b>	<b>Hard</b>	<b>Hard</b>	<b>Hard</b>	<b>Hard</b>	<b>Less hard</b>
Clinical research institute							Easy	<b>Hard</b>
Computer supplier	Easy	Easy						
Diabetes nurse	Easy	Easy						
Electrical engineer			Easy	Easy	Easy	Easy	Easy	Easy
Electrical supplier			Easy	Easy	Easy	Easy	Easy	Easy
Technical university							Easy	<b>Hard</b>
Health fund					Easy	<b>Hard</b>	Easy	<b>Hard</b>
Industry player							Easy	<b>Hard</b>
Local hospital	Easy	Easy						
Market leader							<b>Hard</b>	<b>Hard</b>
Mechanic supplier	Easy	Easy	Easy	Easy	Easy	Easy	Easy	Easy
Medical supplier							Easy	Easy
Medical university							Easy	<b>Hard</b>
Notifying body							Easy	Easy
Regional hospital							Easy	Easy
Research institute					Easy	Easy	Easy	<b>Hard</b>
Software firm							<b>Easy</b>	<b>Hard</b>
Software developer	Easy	Easy						
Software supplier			Easy	Easy	Easy	Easy		

**Table 3. Ability of startup to mobilize and leverage resources of partners**

However, first three points deserve to be highlighted regarding the determination of the power position of the startup partners based on the 4R model. Firstly, as can be seen in table 3 not all established partners of the startup had a favorable power position. Although all the powerful partners of the startup were established organizations, it was not a sufficient condition to have a relative better position in comparison to the startup. For example, the component suppliers often were established firms, but because they were easily replaceable and the startup did not experience difficulties in mobilizing and leveraging their resources. Also, the local and regional hospitals were in a relatively balanced power relationship with the startup. This was mainly caused by the close personal contact with key individuals in the organizations. This

<b>Challenges</b>	<b>Strategies</b>	<b>Effect</b>	<b>Empirical examples</b>
Difficult to gain access to and attention from	Referrals of existing ties	Find actors with desired resources	Contact with teaching hospital was established via an acquainted physician, and with market leader via the health foundation Three of the partners in the European project were attracted by the teaching hospital, two via personal relationships
	Public exposure	Get contacted by actors with relevant resources	Startup came in contact with health foundation at one of their donor meetings Startup was contacted by market leader after media exposure after winning the audience award of the health foundation
Lack of commitment to the startups innovation	Demonstrate skills	Motivate partner to invest resources	Market leader and teaching hospital were convinced to collaborate after the good clinical test results Research institute was motivated to collaborate, because the startup had sufficient access to financial resources
	Share resources	Combine resources to achieve desired objective	Market leader expects resources, like raw test data, in return for its own investments, such as the gearboxes Startup had to invest own time, money and human resources to carry out the first three clinical trials
Dispensability of the startup	Goal complementarity	Value creation potential of combining resources	Startup has the device and teaching hospital the skills which are both necessary to conduct clinical trials Startup has the invention and market leader has production and distribution facilities which are both necessary to innovate
	Compatibility	Lower dependence on a single actor for resources	Startup always tries to have a plan B, if plan A may not work. As it has an alternative developer of glucagon. Several components can be bought by multiple suppliers lowering dependence on a single component supplier
Opportunistic behavior of the powerful firm	Formalization	Avoid unwanted transfer of resources	Contract with the research institute prohibits transfer of knowledge to other project of the institute Market leader cannot imitate the artificial pancreas one-to-one due to the combination of patent and trade secret
		Improve willingness of partner to share resources	Teaching hospital was willing to conduct trials because they gained 5 percent of the startups shares NDAs with the established partners ensured their willingness to share the relevant knowledge

**Table 4. Startups mobilizing and leveraging resources in interaction with powerful partners**

<b>Challenges</b>	<b>Strategies</b>	<b>Effect</b>	<b>Empirical examples</b>
Unilateral determination of relationship characteristics	Informality	Build stable, trusting resource exchange relationship  Increase ability to integrate relevant resources	Head of research of the health foundation is still looking for appropriate form of collaboration Showing the results of ongoing development with partners build trust and motivates Face-to-face meetings enable the transfer of knowledge with the various more powerful partners Co-location of staff enables the integration of knowledge with the various established partners

**Table 4. Startups mobilizing and leveraging resources in interaction with powerful partners (continued)**

finding contests the widely held assumption in asymmetry literature that organization size and/or age is synonymous with a position of power (Vandaie and Zaheer, 2014). This underwrites the findings of Gardet and Fraiha (2012) who have shown that that small size is not synonymous with a position of dependence. Secondly, the determination of power based on resources that nominally in ownership of a certain actor and the 4R model yields different outcomes. For instance, based on the resource control argument the notifying body would have considerable power relative to the startup, because it controls the allocation of the CE mark. However, the ability to mobilize and leverage the CE mark is almost entirely in the startup's own hands. As long as it pays for the services of the notified body and meets the legal requirements to get the mark, the notified body has no reason to withhold it. Thus, it may be interesting to compare the two approaches in future research to see if they are actually complementary or opposite ways to identify the relative power position of actors. Thirdly, it was observed that power changes. The power position of the teaching hospital and the research institute changed. In the first case, the startup was better able to mobilize and leverage the resources, because the commitment of the teaching hospital increased after the start of the European project. In the second case, the startup experienced considerable delays in the sensor development project with the research institute after the research institute wanted to change the specifications of the project. Lee and Johnsen (2012) provided a first step in demonstrating how the characteristics of asymmetric relationships evolve during the stages of the relationship. However, more research is needed in this area that explains how and why power position in asymmetric relationship change.

