



Utrecht University

Partnering, or not?

The roles of resource heterogeneity and market heterogeneity in alliance formation of technology based startups

Master thesis Innovation Sciences

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Abstract

During the product lifecycle (PLC) startups need to adjust their strategy to remain competitive. To develop a proper strategy, a combination must be made between the technology-push strategy that focuses on resource heterogeneity, and demand-pull strategy that focuses on market heterogeneity. Since it is difficult for starting firms to obtain resources, due to their liability of newness and smallness, the firms need to enter into alliances. However, from a pull-viewpoint in which unique market knowledge is the focal point, alliances can lead to knowledge leaking, resulting in a decrease of the uniqueness of the knowledge. The strategies seem contradictory but can be complementary during the PLC, where the push-strategy is dominant in the prototype phase and the pull-strategy in the commercialization phase. To find alliance partners, entrepreneurs can make use of their former firm network of strong ties. Besides, entrepreneurs have a personal network of strong and weak ties: weak ties to find unique market knowledge and strong ties to extend the firm network. To examine how startups deal with this paradox, of alliancing or not, and what the role of the different networks is, the following research question is answered: *How do technology-push or demand-pull conditions influence alliance formation by startups in different phases of the product lifecycle?* An exploratory qualitative research design is deployed to examine the narratives of fourteen startups from the consumer electronics industry and fourteen from the clean technology industry. These narratives are obtained by conducting semi-structured interviews and analyzed by using a combination of a paradigmatic and narrative type of data analysis. Based on the findings, it becomes clear that the pull conditions do not have a negative impact on the formation of new alliances in the prototype phase of the PLC. Instead, weak personal ties are deployed to find new ties; new ties are used to extend the firm network. Besides, unique market knowledge is already obtained in the prototype phase by using weak personal ties (consumer electronics industry) or new alliance partners (clean technology industry). In the commercialization phase, also firm ties are used by the clean technology startups to obtain unique market knowledge. Therefore, the technology-push and demand-pull conditions are complementary instead of contradictory, and both have a positive effect on the creation of new alliances and the finding of unique market knowledge. Additionally, this study clarifies the roles of the different networks and how entrepreneurs can deploy these networks.

Table of content

1. INTRODUCTION	4
2. THEORETICAL FRAMEWORK	7
2.1 RESOURCE HETEROGENEITY	7
2.1.1 Alliance formation	7
2.1.2 Firm network	8
2.1.3 personal network (strong ties)	9
2.2 MARKET HETEROGENEITY	9
2.2.1 Personal network (weak ties)	10
2.3 CONCEPTUAL MODEL	11
2.4 COMBINING STRATEGIES	11
3. METHODOLOGY	13
3.1 OPERATIONALIZATION OF CONCEPTS	13
3.1.1 Definition and measurement of the dependent variable	13
3.1.2 Definition and measurement of intermediate and independent variables	13
3.2 RESEARCH DESIGN	14
3.3 CASE SELECTION	14
3.4 DATA COLLECTION	15
3.4.1 Semi-structured interviews	16
3.5 DATA PREPARATION	16
3.6 DATA ANALYSIS	17
4. OVERVIEW OF THE CASE RESULTS	19
4.1 SUMMARY PER CATEGORY	19
4.1.1 Consumer electronic startups in the prototype phase (Cons-New)	19
4.1.2 Consumer electronic startups in the commercialization phase (Cons-Old)	22
4.1.3 Clean technology startups in the prototype phase (Clean-New)	25
4.1.4 Clean technology firms in the commercialization phase (Clean-Old)	28
4.2 ASSESSMENT OF THE PROPOSITIONS	31
4.2.1 Dependent variable: Collaboration activity	32
4.2.2 Independent and intermediate variables	32
4.3 NEW PATHS	36
4.3.1 Weak personal ties to firm network	36
4.3.2 Firm network to new commercial alliance formation	36
4.3.3 Acquiring unique market knowledge	37
4.4 PUSH- AND PULL-STRATEGY	37
4.4.1 Combination of strategies	37
4.4.2 Concepts related to the strategies	38
4.5 ADDITIONAL INSIGHTS	39
4.5.1 Incubator and accelerator programs	39
4.5.2 Complex sustainable products	39
4.6 MERGE OF NARRATIVES INTO A NEW CONCEPTUAL MODEL	40
4.6.1 Prototype phase	40
4.6.2 Commercialization phase	41
5. DISCUSSION	43
5.1 QUALITY AND LIMITATIONS OF THE RESEARCH	43
5.1.1 Internal validity	43
5.1.2 External validity	44
5.1.3 Internal reliability	44
5.1.4 External reliability	45
5.2 THEORETICAL IMPLICATIONS	45
5.3 MANAGERIAL AND POLICY IMPLICATIONS	46
5.4 FURTHER RESEARCH	48
6. CONCLUSION	50
7. ACKNOWLEDGEMENTS	52
8. REFERENCES	53
APPENDIX I: INTERVIEW SCRIPT IN DUTCH	59
APPENDIX II: INTERVIEW SCRIPT IN ENGLISH	62

