Resource interaction in relation to power

How a high tech startup strategizes to cope with the challenges of mobilizing and leveraging resources in asymmetrical power relationships

Work in progress

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 engaged in relationships with a large, established and powerful partner it is faced with several discrete challenges. These challenges make it difficult to mobilize and leverage the relevant 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 and research 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 the challenges of cooperating with powerful partners: visibility, sharing, compatibility, formalization and informality.

Key words
Resource interaction, power asymmetry, startup, strategizing
INTRODUCTION

Innovation in startups is important both because of its effects on the success of these businesses and their potential to act as the initiator and catalyst for economic progress (Freel, 2000, Lind, 2012, Verhees and Meulenberg, 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. The Industrial Marketing and Purchasing (IMP) research tradition has emphasized the importance of inter-organizational relationships for this purpose. Through partnerships a startup can acquire the resources that are necessary in its path from invention to innovation (Konst-Laakso et al., 2012). Nonetheless, startups find it difficult to develop and maintain relationships with relevant partners due to the challenges associated with such relationships (Colombo et al., 2012). In recent years, the challenges for startups in building and maintaining relationships are aggravated by their increasing asymmetry (Hurmelinna et al., 2005, Kalaigianam 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 set of basic principles concerning how resources interact at a network level over time (Håkansson and Waluszewski, 2002). In this way, 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 and dependency. 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 asymmetric relationships to connect them to their own. Within asymmetrical relationships startups are widely considered to be in the subordinate position (Gardet and Fraiha, 2012). Considering the challenges associated with this position, it can be expected that startups have difficulties in identifying, connecting, using and developing resources in asymmetric relationships. Still, the deliberate strategic actions of startups to deal with the challenges of asymmetric relationships are never researched from a research interaction perspective to my knowledge. Consequently, the practical value of the current literature on the management of asymmetric relationships is limited. And it precisely the practical relevance that is lacking in academia, but so necessary for startups to encourage them to successfully mobilize and leverage the resources of their powerful partners. Hence, in this paper the following research question will be explored: how can startups take deliberate strategic actions to better mobilize and leverage the resources in their asymmetrical relationships? This issue is explored in a case study of a Dutch startup that is collaborating with several organizations to develop an 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). 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 hypothesis are developed as a direction for future research. Yet, first the state-of-the-art in the literature regarding the resource interaction approach and strategizing in asymmetric relationships will be discussed.
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 from which they develop specific resource interfaces in relation to each other 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 the 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 process, such as the development of an innovation. In this way, it is possible to determine those resources that are pivotal 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, other central dimensions of a network, such as actors and activities, are downplayed. Focusing solely on the structural dimension of resources may leave out important aspects and attributes of resources that derive from how actors shape, combine and use 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). 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, Baraldi et al. (2012) argues that an enhanced 4R analysis should be conducted that clearly defines the controls attached to each resource in the network to study how actors drive the process of identifying, connecting, using and developing resources in interaction.

According to the IMP research tradition power and control represent a crucial dimension in interaction and relationships (Håkansson et al., 2009). 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 actors from the interaction perspective has some consequences for the conceptualization of the actor. An actor acquires an identity in
interaction with others, because its behavior is a matter of concern to or affects another (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 their activities and ties with their resources. A network identity has a certain power content, because it is based on the particular resources an actor can control. These resources are made apparent through exchange interaction in a firm’s set of connected relationships (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). An organization with a strong network identity can attract new partners to strategically mobilize and leverage particularly important resources or mix of resources. However, it can be expected that not all partners in a network share benefits of a focal actor’s strong network identity equally (Bonner et al., 2005). These asymmetric relationships 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). In recent years mergers and acquisitions, rapid and costly technological changes, the growth of outsourcing as well as global sourcing create conditions for growing asymmetry in relationships between organizations (Mouzas and Ford, 2007).