#### **Referrals and public exposure to gain access to and attention from**

The startup experienced great difficulties in mobilizing the resources of powerful partners in the early stages of the innovation process. For instance, it took about two years before the company found the teaching hospital prepared to conduct the official clinical trials. This is in line with previous findings in literature that found that is hard for a startup to get access to and attention from powerful partners (Prashantham and Birkinshaw, 2008, Mouzas and Ford, 2007, Das and He, 2006). The startup used two strategies improve its ability to gain access and attention from the powerful partners. Firstly, the startup gained attention from new partners with desired resources by deliberately using the mediating function of existing ties. For example, the startup was referred to the teaching hospital by a physician whom the entrepreneur met in reaction to a magazine publication. In addition, the health foundation connected the startup to the research institute, the financial investor used his personal relationships with key individuals in to attract two partners to the European project and the teaching hospital brought in three partners for the same project. Secondly, the startup consciously took advantage of the attention from the media for the project. Like when the startup got in touch with the market leader after winning the audience award of the health foundation or when the startup gained the attention of the health foundation at a donor meeting. The findings confirm that to engage in a relationship with a powerful partner a startup will attempt to build 'bridges' between itself and the potential partner (Prashantham and Birkinshaw, 2008). For this purpose, the referrals of prior ties and exposure of the project in public were important for the formation of new partnerships. The importance of prior ties for forming new relationships is widely recognized in the literature by authors like Berends et al. (2010) and Larson (1992). In contrast the significance of public exposure gained less attention in the literature. Ritter and Gemunden (2003) mentioned the use of external information sources to identify potential partners which implicitly assumes that if you have a prominent presence in the media you can be found easier by potential partners. However, this issue has remained underexposed so far. In conclusion, the deliberate use of referrals of existing ties and public exposure increased the visibility of the startup in the network. This made the startup better able to rise up to the challenge of gaining access to and attention from

powerful partners. In the end, this made easier to find potential partners with relevant resources as well as get in touch with them. The need to attract and gain attention from powerful partners is inevitable for startups before it can actually mobilize its resources. Therefore, it is expected that startups are better able to mobilize the resources of powerful partners by increasing their visibility in the network using the referrals of existing ties and public exposure.

### **Demonstrate skills and share resources to gain the commitment**

The startup found it difficult to mobilize and leverage the resources of the powerful partners, because they lacked sufficient commitment to invest resources in the startup's innovation. The reason for the lack of commitment is threefold. Firstly, the teaching hospital lacked commitment to the innovation project, because the startup was only 'a drop in the ocean'. Secondly, it appeared to be problematic to leverage the resources of the partner in the European project, since most employees executing the project are not directly responsible for the results of the project. Thirdly, the market leader wants to get access to and keep updated with the innovation, but is unwilling to invest relevant resources until the success of the artificial pancreas is proven. The findings support current literature that suggests that it is a challenge for the less powerful partner in the asymmetrical relationship to gain commitment of the other in resource terms (Das and He, 2006, Faems et al., 2012, Lawton Smith et al., 1991). In the early stages of the relationship, the startup coped with the commitment challenge by demonstrating its skills to partners. It showed off its achievements through the developed prototypes, the initial test results and its financial resources to mobilize desired resources. Multiple powerful partners, like the market leader and the teaching hospital, were willing to commit to the startup's project in the first place, because they were impressed by the prototypes and the test results. Also, the sound financial resource base of the startup was a reason to collaborate for the research institute. In the later stages of the relationships, the startup conquered this challenge by sharing its own resources with the powerful partner. During the execution of the first three clinical pilot trials, for example, the startup invested a lot of its own time and effort to support the teaching hospital. In return the teaching hospital was prepared to devote one of its fulltime PhD students to the innovation project. Also, the nascent relationship with the market leader is maintained by feeding them occasionally with valuable resources, such as raw data. In response the market leader gave the startup gearboxes that could be implemented in the artificial pancreas. Indeed, Rousseau et al. (1998) argue that the information and resources available from repeated interaction between partners leads to the emergence of trust in the performance and behavior of the partner. In turn this results in the commitment to and interest in the outcomes of the relationship. This increases the ability of the startup to mobilize and leverage the resources of the powerful partners in both the early and later stages of the innovation process. The result confirms the suggestions of existing literature that developing a reputation of valuable cooperators is important for the startup to be able to capitalize on point of the relationship (Prashantham and Birkinshaw, 2008, Johnsen and Ford, 2008, Mouzas and Ford, 2007). Thus, by proactively demonstrating skills and sharing resources the startup build a reputation as a trusted partner which motivated the partner to invest resources in the relationship to achieve desired objectives. As a result it is expected that startups have a greater chance of mobilizing and leveraging the resources of powerful partners when it demonstrate its skills and shares its resources with them to build trust and increase their commitment.