1. Introduction

Due to the changing conditions during the product lifecycle, the needs of startups¹ change (Rothaermel & Deeds, 2004). Therefore, the strategy of these startups must move along with the evolving needs to stay competitive at all times. To develop a proper strategy, the strategy must be based on technology-push and demand-pull factors, because a combination of these factors provides a better understanding of the innovation process (Van Den Ende & Dolfsma, 2005). Within the technology-push perspective, the resource-based view (RBV) has a pre-eminent position (Ye, Priem & Alshwer, 2012). RBV scholars assume that resources are heterogeneously distributed over firms and immobile, and to create a competitive advantage firms need to develop a strategy based on the resources it possesses (Mahoney & Pandian, 1992; Wernerfelt, 1984). However, for new starting firms it is impossible to own all the required resources themselves (Cefis & Marsili, 2005). Therefore they have to acquire these resources in a different way.

Transaction costs theory (TCT) explains how firms can make the most economically efficient decision to obtain the additional resources (Williamson, 1981). The TCT literature has focused mainly on vertical contracts, which include the vertical (de)integration of business units into the supply chain (Parkhe, 1993; Oxley, 1997). Among others Geyskens, Steenkamp & Kumar (2006) added the option of forming alliances² to the TCT literature to reduce transaction costs, where alliances can be defined as “*voluntary (contractual) arrangements between firms involving exchange, sharing, or co-development of products, technologies or services*” (Gulati, 1998, p.293). However, transaction costs minimization is not the only ‘push-focused’ motivation to enter into alliances (Eisenhardt & Schoonhoven, 1996). Other motivations to collaborate are gaining access to complementary resources (Yasuda, 2005), increasing learning and enhancing legitimacy (Baum & Oliver, 1991; Kogut, 1988; Baum, Calabrese & Silverman, 2000; Mowery, Oxley & Silverman, 1996), staying competitive in rapidly changing environments (Yasuda, 2005), or entering faster into new markets because of the availability of complementary resources (Kogut, 1991).

These influential theories explain, from a technology-push perspective, the importance of alliance formation for the development of technological innovations and how alliances can help firms to adapt to the changing characteristics of the industry. However, the technology-push view assumes that markets are homogeneous (Priem & Butler, 2001). This means that competition is based on resources and market demand is fixed and uniformly available (Priem, Li & Carr, 2012). According to Priem et al., (2012) the importance of the demand side of the value equation is underexposed. Embracing a demand-pull approach will provide insights into different factors that affect the performance of firms and in particular their effects on innovations. Scholars who have applied a demand-pull approach argue that the direction of innovation is driven by demand – demand guides the target point of firms – and when changes in market conditions occur, firms can quickly react and invest in innovations that satisfy unmet needs (Nemet, 2009; Weaver, 2008).

Alliance formation from a demand-pull perspective seems, however, less beneficial. Ye et al. (2012) have studied alliance formation from a demand-pull perspective and argue that alliances cause difficulty in serving changing market needs; evolving market conditions ask for different resources, but contractual agreements lack the flexibility to provide them. This corresponds with a statement of Teece (1986), who argued that in order to respond to the changing market needs, firms must own resources specialized in the commercialization of an

¹ In this paper, startups are referred to as ‘startups’ and ‘firms’. The partner firms of the startup are named ‘firms’. All the startups are SME’s younger than 10 years old, but referred to as startups because the word startup better describes the way the firms are seen.

² In this paper, alliances are referred to as ‘alliances’, ‘partnerships’, and ‘collaborations’.

innovation to gain the highest benefits from the innovation. Besides that, within alliances firms expose critical knowledge, a major source of competitive advantage, which can lead to knowledge leaking and results in a diminishing ability to create customer value (Norman, 2002).

In order to lower the risk of knowledge leaking, the alliance needs to be based on a trustful relationship (Inkpen, 1998). Gulati (1998) explains that firms' repeated ties provide strong ties as the basis of a proper formal alliance, because these strong ties deliver the required level of trust. However, according to Granovetter (1973), a network of strong ties reduces the novelty of the information that is exchanged. Therefore, to obtain radical new knowledge firms must use weak ties. These ties cross network boundaries and are not as socially involved as strong ties are, which results in an increase of the radicalness of the knowledge that can be exchanged. This is especially the case for weak ties from informal networks, which will be denoted as personal ties, because these ties extend well beyond the organizational boundary (Macdonald & Piekkari, 2005). For startups that lack a proper firm network, these personal networks appear to be of main importance. Thus, it seems that informal personal weak ties better fit to a demand-pull strategy, where radical knowledge about market demands need to be obtained, while formal strong firm ties better fit to a push-strategy to find appropriate alliance partners with whom resources are shared.