**Asymmetric relationships between startups and established organizations**

In particular across fields with dynamic environment and 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). The resulting interdependence between startups and established organizations has led to an increase in the number of asymmetric relationships (Das and He, 2006, Pérez et al., 2012, Aaboen et al., 2011). Studies small and young firms have shown on that by building and maintaining business relationships with large 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 still often considered in a situation of asymmetric dependence (Gardet and Fraiha, 2012). This possess substantially challenges on the ability of the startup to exploit the resource of the established organization (Aaboen et al., 2013).

There are five inherent challenges in identifying, connecting, using and developing resources in interaction with established partners (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 ethnocentric 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). 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). Accordingly, startups are confronted with the task of making themselves difficult to replace by developing skills and capabilities that are valued by the established firm (Mouzas and Ford, 2007). 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). 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). Therefore, the startup has to carefully balance business opportunities of asymmetric relationships against their inherent risks (Mouzas and Ford, 2007). 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).

**Startups need to exploit the resources in asymmetric relationships**

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). According to Aaboen et al. (2013), it can be assumed that startups are able to engage in deliberate strategizing in inter-organizational relationships. 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 interdependencies, relationships and networks (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 startups operate and develop resources in interaction with established organizations (Aaboen et al., 2013). 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 connect, use and develop 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 how a startup strategizes in its business relationships in asymmetric R&D projects over time. Process research involves “the study of how and why some significant temporally evolving phenomenon unfolds over time” (Bizzi and Langley, 2012). 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 human 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 the hormones and measure the 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 were used as a proxy for exploring asymmetry in the partnership. Based on the Oxford dictionary mobilization is defined as the ability of an organization to bring resources into use for a particular purpose. In contrast, 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). Researchers have often used the relative differences in organization size as a proxy for asymmetry in relationships, because these differences may be indicative of potential problems in the relationships (Johnsen and Ford, 2008). However, Gardet and Fraiha (2012) have shown that that small size is not synonymous with a position of dependence. Dependence encompasses an organization’s need to continue an exchange relationship to realize its goals and is considered the opposite of power (Emerson, 1962). In addition, 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 confidentially.
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 214. Observation 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.

<table>
<thead>
<tr>
<th>Interviews</th>
<th>Passive observation</th>
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<tbody>
<tr>
<td><strong>Organization</strong></td>
<td><strong>Interviewee</strong></td>
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<tr>
<td>Teaching hospital</td>
<td>First PhD student</td>
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<tr>
<td>Startup/teaching hospital</td>
<td>Second PhD student</td>
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<td>Startup</td>
<td>Entrepreneur</td>
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<td>Startup</td>
<td>Informal investor</td>
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<td>Health fund</td>
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<td>Teaching hospital</td>
<td>Project leader</td>
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<td>Entrepreneurial university</td>
<td>Director</td>
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<td>Market leader</td>
<td>Head business</td>
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<td>Research institute</td>
<td>Manager SME</td>
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Table 1. Primary data sources

<table>
<thead>
<tr>
<th>Internal data</th>
<th>External data</th>
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<tbody>
<tr>
<td>63 pages of interviews</td>
<td>9 articles about the innovation project</td>
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<tr>
<td>72 pages of project description</td>
<td>15 web pages of partners</td>
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<td>15 pages of observation diary</td>
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<tr>
<td>120 pages of presentations and reports</td>
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<td>2 contracts</td>
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Table 2. Secondary data sources

To analyze the recorded interviews as well as the diary reports and archival documents, ALTLAS 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 last step was explored how the startup strategized in its asymmetric relationships to handle these challenges. The analysis revealed five strategies for each of the challenges: visibility, sharing, compatibility, formalization and informality.
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. The fat line around an inter-organizational unit suggest that the it was difficult for the startup to mobilize and leverage the resources of that unit. In table 3 a specification of the startups ability to mobilize and leverage resources can be found. Below the resource interaction between the inter-organizational units and their power positions are 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 as well. 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 the friends 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 an 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. As table 3 presents, 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 resulted 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 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 financer 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 focus on fundamental diabetes
related research 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 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 he 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 solutions 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 of the artificial pancreas. 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.” As displayed in table 3, 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 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 due to its size. 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 a 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 startups 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 Technologocial 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 entrepreneurial 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, see also table 3, 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 entrepreneurial 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 delivered 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 the sense it was hard for the startup to mobilize and leverage
their resources. In these relationships it experienced had to conquer several challenges. This
issue is further explored in the next section.