### **Goal complementarity and compatibility to guard against dispensability**

For the startup the relationship with a powerful partner is often vital to its survival, but the reverse is generally not the case. For instance, if the startup was unable to find the teaching hospital prepared to conduct official clinical trials, it would have become extremely difficult to find a foreign partner willing to the tests. However, the teaching hospital has access to multiple devices to treat diabetes. Moreover, the development of the glucagon is crucial for the usability of the artificial pancreas in the market and thereby the success of the startup. Yet, if the development of glucagon fails it is not detrimental to the success of the industry player which has wide portfolio of other opportunities to rely on. This confirms that whereas the asymmetric relationship is often a matter of life and death for the startup, the more powerful firm sees it as a strategic option, and little more (Faems et al., 2012, Prashantham and Birkinshaw, 2008, Mouzas and Ford, 2007). The startup handled with this dispensability in two ways. Firstly, it believed that goal complementary was the basis of a good relationship. The company only engaged in a relationship when the goals of both were complementary. For example, the startup needed clinical trials to prove the working principle of the artificial pancreas, but it lacked financial resources and required knowledge to set these up. On the other hand, the teaching hospital aims to research the efficiency and effectiveness of medical devices, but it lacks the technical capabilities to develop them. The same goes for the startup and the market leader; the startup has the invention while the market leader has the production and distribution facilities. This supports the finding of Pérez et al. (2012) who found that a dual appropriation of value where each partner fully appropriates a different and unique value from the relationship may be beneficial for asymmetric relationships. When the objectives are complementary, a foundation of common understanding and the means to achieve the mutual goals is established among partners. As a result the consensus on goals and motivations is a necessary condition to ensure the flow of resources necessary for successful innovation. When partners have contradicting goals inter-partner conflicts may arise which inhibits the flow of resources between partners (Emden et al., 2006, Pullen et al., 2012). Secondly, the startup ensured that it could quickly switch to alternative partners. The startup's artificial pancreas is designed in such a way that is compatible with existing sensors, infusion sets, etc. of multiple suppliers. This strategy did not only ensured that it would not spill valuable resources on reinventing the wheel, but also protected the company from becoming too dependent on a single supplier. Even when one the supplier may decide to stop supplying the key components, the startup can easily switch to another. Furthermore, the startup developed for every key relationship a backup plan so that when the relationship failed or not worked out as expected, it could fall back on its alternative. The finding emphasizes the importance of keeping as many options open as long as possible (Prashantham and Birkinshaw, 2008). Especially, when the startup is unable to establish complementary goals with a powerful partner the only strategic option may be to have alternative partners to fall back on (Johnsen and Ford, 2001). In conclusion, when the startup ensures goal complementarity, but stays compatible to alternatives in the network it lowers the chance that it will suddenly not be able to mobilize and leverage relevant resources any longer. Goal complementarity ensures that both the startup and more powerful partner can create value by combining the resources in the relationship. This will lower the chance that the powerful partner will terminate the relationship. Compatibility to alternatives enables the startup to quickly switch to alternative partners when necessary. This guarantees a continuous access to the relevant resources. Therefore, it expected that goal complementarity and compatibility to alternatives will ensure a more stable flow of necessary resources for the startup.

### **Formalization to protect against the opportunistic behavior**

The consequences of opportunistic behavior from partners in asymmetrical relationships resulting in unwanted resource spillovers can be detrimental for startup (Colombo et al., 2012, Rosenbusch et al., 2011, Sawers et al., 2008). This is shown by the delays the startup experienced in the project with the research institute. Also, the wait and see attitude of the market leader can be seen as opportunistic behavior. It tries to stretch the innovation project as long as possible to not capitalize on its own existing products, only when the startup's product has proven its value or competitors enter the market with similar products it will invest. The startup handled the potential opportunistic behavior of the powerful partners by closing formal, written agreements, such as contracts and NDAs, with them at the start of the relationship. If the startup would not have covered the agreement in a contract beforehand, the research institute would be able to spill the knowledge of the project over to the multiple partner research program leaving the startup with nothing. Although the startup still experiences the negative aspects of the willingness of research institute to change the specifications of the relationship, it would have been worse off if it did not have a contract. Anyhow, by capturing the agreement in contracts in each single partnership, the startup deliberately safeguarded their resources from being appropriated by the potentially opportunistic partners. The importance of the formalization of agreements in contract is acknowledged in contemporary literature for relationships in general (Dekker, 2004, Hoffmann and Schlosser, 2001) and asymmetrical relationships in specific (Mouzas and Ford, 2007, Hurmelinna et al., 2005). In contrast Johnsen and Ford (2008) suggest that while small firms rely on written plans to give them support in working with the large company's objectives, "*written plans often backfired*" letting the large company hold the small firm to account on a particular issue (Johnsen and Ford, 2008). However, the example shows that "*contracts are needed in many situations and may end up being very useful*" (Hurmelinna et al., 2005, p. 375). The formalization of the agreements in contracts and NDAs had an additional unexpected side effect for the startup. The startup strongly believes that a formal agreement not only protect its own knowledge, but also motivates the powerful partner to share its resources with the startup. For instance, the teaching hospital was willing to do the clinical trials in exchange for five percent of the shares in the startup. Additionally, the partners were willing to share knowledge with the startup, because they closed a NDA beforehand. The latter findings confirms the propositions of Hoffmann and Schlosser (2001) that a NDA increases the transparency of the partner's complementary knowledge, and in turn improves the startups capability to mobilize and leverage resources from partners. Furthermore, the startup protected its core knowledge of the artificial pancreas in a patent while keeping the algorithm a trade secret. The company believes that in this way, it can protect itself from imitation by large firms. It can be questioned if the startup has sufficient resources to sue when the patent is infringed, but the trade secret gives it the security that a large firm cannot imitate it one-to-one at least. The patent also prevents other companies from patenting a similar device and thus gives the startup the freedom to operate. This finding support the results of Katila et al. (2008) who show that startups take the risks associated with established partners when they have effective defense mechanisms to protect their own resources. Hence, formalization had a two-sided effect. It lowered the ability of the powerful partner to mobilize and leverage the resources of the startup. In this way, the startup was able to avoid unwanted transfer of core resources. While it increased the ability of the startup to mobilize and leverage the resources of the powerful, because the formalization increased their willingness to share relevant resources. Thus, it is expected that formalization makes it easier for the startup, but harder for the powerful partner, to mobilize and leverage resources in the relationship.