The technology-push and demand-pull insights seem paradoxical, but can be sequential and complementary over the innovation process (Kim & Lee, 2009; Godin & Lane, 2013). According to Kim & Lee (2009) the technology-push strategy is more important in the early phases of the product lifecycle. The importance of the demand-pull strategy increases during the process and becomes more influential in the later phases of the lifecycle. This may indicate that startup firms' needs for alliancing also change during the innovation process, implying that alliancing is preferred in the exploration phase of the product lifecycle and less beneficial in the exploitation phase of the process.

Many studies have been conducted to provide an understanding of alliances from a technology-push perspective (Gulati, 1998; Das & Teng, 2000; Tsang, 1998; Chen & Chen, 2002), and to a lesser extent from a demand-pull perspective (Ye et al., 2012; Priem, 2007; Priem et al., 2012; Adner, 2002; Weaver, 2008). However, there is a lack of studies that combine both perspectives, while such a combination gives a better understanding of the innovation process itself (Van den Ende & Dolfsma, 2005). Moreover, the literature lack an explanation of the startup firms' alliancing needs during the different stages of the innovation process, while this profoundly affects the strategy of firms (Rothaermel & Deeds, 2004). Besides that, there is also a lack of studies that combine the strategic management literature with the sociological literature, while this combination reinforces the understanding of how firms can make proper strategic choices. At the same time, the combination of these literature streams enhances the understanding of the role of firm networks and personal networks of founders during the innovation process. In order to understand how startups use alliances from a push- and pull-perspective, and how these needs for alliancing change over time, this study will answer the following research question: *How do technology-push or demand-pull conditions influence alliance formation by startups in the different phases of the product lifecycle?*

The scientific contribution of this study lies in the clarification of the discrepancy that exists about alliancing between the different literature streams. Besides, the combination of push- and pull-theories into a single conceptual model converges literature into a more comprehensive model of alliance formation by startups. This study has managerial implications because it clarifies how the needs of firms for alliance formation change during the product lifecycle, and how they must act upon that. Additionally, this study provides insights into how startups need to make use of their firm and personal ties, and in particular what role personal weak ties can play during the innovation process of these firms.

This paper is organized as follows. In section 2 the literature on motivations and conditions to form alliances from a technology-push and demand-pull perspective is analyzed and combined into a comprehensive model. From the literature and this model several propositions will be derived. In section 3 the methods are described, which are chosen to collect and analyze the required data to assess the propositions and to answer the research question. Section four presents the results of the data analysis performed. The implications and limitations of these results are discussed in section 5. The conclusions drawn from this study are presented in section 6.

2. Theoretical framework

The difference between technology-push and demand-pull strategies lies in the sources of innovation and the motivation to innovate (van den Ende & Dolfsma, 2005), and the different views on the heterogeneity of resources and markets (Priem et al., 2012). With a push-strategy firms can create competitive advantage based on their resources, but with a pull-strategy firms compete on the heterogeneity of the marketplace (Mahoney & Padian, 1992; Priem, et al., 2012). These two strategies can be paradoxical but also sequential along the product lifecycle. The product lifecycle starts with the idea and development phases where ideas need to be converted into innovations with the help of R&D or other sources of innovation; this stage is called the prototype phase. The strategy will be formulated based on the unique resources a firm possesses and the ideas or innovative concepts that are turned into products, which can be sold (Grant, 1991). After the prototype phase the innovation will enter the commercialization phase, in which the startup needs to commercialize their inventions to create profits. Kim & Lee (2009) argue that technology-push is dominant at the beginning of the innovation process, while demand-pull is dominant at the end of the process. With this in mind, it can be argued that alliances may be more important in the first phases of the product lifecycle and become less favorable later on, when firms rather possess than share unique market knowledge. In the following sections the literature on alliance formation from a push- and pull-perspective is analyzed and compared over the different stages of the product lifecycle.

2.1 Resource heterogeneity

According to Grant (1996), firms can be seen as an idiosyncratic bundle of resources (Peteraf, 1996), where resources are defined as a bundle of “*assets, capabilities, organizational processes, knowledge, information etc. controlled by a firm*” (Barney, 1991, p.10). Due to the heterogeneity and immobility of these resources, firms need to focus on their unique resources to create a competitive advantage (Mahoney & Pandian, 1992; Wernerfelt, 1984). Unique resources can be defined as resources that are valuable, rare, non-imitable and non-substitutable (Barney, 1991). Firms focusing on these unique resources create an advantage by being able to differentiate from other firms. However, creating successful innovations and a competitive advantage does not only depend on these unique resources. In fast changing industries, resource endowments are rather static; *firms are to some degree stuck with what they have and may have to live with what they lack* (Teece, Pisano & Shuen, 1997; p. 514).