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

This paper started off with the question of how startups can take deliberate strategic actions to better mobilize and exploit the resources in their asymmetrical relationships. In this section, five hypotheses are developed based on the case analysis of how startups deal with the challenges identified in the literature section to be able to better exploit the resources in asymmetric relationships.

Visibility to gain access to and attention from powerful partners
The startup experienced great difficulties in mobilizing the resources of powerful partners in the early stages of the innovation process. It took a lot of time 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 it 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). In the end the startup was referred to the center by a physician whom the entrepreneur met in reaction to a magazine publication about the project. The success of increasing the visibility of the startup to acquire the desired resources made it aware that this is a fruitful strategy to attract powerful partners. As a result the startup deliberately used the mediating function of existing partners, such as when the health foundation connected the startup to the research institute and the teaching hospital brought in three partners for the European project. Moreover 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. The deliberate increase in visibility of the project made it easier to rise up to the challenge of gaining access to and attention from powerful partners. 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). In other words, startups need to analyze and influence their partners mediating functions to attract powerful partners (Holmen and Pedersen, 2003). 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 media attention gained less attention in the literature. Ritter and Gemunden (2003) mentioned the use of external information sources to identify potential partner which implicitly assumes that if you have a prominent presence in the media you can be found by potential partners easier. However, this issue have remained underexposed so far. The need to attract powerful partners is inevitable for startups before it can exploit its resources. Therefore it is expected that startups are better able to mobilize and leverage the resources of powerful partners by increasing their visibility in the network. So it is hypothesized that:

H1 A visibility strategy has a positive effect on a startup’s ability to mobilize and leverage the resources in its asymmetric relationships.

Sharing to gain the commitment to the startups innovation
The startup found it difficult to leverage the resources of the powerful partners to support its own innovation for three different reasons. Firstly, the teaching hospital lacked commitment to the innovation project, because the startup was only ‘a drop in the ocean’ for the center. 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 suggest 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). The startup coped with this challenge by sharing information regarding the progress of product development as well as the results of the clinical trials. Multiple powerful partners pointed out that they were willing to commit to the startup’s project in the first place, because they were impressed by the prototypes and the test results. In the later stages of the relationships sharing information about the progress of the startup also had a positive effect on its ability to leverage resources, since it motivated the partners to execute their work as agreed. Indeed, Rousseau et al. (1998) argue that the information 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. Furthermore, 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. Also, the nascent relationship with the market leader is maintained by feeding them occasionally with valuable resources, such as raw data. Thus, by proactively demonstrating skills and sharing resources the startup build a reputation as trusted partner which helped it to overcome the lack of commitment associated with more powerful partners. This confirms the suggestions of existing literature that developing a reputation of valuable cooperator 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). As a result it is expected that startups have a greater chance of exploiting the resources of the powerful partner when it shares information and resources with them to increase their commitment. Therefore, the hypothesis reads as follows:

H2 A sharing strategy has a positive effect on a startup’s ability to mobilize and leverage the resources in its asymmetric relationships.

Compatibility to guard against the startup’s dispensability

For the startup the relationships with the powerful partners are often vital to its survival. 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. 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 center aims to research the efficiency and effectiveness of medical devices, but it lacks the technical capabilities to develop them. 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. Secondly, the startup ensured that it could easily 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). In conclusion, when the startup ensures has the goals of its partners complementary, but stays compatible to alternatives in the network it enhances its ability to mobilize and leverage the resources in asymmetric relationships. For that reason, the third hypothesis is a follows:

H3 A compatibility strategy has a positive effect on a startup’s ability to mobilize and leverage the resources in its asymmetric relationships.