### **Informality to determine relationship characteristics**

Johnsen and Ford (2008) found that large partners in asymmetric relationships can often unilaterally define the characteristics of the relationships. In the case of the startup the powerful partners were often able to unilaterally determine which resources it could leverage, the amount of knowledge exchanged and the conflict resolution mechanisms used. Firstly, the startup was unable to leverage the financial resources of the health foundation due to its traditional focus on fundamental research in knowledge institutes. The startup tried to solve this issue by keeping close contact with the head of research department. Together with him the startup found a way to circumvent the internal auditing committees. Although the attempt failed it showed the startup that by maintaining informal relationships with key individuals it can better leverage the partner's resources. Secondly, the startup was unable to determine the conflict resolution mechanisms used in the European project. As a result the startup had difficulties in solving conflicts with some of its partners within the project. However, when the partners got to know each other in a more informal way, the startup was able to directly raise the issue with the partner instead of following the predetermined paths. Thirdly, the startup was unable to define how much knowledge was exchanged in multiple of its asymmetric relationships. According to the company the solution was to establish informal communication mechanisms, such as transfer of staff and social events, within the relationship. The informal means of communications especially allowed the startup to identify, link, use and develop tacit, complex and ambiguous knowledge of the more powerful partner to their own. In the first two instances the startup build informal relationships with the powerful partner with goal of building stable, trusting relationships. As mentioned before, relationships low in inter-firm conflicts are conducive to the flow of resources between partners (Pullen et al., 2012, Emden et al., 2006). In the latter instance, the informal relationships helped the startup to integrate the relevant resources of the partner organization with their own. In this way, its ability to leverage the resources of the partner is improved. The findings confirm that informal communication is in general important for a good relationship, but especially for startups to influence the characteristics of the relationships (Johnsen and Ford, 2008, Gardet and Fraiha, 2012, Schreiner et al., 2009, Mohr and Spekman, 1994). Thus, the startup is expected to be better able to build stable, trusting exchange relationships and integrate the partner's resources with its own when it builds informal relationships with key individuals in the partner's organization.

### **CONCLUSION**

The focus of this paper was on establishing the power positions of actors based on the 4R model, exploring the strategic actions startups take to be better able mobilize and leverages the resources of powerful partners and research how these influence the resource interaction process. The case shows that it is possible to identify the power position of actors based on the 4R model. However, the analysis yields different outcomes than establishing the power position based on the actual control of the resources. In addition, it was demonstrated that not all established organizations have an unequal power position relative to the startup and that power positions change over time. Moreover, the case illustrates that startups can use five strategies to conquer the challenges associated with mobilizing and leveraging the resources in asymmetric relationships. Firstly, the startup increased its visibility in the network by using referrals of existing ties and public exposure. In this way, it was better able to find and get in touch with the actors controlling desired resources which made it easier to mobilize them. Secondly, the startup demonstrated its skills and shared resources to build trust and motivate the (potential) partner to invest resources to achieve the mutual goals improving the startup's ability to mobilize and leverage the powerful partner's resources. Thirdly, the startup build relationships with partners with a high goal complementarity while ensuring compatibility

with alternative partners. The first lowers the chance on conflicts which may negatively influences the resource flow between partners. The latter lowers the chance that necessary resources cannot be mobilized and leveraged any longer when a partner terminates the relationships. In both ways, the startup ensures a steady flow of resources that are necessary for the innovation process. Fourthly, the startup formalized the terms of the relationship and used formal intellectual property protection mechanisms to avoid unwanted transfer of resources to the powerful partner. Thus, the startup made it actually harder for the powerful partner to mobilize and leverage its own resources. The formalization had an unexpected side-effect. Namely, the formal contracts motivated the partners to share resources making it easier for the startup to mobilize and leverage their resources. Fifthly, the startup build informal relationships with partners to form stable, trusting relationships with the partner resulting in a steady flow of resources and to increase its ability to leverage relevant resources by integrating them with their own.

In this way, the research contributes to extant literature on asymmetrical relationships as well as the resource interaction approach by integrating the two streams of research. It directly connected the discrete challenges startups are confronted with in asymmetric relationships to the strategic actions taken to deal with these challenges and in turn the ability of the startup to mobilize and leverage the resources of the powerful partner. In addition, the power position of the actors in the resource interaction network of the startup was determined from a network perspective. Where extant literature either used size or the possession of resources as a proxy for the problems in asymmetric relationships. The findings of this research are also of relevance to startups considering to or that are cooperating with powerful partners in their resource interaction network. The research provides insight into the how the ability of a startup to mobilize and leverage resources of a particular partner determines the power position visa vie the startup. More importantly, it reveals the five strategic actions that can be taken to better exploit the resources in asymmetric relationships.

This paper also give some interesting directions for future research. First of all, the two ways – resource interaction and resource control – to identify the power position of actors can be compared. Secondly, the nature of changes in power positions can be explored in more depth. Thirdly, the paper focused on the strategies used by the startup to improve its power position in respect to the established firm. However, it can be expected, as shown in figure 1, that established firms use strategies to influence the resource interaction process as well. It may be valuable in future to take a two-sided perspective in which both the strategies of the startup and established organization are researched to see how these interact. A last avenue for future research may be to explore how the resource interaction and strategies in dyadic relationships influence the wider network.