To strengthen their competitive position, firms need to amplify their unique resources with complementary resources, which, for example, can help firms to learn new capabilities (Barney, Wright & Ketchen, 2001). Additionally, according to Teece (1986) complementary resources are necessary to commercialize a product successfully, and make the difference between winning and losing in an industry (Rothaermel, 2001). This is particularly the case in the prototype phase of the product lifecycle where ideas are developed into products. To be able to develop the product and to commercialize it in later stages, firms need to acquire appropriate complementary resources.

2.1.1 Alliance formation

To gain complementary resources firms can form alliances (Rothaermel, 2001). The decision to form an alliance depends on the comparison of the payoffs of proceeding alone or entering into an alliance (Parkhe, 1993). The TCT approach gives insights in how firms can decide which organizational arrangement is most appropriate to acquire lacking resources (Argyres & Liebeskind, 1999). Transaction costs arise due to opportunistic behavior, the difficulty of measuring the exchanged goods or services, and include the costs of negotiating, monitoring, enforcing contracts and the management costs caused by the internal

governance of the exchange (Poppo & Zenger, 1998; Klein, Crawford, and Alchian, 1978). The decision to produce the lacking resources internally, form alliances, or buy them from the market depends upon three critical dimensions: The uncertainty of supply, the frequency of the recurrence of a transaction, and the asset specificity of the transferred resources (Williamson, 1979; 1981).

However, startup firms do not always have the possibility to make the most efficient 'make-or-buy' decision. According to Cefis & Marsili (2005) firms that are small and/or new have a vulnerable position in the market, due to high competition, lack of resources, or because resources are squeezed (Shan, 1990). Eisenhardt & Schoonhoven (1996) argue that if firms find themselves in a vulnerable position it becomes particularly likely that alliances create the highest payoff and therefore can be a solution to improve their strategic positions (Das & Teng, 1999). Therefore, according to these arguments, it is assumed that the startups analyzed in this study lack the required resources due to their liability of newness and smallness, which ensure that firms are motivated to form alliances to improve their vulnerable position.

Moreover, firms are bounded to the resources they possess which make them less able to react flexibly to changing conditions; alliances enable firms to adjust their resource base when conditions change, which improves the position of the firm (Eisenhardt & Schoonhoven, 1996). This is in line with Tidd & Bessant (2009), who state that if firms have the possibility to mobilize a set of complementary resources, the appropriation of the benefits from innovations will be higher. In particular in the early phase of the product lifecycle – where conditions will change rapidly due to the lack of a dominant design – the market is highly differentiated and uncertain, which makes the flexibility to react to changing conditions and protection of the unique resources important in order to survive (Gilsing & Nootboom, 2006; Utterback & Suarez, 1993).

2.1.2 Firm network

To form alliances a suitable partner needs to be found. Network theories provide an understanding of alliance formation processes. Firms are positioned in a firm network and gaining a more central position in this network increases the possibility to access information about the trustworthiness and capabilities of potential alliance partners (Gulati, Daldin & Wang, 2002). This information is important because to create successful alliances, trust between the partners is an absolute must (Parkhe, 1998). According to Gulati (1995), trust can be engendered among partners due to their prior alliancing experience, because the repeated interaction improves the knowledge about each other. The recurrence of the alliance increases the strength of the ties; they become strong ties (Ibid.). Through these strong ties that provide the appropriate level of trust, firms can distribute complex, tacit and abundant information (Kijkuit & Van der Ende, 2010).

Startups lack both a central position and the repeated alliancing experience from which the knowledge about trustworthiness of potential alliance partners can be obtained. Developing a new reputation and creating strong firm ties takes time and effort (Zaheer, Gulati & Nohria, 2000; Granovetter, 1973). Therefore, they can only rely on the generated expertise about the trustworthiness of firms and reputation of the founder created during former job experiences (Eisenhardt & Schoonhoven, 1996). Possessing a network of former formal ties enhances the availability of useful strong firm ties, which increases the knowledge about the trustworthiness of potential alliance partners. Since, from a technology-push perspective, the formation of alliances seems to be particularly important during the early phases of the product lifecycle, firms need to obtain knowledge about the trustworthiness of partners and find strong firm ties in the first phases of the innovation process to positively influence their strategic position. Therefore the following propositions can be formulated:

- Proposition 1. In the prototype phase, the former formal network of the founder is positively related to finding strong firm ties.*
- Proposition 2. In the prototype phase, strong ties are positively related to the formation of new alliances in which resources are shared.*

2.1.3 personal network (strong ties)