**Formalization to protect against the opportunistic behavior of the powerful partner**

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 which made it more difficult to mobilize and leverage its partner’s resources. If the startup would not have covered the agreement in a contract beforehand, the research institute would be able spill the knowledge of the project over to the multiple partner research program leaving the startup with nothing. However, it should be noted that the startup still experience delays in the joint project, but did not yet find a solution to handle this problem. 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). 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). 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 question 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. Additionally, the startup had a NDA with most of its powerful partners, such as the market leader and the research institute. The startup strongly believes that a NDA not only protects its own knowledge, but also motivates the powerful partner to share their knowledge with the startup. This 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 learn from its partner. Thus, formalization in the form of contracts, intellectual property and NDAs does not only protects the startup against opportunistic behavior of the powerful partner, but also increases the startup’s ability to mobilize and leverage relevant resources. Hence, it is hypothesized that:

H4 A formalization strategy has a positive effect on a startup’s ability to mobilize and leverage the resources in its asymmetric relationships.
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 who was enthusiastic about the artificial pancreas from the start. 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 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. Thirdly, 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. 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). Concluding, the startup was better able to determine the resources it could use, the amount of knowledge transferred and the conflict resolution techniques when it build informal relationships with key individuals in the partner’s organization. Therefore, the last hypothesis reads as follows:

H5 A informality strategy has a positive effect on a startup’s ability to mobilize and leverage the resources in its asymmetric relationships.

CONCLUSION

The focus of this paper was on exploring the strategic actions startups take to be better able mobilize and leverage the resources of powerful partners in their resource interaction network. The case showed that the startup first enhanced its visibility in the network via referrals of other partners and media publicity to gain access to and attention from powerful actors. Secondly, it shared relevant knowledge and resources to increase the commitment of the partner in the asymmetric relationship. Thirdly, it ensured compatibility with both existing partners as well as the wider network to reduce risk of getting dispensed and lower the negative consequences when it would be dispensed by the powerful partner. Fourthly, the startup formalized the relationship to protect itself from opportunistic behavior in the asymmetric relationship. Lastly, it used informal contact with key individuals within the powerful organization to influence the characteristics of the asymmetric relationship. It was hypothesized in the discussion section that these strategic actions will enable startups to better mobilize and leverage the resources in asymmetrical relationships. In future research these hypotheses can be tested using quantitative methodologies enhancing the generalizability of the results of this study.
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 (Johnsen and Ford, 2008, Astley and Sachdeva, 1984, Pfeffer and Salancik, 2003). 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.

The theoretical and managerial contributions notwithstanding, there are several limitations to the study. Firstly, the case research here may be typical for asymmetrical relationships of startups in a medical innovation context. The development of medical devices is a process that is highly regulated and fraught with uncertainty. The question remains if the proposed model applies to startups in more certain and less regulated innovation contexts. Thus, the results do not lend themselves well for generalization. However, it was never the intention to prove a general theory. Rather, this paper is an effort to explore the ways startups take strategic action to cope with the challenges associated with cooperating with powerful partners. Secondly, the findings are based on a combination of a retrospective and real-time longitudinal process research. Although this approach allows the strengths of both approached to be merged, it also means that the weaknesses of both may have influenced the results. On the one hand, the retrospective part of the research may suffer from hindsight bias limiting the accuracy and completeness of the data. The respondents may have forgotten relationships in the early phase of the innovation project. However, this seems unlikely due to small number of inter-relationships overall. Moreover, the researcher asked every interviewee to check the developmental process of their relationships with the startups account. On the other hand, the real time longitudinal case study may have suffered from researcher bias. The vast amount of data being collected may have cause misinterpretation of data by the researcher. Moreover, the presence of the researcher at the startup made it harder for her to always take an objective look which could have negatively influenced the scientific rigor of the research. This issue was conquered by carefully keeping a diary in which field notes were evaluated every week. In conclusion, this research has provided a better understanding of the strategies startups use to handle the challenges associated with asymmetric relationships. However, there are multiple ways in which the results of this study can be extended and improved upon.
BIBLIOGRAPHY


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