## REFERENCES

- AABOEN, L., DUBOIS, A. & LIND, F. 2011. Start-ups starting up: Firms looking for a network. *The IMP Journal*, 5, 42-58.
- AABOEN, L., DUBOIS, A. & LIND, F. 2013. Strategizing as networking for new ventures. *Industrial Marketing Management*, 42, 1033-1041.
- ANDERSON, J. C., HÅKANSSON, H. & JOHANSON, J. 1994. Dyadic Business Relationships within a Business Network Context. *Journal of Marketing*, 58, 1-15.
- ASTLEY, W. G. & SACHDEVA, P. S. 1984. Structural sources of intraorganizational power: A theoretical synthesis. *Academy of Management Review*, 9, 104-113.
- BARALDI, E., GRESSETVOLD, E. & HARRISON, D. 2012. Resource interaction in inter-organizational networks: Foundations, comparison, and a research agenda. *Journal of Business Research*, 65, 266-276.
- BAUM, J. A. C., CALABRESE, T. & SILVERMAN, B. S. 2000. Don't go it alone: Alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal*, 21, 267-294.
- BERENDS, H., VAN BURG, E. & VAN RAAIJ, E. M. 2010. Contacts and contracts: Cross-level network dynamics in the development of an aircraft material. *Organization Science*, 22, 940-960.
- BIZZI, L. & LANGLEY, A. 2012. Studying processes in and around networks. *Industrial Marketing Management*, 41, 224-234.
- BLOMQVIST, K. 2002. *Partnering in the dynamic environment: The role of trust in asymmetric technology partnership formation*.
- BONNER, J. M., KIM, D. & CAVUSGIL, S. T. 2005. Self-perceived strategic network identity and its effects on market performance in alliance relationships. *Journal of Business Research*, 58, 1371-1380.
- CANTU, C., CORSARO, D. & SNEHOTA, I. 2012. Roles of actors in combining resources into complex solutions. *Journal of Business Research*, 65, 139-150.
- CHEN, H. & CHEN, T. J. 2002. Asymmetric strategic alliances: A network view. *Journal of Business Research*, 55, 1007-1013.
- COLOMBO, M. G., LAURSEN, K., MAGNUSSON, M. & ROSSI-LAMASTRA, C. 2012. Small business and networked innovation: Organizational and managerial challenges. *Journal of Small Business Management*, 50, 181-190.
- DAHL, R. A. 1957. The Concept of Power. *Behavioral Science*, 2, 201-215.
- DAS, T. K. & HE, I. Y. 2006. Entrepreneurial firms in search of established partners: Review and recommendations. *International Journal of Entrepreneurial Behaviour and Research*, 12, 114-143.
- DEKKER, H. C. 2004. Control of inter-organizational relationships: Evidence on appropriation concerns and coordination requirements. *Accounting, Organizations and Society*, 29, 27-49.
- DOOREWAARD, H. & VERSCHUREN, P. 2010. *Designing a research project*, The Hague: Boom Lemma Uitgevers.
- EMDEN, Z., CALANTONE, R. J. & DROGE, C. 2006. Collaborating for new product development: selecting the partner with maximum potential to create value. *Journal of product innovation management*, 23, 330-341.
- FAEMS, D., VAN LOOY, B., JANSSENS, M. & VLAAR, P. W. L. 2012. The process of value realization in asymmetric new venture development alliances: Governing the transition from exploration to exploitation. *Journal of Engineering and Technology Management*, 29, 508-527.