When startups lack a proper former firm network, due to their liability of newness, the firms can make use of the informal personal networks. According to Hite & Hesterly (2001), when cooperation between personal ties accrues – the emotional intensity of the relationship increases and the ties become strong personal ties which are based on a trustful relationship (Marsden & Campbell, 1984) – and becomes more formalized, ties can transform into firm ties that provide information and resource exchange relationships, because the trustworthiness between the parties already exists. In addition to the trust that is stored in the relationship of strong personal ties, these ties can easily be approached and are more willing to be of assistance to the entrepreneur (Granovetter, 1973). Therefore, startup firms should use their personal network to develop such a formal firm network by increasing the intensity of the relationship and formalize the collaboration. This is especially of importance in the prototype phase of the PLC, since in this phase an extensive firm network is needed to find and create new alliances. These arguments lead to the following propositions:

- Proposition 3. In the prototype phase, the increasing intensity of personal network ties is positively related to the creation of strong personal ties, which can assist the entrepreneur.*
- Proposition 4. In the prototype phase, the informal strong personal ties are positively related to the creation of a formal firm network.*

2.2 Market heterogeneity

Instead of developing a strategy based on resource heterogeneity, demand-pull strategies are concerned with market heterogeneity (Priem, 2007; Priem et al., 2012). This implies that the focus is not on the rents obtained from the unique resources but on the profit that can be earned from the successful commercialization of products. Besides that, it also means that creating competitive advantage based on demand-side strategies is also possible without holding unique resources (Adner & Snow, 2010). From a RBV perspective firms create an isolating mechanism, based on resources, to improve their strategic position and try to obstruct imitators (Rugman & Verbeke, 2002). Alliances can improve the isolated position through sharing immobile resources. From a demand-pull perspective, firms – even if they are able to do so – are not always willing to imitate and compete on resources because they can create value for other demands (Madhok, Li & Priem, 2010; Ye et al., 2012). This implies that firms, with their unique resources, can serve several markets. However, few firms serve all the markets in which they can create a competitive advantage. Therefore, the essence of a demand-pull strategy is not based on the resources but on the willingness of the firm to serve specific markets (Ibid.).

To be able to decide which markets to serve, knowledge about new markets is needed. According to Weaver (2008) firms with a demand-pull strategy can benefit from collaboration, because knowledge about new markets from outside the firm can be gained. However, such collaborations should not be based on contractual arrangements that make alliances beneficial, because such arrangements induce a lack of flexibility to respond to changing market needs (Ye et al., 2012). When market needs change, alliancing contracts must be renegotiated, which results in the recurrence of contracting costs. In this kind of situations the TCT prescribes a hierarchical governance structure in which the activity needs to be internalized (Williamson, 1979). Besides that, alliances may result in knowledge leaking (Norman, 2002), while possessing unique market knowledge improves the competitive position of firms. Therefore, firms that possess unique market knowledge do not need to seek for alliances, since the knowledge provides a proper strategic position. This is

especially the case in the commercialization phase of the product lifecycle. In this phase the focus is on creating rents from the innovation through successful commercialization, which means serving the best fitting markets.

2.2.1 Personal network (weak ties)

To obtain unique market knowledge, not the formal firm network or informal strong personal ties, but the informal weak personal ties of founders seem more favorable to be used, because weak personal ties go far beyond firm boundaries, which increases the newness of the knowledge obtained. Besides, knowledge can be shared more easily between personal ties than between firm ties (Macdonald & Piekkari, 2005). Strong personal ties seem to be of importance in a push-strategy to extend the firm network (which is used to find new alliance partners), while from a demand-pull perspective alliance formation negatively affects the possession of unique market knowledge. According to this view, investing time in finding useful weak personal ties – to find new unique market knowledge – is more important than investing time in building a proper firm network.

Granovetter (1973) describes another disadvantage of strong ties. He states that in networks with many strong ties, it is likely that actors who know each other also know the focal actor, which reduces the novelty of the information that is exchanged (Gilsing & Duysters, 2008). This implies that firms that only make use of their strong personal ties become sealed off from the outside world. Firms can transcend this kind of lock-in by actively using their weak ties; these ties cross network boundaries and form bridges between otherwise disconnected groups (Granovetter, 1973). Moreover, the knowledge that will be exchanged can be of a more radical nature, because weak ties are not as socially involved as strong ties, which means that the network density is low; resulting in the possibility to create new relations with actors outside the current network (Michelfelder & Kratzer, 2013; Granovetter, 1983). Therefore, it can be argued that to obtain radical new market knowledge, which is of importance in the commercialization phase, firms may need to make use of their personal weak ties. Based on the previous arguments the following propositions can be formulated:

- Proposition 5. In the commercialization phase, personal networks of entrepreneurs are positively related to the possession and utilization of weak personal ties, which can provide knowledge to the startup.*
- Proposition 6. In the commercialization phase, weak personal ties are positively related to obtaining radical unique market knowledge.*
- Proposition 7. In the commercialization phase, alliance formation is negatively related to the possession of unique market knowledge.*
- Proposition 8. In the commercialization phase, the possession of unique market knowledge is negatively related to the formation of alliances.*

2.3 Conceptual model

Figure 1 provides a comprehensive model of the aforementioned propositions.

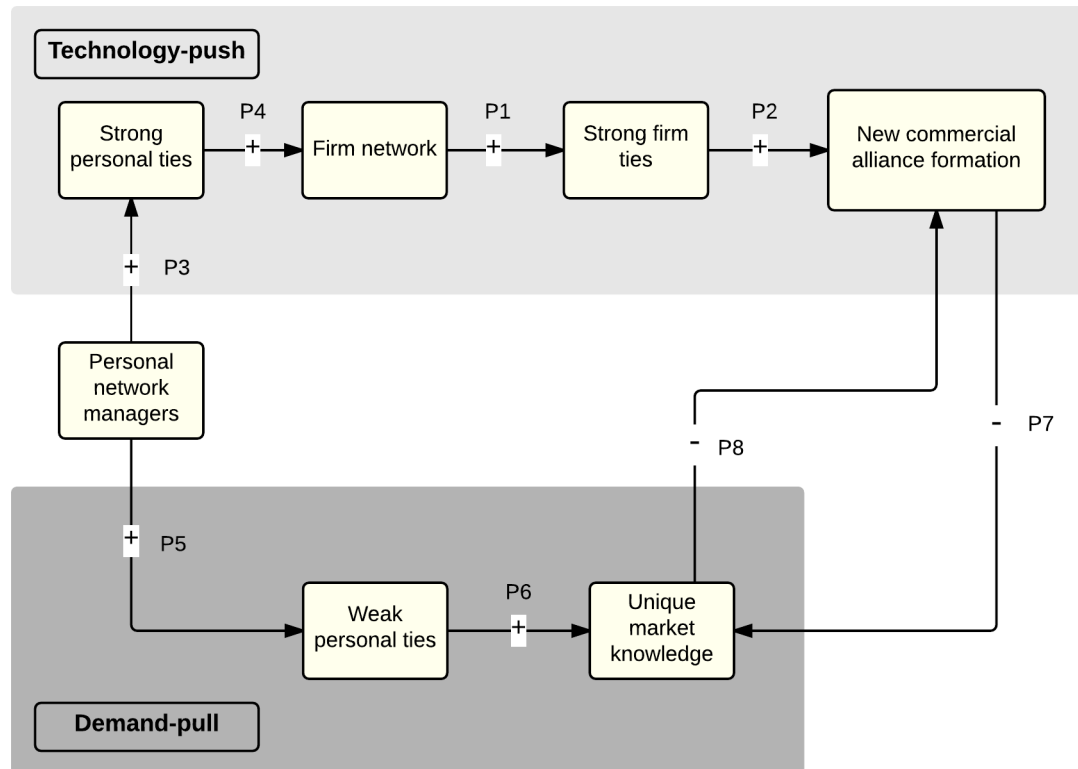


Figure 1. Conceptual model.

2.4 Combining strategies

In this study, both approaches are not only analyzed as opposing strategies, because both strategies can be complementary. According to Van den Ende & Dolfsma (2005), it is important to combine both strategies, because they state that to successfully develop an innovation both strategies are needed. However, the dominance of the perspectives will change during the innovation process. In the prototype phase competition is based on product differentiation. This means that, due to the lack of dominant product characteristics, the design and features of the product lack clarity.

To develop an innovation as a startup, a set of (complementary) resources needs to be developed or obtained through alliances to enhance the success of the innovation, which makes the technology-push strategy of main importance. Alliances can provide resources in a flexible way, which is meaningful in the early stages of the PLC due to the lack of a product standard. However, only using a technology-push strategy can lead to a mismatch with customer demands (Brem & Voigt, 2009). By using demand-pull insights such as unique market knowledge in the first phases of the innovation process, firms can prevent themselves from this mismatch. Therefore, it can be argued that in the early phase of the product lifecycle both strategies are necessary, only the push strategy will be more dominant than the pull strategy.

In the commercialization phase, markets are more defined because a product's characteristics have become clear, which causes a shift of focus from product differentiation to market differentiation (Abernathy & Utterback, 1978; Klepper, 1996). In this phase, commercialization of the developed products is of great importance. Therefore, firms need to

possess unique market knowledge to select the most appropriate market and customers; which enhances the success of the innovation. The possession of unique market knowledge provides the possibility to make targeted adjustments based on specific customer demands to improve the performance of the innovation (Abernathy & Utterback, 1978), or to customize the innovation to customer demands. However, making changes to serve differentiated customer needs is only possible when firms are able to do so. If firms lack the commercialization capabilities or the resources to make the incremental adjustments, they need to obtain these resources from other firms by forming alliances. Therefore, it can be stated that the dominance of the pull-strategy is high in this phase, but also the push-strategy needs to be in place.