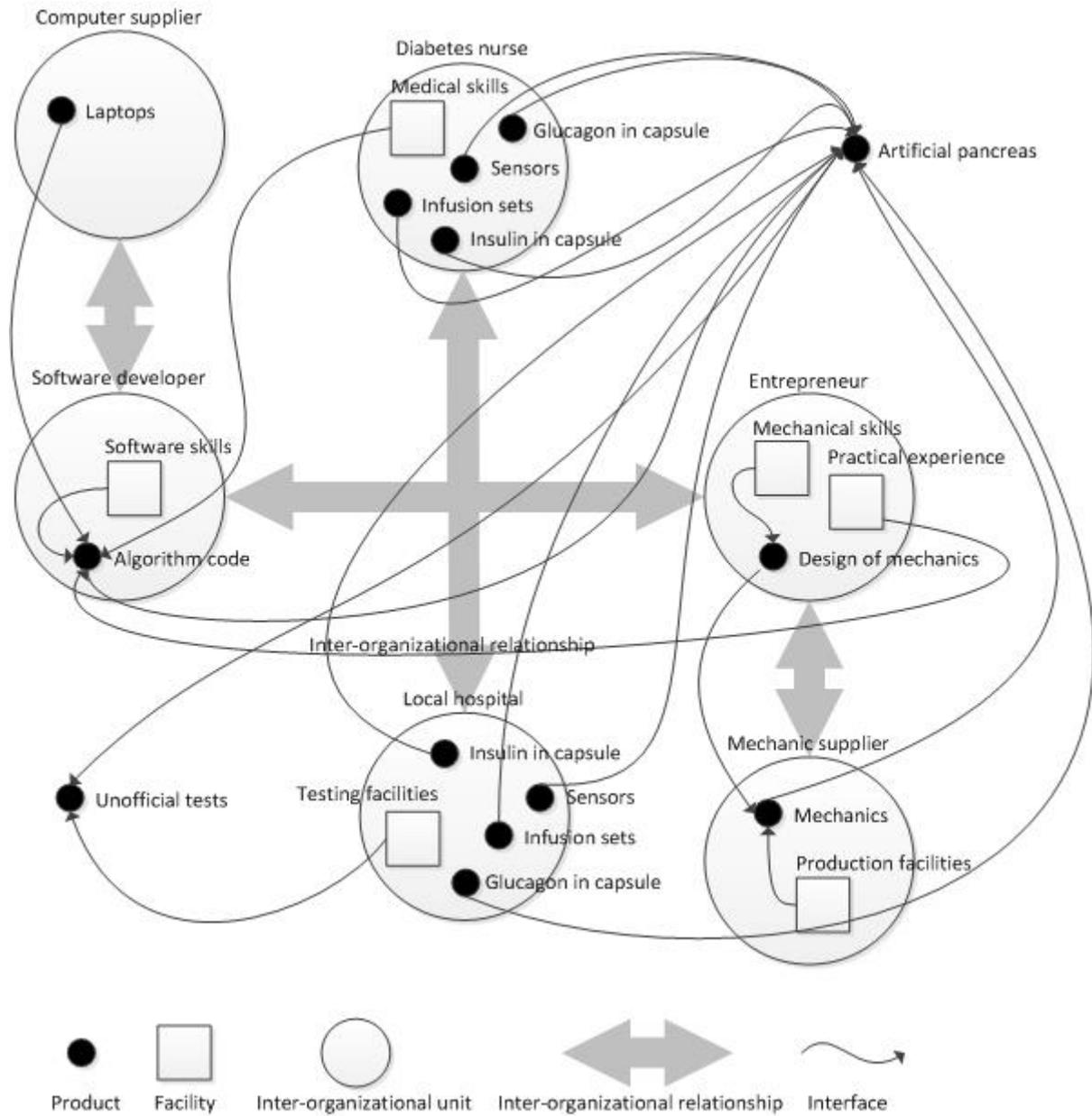
- FORBORD, M. 2003. *New Uses of an Agricultural Product? - A case study of development in an industrial network*. Norwegian University of Science and Technology.
- FREEL, M. S. 2000. Barriers to product innovation in small manufacturing firms. *International Small Business Journal*, 18, 60-80.
- GARDET, E. & FRAIHA, S. 2012. Coordination Modes Established by the Hub Firm of an Innovation Network: The Case of an SME Bearer. *Journal of Small Business Management*, 50, 216-238.
- GARUD, R., TUERTSCHER, P. & VAN DE VEN, A. H. 2013. Perspectives on innovation processes. *The Academy of Management Annals*, 7, 775-819.
- GIBBERT, M., RUIGROK, W. & WICKI, B. 2008. Research notes and commentaries: what passes as a rigorous case study? *Strategic Management Journal*, 29, 1465-1474.
- HÅKANSSON, H., FORD, D. I., GADDE, L. E., SNEHOTA, I. & WALUSZEWSKI, A. 2009. *Business in networks*, Chichester, John Wiley & Sons.
- HÅKANSSON, H. & WALUSZEWSKI, A. 2002. Path dependence: restricting or facilitating technical development? *Journal of Business Research*, 55, 561-570.
- HALINEN, A., MEDLIN, C. J. & TÖRNROOS, J. 2012. Time and process in business network research. *Industrial Marketing Management*, 41, 215-223.
- HALINEN, A. & TÖRNROOS, J. 2005. Using case methods in the study of contemporary business networks. *Journal of Business Research*, 58, 1285-1297.
- HOFFMANN, W. H. & SCHLOSSER, R. 2001. Success factors of strategic alliances in small and medium-sized enterprises: An empirical survey. *Long Range Planning*, 34, 357-381.
- HURMELINNA, P., BLOMQVIST, K., PUUMALAINEN, K. & SAARENKETO, S. 2005. Striving towards R&D collaboration performance: The effect of asymmetry, trust and contracting. *Creativity and Innovation Management*, 14, 374-383.
- INGEMANSSON, M. 2010. *Success as Science but Burden for Business? On the Difficult Relationship Between Scientific Advancement and Innovation*. . Doctoral thesis, Uppsala University.
- JOHNSEN, R. E. & FORD, D. 2001. Asymmetrical and symmetrical customer-supplier relationships: Contrasts, evolution and strategy. *Proceedings of the 17th Annual IMP*.
- JOHNSEN, R. E. & FORD, D. 2008. Exploring the concept of asymmetry: A typology for analysing customer-supplier relationships. *Industrial Marketing Management*, 37, 471-483.
- KALAIANANAM, K., SHANKAR, V. & VARADARAJAN, R. 2007. Asymmetric new product development alliances: Win-win or win-lose partnerships? *Management Science*, 53, 357-374.
- KATILA, R., ROSENBERGER, J. D. & EISENHARDT, K. M. 2008. Swimming with sharks: Technology ventures, defense mechanisms and corporate relationships. *Administrative Science Quarterly*, 53, 295-332.
- KONSTI-LAAKSO, S., PIHKALA, T. & KRAUS, S. 2012. Facilitating SME Innovation Capability through Business Networking. *Creativity and Innovation Management*, 21, 93-105.
- LARSON, A. 1992. Network dyads in entrepreneurial settings: A study of the governance of exchange relationships. *Administrative Science Quarterly*, 37, 76-104.
- LAWTON SMITH, H., DICKSON, K. & SMITH, S. L. 1991. There are two sides to every story: Innovation and collaboration within networks of large and small firms. *Research Policy*, 20, 457-468.
- LEE, C., LEE, K. & PENNING, J. M. 2001. Internal capabilities, external networks, and performance: A study on technology-based ventures. *Strategic Management Journal*, 22, 615-640.