The next section describes how the concepts are defined and operationalized, and how the data will be gathered and analyzed to evaluate these propositions.

3. Methodology

In this section the methods used to examine the research question are described and explained. This includes an operationalization of the concepts used, the research design, case selection, data collection and the data analysis.

3.1 Operationalization of concepts

3.1.1 Definition and measurement of the dependent variable

The dependent variable of this study is whether startups enter into an alliance or pursue independently, in both the prototype phase and the commercialization phase. First for each case the collaboration activities performed by firms in the different phases of the PLC are measured. With the help of narratives, the path traveled by firms that lead to a go-it-alone or collaboration strategy is analyzed.

3.1.2 Definition and measurement of intermediate and independent variables

Networks

To make the distinction between personal networks and firm networks, a clear definition of both concepts is necessary. If a relationship is based on a formal (contractual) arrangement and has a commercial attachment then the tie will be labeled as firm tie (Hite & Hesterly, 2001). It is a personal tie when the relationship is built on an informal basis, and the contact is not based on gaining commercial interest. In this research new ties are conceived to belong to the personal network, because an individual working in the startup has established the connection and therefore the tie is part of that individual's personal network; it becomes a weak personal tie. When there is a commercial interest between the firms in which the ties are active, the firm can become part of the firm network.

Strength of ties

The frequency of the repetition of the interaction can be used to explain the strength of the personal ties (Granovetter, 1973). However, in some cases it is hard to recall how often there was an interaction, and therefore another definition will be used: the definition of strong and weak personal ties of Marsden & Campbell (1984). In their study, they examined multiple measures for tie strength and concluded that a measure of 'closeness/emotional intensity' is the best indicator. According to this definition, close friends are defined as strong ties, and acquaintances or friends of friends as weak ties. In the firm network, strong *firm* ties are the repeated ties with whom the entrepreneur had a partnership before; the trustworthiness in this relationship is already developed and maintained. However, not all startups possess a network of repeated ties. Therefore strong personal ties – which transform into strong firm ties if there is a commercial interest – can be used. These ties are already strong ties according to the definition of Marsden & Campbell (1984).

Alliances

Also a clear distinction needs to be made between a collaboration partner and a buyer-seller relationship. In this study alliances are seen as voluntary (contractual) arrangements (Gulati, 1998) in which both firms are committed to and influence the development of the product. This means that a party can take an active role in helping the startup to improve the innovation by the mobilization of assets, developing unique components, or by providing important knowledge. However, partner firms can also passively assist the startup by giving the startup deferment of payments, or other kinds of assistance in which no effort of the partner firm is required. When a firm does not have to make any changes to its standard procedures, the interaction between the startup and the firm will be seen as a normal buyer-seller relationship.

Unique market knowledge

Unique market knowledge is defined as knowledge that describes a new customer segment, which was not known to the firm and the market before. Radical innovations are often developed by startups and are new to the market, which means that new customer groups need to be defined. Since a product can serve several audiences, the most promising customer group must be selected. To be able to select this group, unique market knowledge is needed. In this study, knowledge will be classified as unique market knowledge, when the knowledge is new to the firm, and based on this knowledge new business opportunities were found.

3.2 Research design

To obtain a better understanding of the phenomenon under investigation a qualitative research based on narratives from multiple cases is conducted. Several cases are analyzed instead of a single case analysis, since analyzing multiple cases results in a study that is more robust and the results are considered more compelling (Yin, 2003). A qualitative approach provides the possibility to investigate the concepts and the relationships between those concepts in-depth, since a small amount of cases are analyzed (Silverman, 2006). Besides, a qualitative approach is commonly used when conducting an exploratory research (Bryman, 2008). Therefore, it is the most suitable approach to perform an in-depth analysis in order to examine and understand what the role of alliances and networks is under technology-push and demand-pull conditions and how they influence the development and introduction of innovations, because this remains relatively unexplored in the current literature.

This qualitative research is based on the narratives of startups. According to Søderberg (2006) *“a narrative has a chronological dimension. It is made up of a sequence of actions and events along a timeline”* (Søderberg, 2006). Since the model that is presented in the previous section provides a sequence of factors that lead (not) to alliance formation, conducting a narrative analysis gives the possibility to analyze the storyline and to take this sequence into account.

The unit of analysis for each case is the startup firm. To examine alliance formation by a startup, the sequence of actions that take place before the alliance is established needs to be taken into account. Therefore, the storylines of firms are gathered to be able to understand the development of the firm, which explains its search for alliance partners or the choice to stay independent.