- LEE, C. J. & JOHNSEN, R. E. 2012. Asymmetric customer-supplier relationship development in Taiwanese electronics firms. *Industrial Marketing Management*, 41, 692-705.
- LEONARD-BARTON, D. 1990. A dual methodology for case studies: Synergistic use of a longitudinal single site with replicated multiple sites. *Organization Science*, 1, 248-266.
- LIND, P. 2012. *Small business management*, Oxon, United Kingdom: Routledge.
- MOHR, J. & SPEKMAN, R. 1994. Characteristics of partnership success: Partnership attributes, communication behavior, and conflict resolution techniques. *Strategic Management Journal*, 15, 135-152.
- MOUZAS, S. & FORD, D. 2007. Contracting in asymmetrical relationships: The role of framework contracts. *The IMP Journal*, 1, 42-63.
- PÉREZ, L., FLORIN, J. & WHITELOCK, J. 2012. Dancing with elephants: The challenges of managing asymmetric technology alliances. *Journal of High Technology Management Research*, 23, 142-154.
- PFEFFER, J. & SALANCIK, G. R. 2003. *The External Control of Organizations: A Resource Dependence Perspective*, Stanford Business Books.
- PRASHANTHAM, S. & BIRKINSHAW, J. 2008. Dancing with Gorillas: How small companies can partner effectively with MNCS. *California Management Review*, 51, 6-23+3.
- PULLEN, A. J., WEERD-NEDERHOF, P. C., GROEN, A. J. & FISSCHER, O. A. 2012. Open innovation in practice: goal complementarity and closed NPD networks to explain differences in innovation performance for SMEs in the medical devices sector. *Journal of product innovation management*, 29, 917-934.
- RAESFELD, A. V., GEURTS, P. & JANSEN, M. 2012. When is a network a nexus for innovation? A study of public nanotechnology R&D projects in the Netherlands. *Industrial Marketing Management*, 41, 752-758.
- RITTER, T. & GEMUNDEN, H. G. 2003. Network competence: Its impact on innovation success and its antecedents. *Journal of Business Research*, 56, 745-755.
- ROSENBUSCH, N., BRINCKMANN, J. & BAUSCH, A. 2011. Is innovation always beneficial? A meta-analysis of the relationship between innovation and performance in SMEs. *Journal of Business Venturing*, 26, 441-457.
- ROUSSEAU, D. M., SITKIN, S. M., BURT, R. S. & CAMERER, C. 1998. Introduction to special topic forum – Not so different after all: A cross-discipline view of trust. *The Academy of Management Review*, 23, 393-404.
- SAUNDERS, M., LEWIS, P. & THORNHILL, P. 2009. *Research methods for business students*, London: Routledge.
- SAWERS, J. L., PRETORIUS, M. W. & OERLEMANS, L. A. G. 2008. Safeguarding SMEs dynamic capabilities in technology innovative SME-large company partnerships in South Africa. *Technovation*, 28, 171-182.
- SCHREINER, M., KALE, P. & CORSTEN, D. 2009. What really is alliance management capability and how does it impact alliance outcomes and success? *Strategic Management Journal*, 30, 1395-1419.
- SHAN, W. J., WALKER, G. & KOGUT, B. 1994. Interfirm cooperation and startup innovation in the biotechnology industry. *Strategic Management Journal*, 15, 387-394.
- STINCHCOMBE, A. L. 1965. Social structure and organizations. In: MARCH, J. G. (ed.) *Handbook of Organizations*. Chicago: Rand McNally.

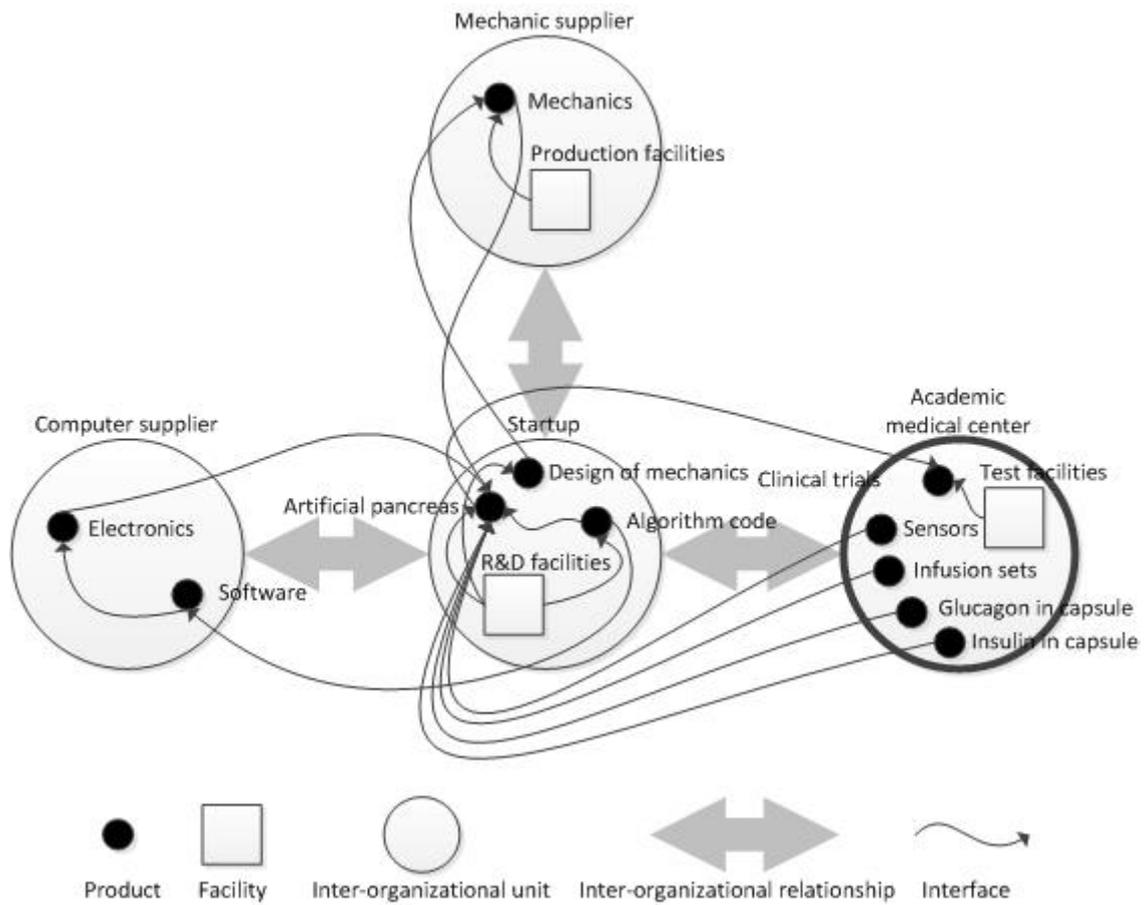
- STUART, T. E. 2000. Interorganizational alliances and the performance of firms: A study of growth and innovation rates in a high-technology industry. *Strategic Management Journal*, 21, 791-811.
- SUBRAMANI, M. R. & VENKATRAMAN, N. 2003. Safeguarding investments in asymmetric interorganizational relationships: Theory and evidence. *Academy of Management Journal*, 46, 46-62.
- TOMLINSON, P. R. & FAI, F. M. 2013. The nature of SME co-operation and innovation: A multi-scalar and multi-dimensional analysis. *International Journal of Production Economics*, 141, 316-326.
- VANDAIE, R. & ZAHEER, A. 2014. Surviving bear hugs: Firm capability, large partner alliances, and growth. *Strategic Management Journal*, 35, 566-577.
- VERHEES, F. J. H. M. & MEULENBERG, M. T. G. 2004. Market orientation, innovativeness, product innovation, and performance in small firms. *Journal of Small Business Management*, 42, 134-154.
- WOLFF, J. A. & PETT, T. L. 2006. Small-firm performance: Modeling the role of product and process improvements. *Journal of Small Business Management*, 44, 268-284.
- YIN, R. K. 1989. *Case study research: Design and methods*, London, United Kingdom: Sage Publications.

# APPENDIX

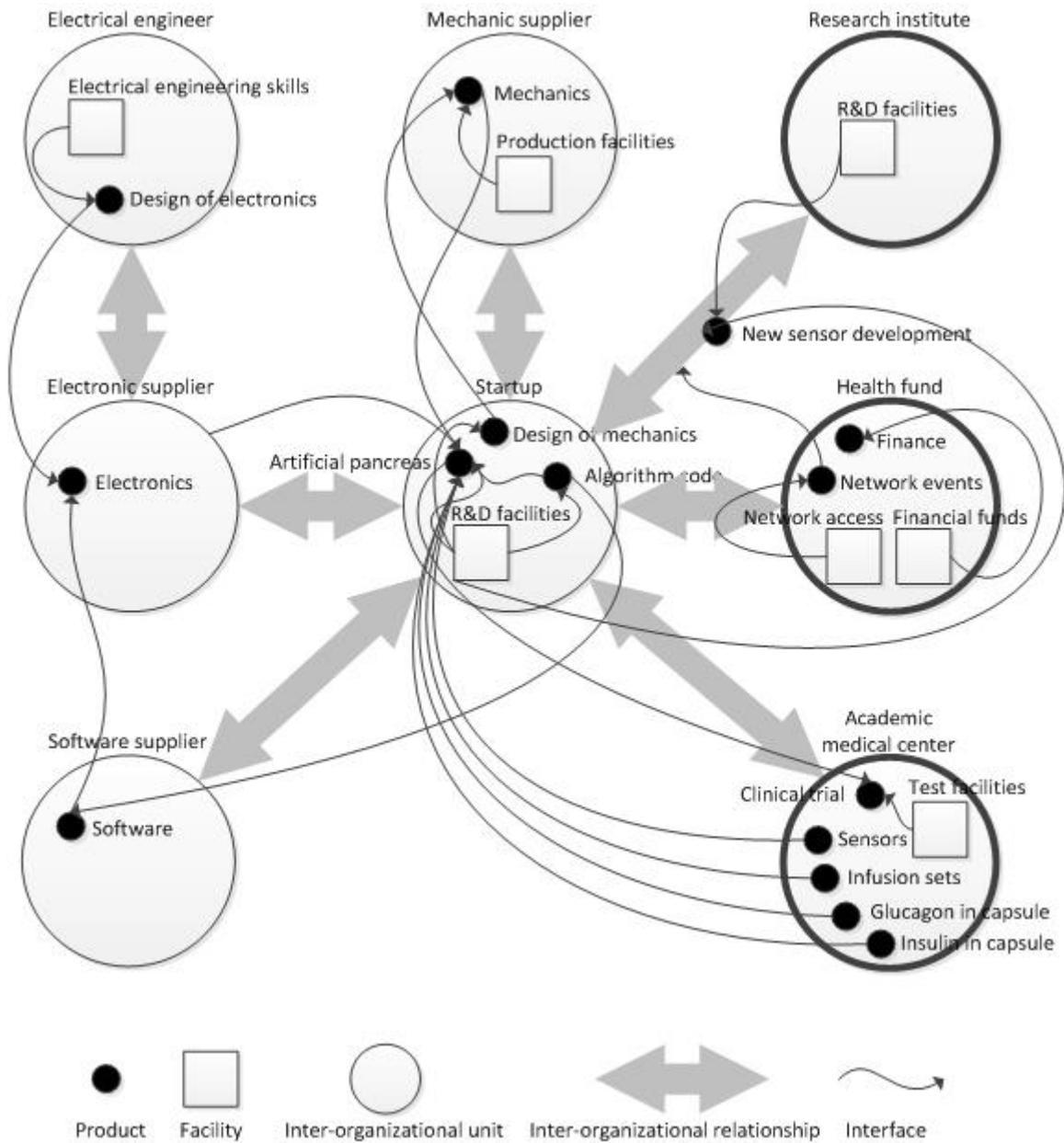
## Appendix A: Research interaction in development of prototype 1



## Appendix B: Research interaction in development of prototype 2



### Appendix C: Research interaction in development of prototype 3



### Appendix D: Research interaction in development of prototype 4