3.3 Case selection

To examine alliance formation from a push- and pull-perspective, consumer electronics startups and clean technology startups will be analyzed and compared. While consumer electronics is a well-known industry, the clean technology industry is less known. Therefore, a definition of what the clean technology industry comprises is given. A firm active in the clean-technology industry can be defined as a firm that develops a product that *“delivers value using limited or zero nonrenewable resources and/or creates significantly less waste than conventional offerings”* (Bjornali & Ellingsen, 2014). Both the consumer electronics industry and the clean-technology industry are known for their large amount of startup firms (Christensen, Olesen & Kjær, 2005). Besides, the startups in both industries develop physical products; this provides the possibility to make a fair comparison between these industries. Moreover, in both industries the demand-driven and technology-push perspectives are influencing the commercialization of the innovations (Christensen et al., 2005; Frankelius, Hultman, Linton, Johanson, & Gunnarsson, 2011). The consumer electronics industry is a buyer-driven industry (Gereffi, 2001), in which the pull strategy seems dominant. In the clean-technology industry the startups are searching for leading-

edge technologies and therefore these firms make use of the research facilities of universities (Polzin, Von Flotow, & Klerkx, 2015), which implies that resources are of main importance to transform the research into a tangible product. The different usage of both perspectives within these industries makes it interesting to analyze them in-depth and compare them.

The cases were selected by using LinkedIn. Through LinkedIn, a database of companies active in both industries is made. Then the selection criteria presented below are applied to the database, to obtain the most appropriate cases. In total twenty-eight cases are selected, fourteen of each industry. Seven out of the fourteen startups are active in the commercialization phase and the other seven startups are active in the prototype phase, so that both phases can be analyzed in-depth. The following criteria are used for the selection of the cases:

- **The startup must be located in The Netherlands.** It is important that the firms are located in the Netherlands because otherwise the entrepreneurial culture and institutions of the country need to be taken into account.
- **The maximum age of the startup is ten years.** This timespan is chosen because some firms, especially in the clean-technology industry, are conducting research for several years before starting to commercialize the product.
- **The startup must create and develop an innovative product.** In the database, many startups are only a reseller of products produced by other firms. This criterion helps to select only innovative firms, which need to be analyzed in this study.
- **Phase of development.** To be able to analyze both the prototype and the commercialization phase, firms from both phases must be selected.

After the selection criteria are applied the database contains eighty-five startups. Contact information of these startups is found on their websites. An email is sent to all these startups to ask if they were willing to participate in this study. Only three startups responded positively, therefore the other firms were approached by phone. The phone numbers are also found on the websites of the startups. If there is a number available the firm is contacted, but not all firms were willing to participate due to limited time. In the end, twenty-eight startups were willing to cooperate; these startups have been interviewed.

3.4 Data collection

To collect the narratives, semi-structured interviews with firm owners, directors or founders are conducted in the period July-September 2015. The advantage of interviews is that it is a suitable technique to obtain rich and detailed data about a topic (Eisenhardt and Graebner, 2007). The interviewees are asked to tell their story about starting a firm, developing and producing a product and (if relevant) commercializing the product. A downside of using interviews is the limited number of cases that can be analyzed, which results in a decrease of the generalizability of the results. However, since in-depth information from the cases is needed to provide an answer to the research question, interviews are the appropriate technique for this study. Besides that, there can be a lack of mutual understanding between the interviewer and interviewee, resulting in a misinterpretation by the interviewer of the intention of the interviewee (Bryman, 2008). Repeating the answer can solve this issue, because the interviewee can check whether the interpretation of the interviewer corresponds with the answer the interviewee attempted to give. Another disadvantage of interviews is that the interviewee can give social desirable answers. Asking supplementary questions or for empirical examples during the interviews will reduce this problem.

During the data collection process, it appears that in a few cases the startup owners or directors were not involved in the firm during the first years. Therefore data about the prototype phase obtained from these firms is handled with care during the data analysis. Additionally, some interviewees did not have plenty of time; therefore during the interview

there was less time to ask additional questions. This is also addressed in the data analysis section.

3.4.1 Semi-structured interviews

Usually unstructured interviews are conducted when narratives are examined. However, unstructured interviews lack the possibility to verify if the data is complete and if all the propositions are covered. Therefore, to ensure that all the topics exposed in the conceptual model are treated, the interviews are semi-structured. Additionally, semi-structured interviews make sure that the interviewee recounts only about topics asked for, which are related to the subject. This does not imply that it is a standard interview, where the interviewer asks questions and the interviewee provides answers. The interviewee is asked to tell his/her story from the beginning of the firm up to now. The interviewer only asks questions when additional information about the topic is needed. Besides, to stimulate the story telling during the interview, the interviewer asks only clarifying questions (Søderberg, 2006).

To prepare for the interview, background information about the development of the firm is gathered via the firm's website and through news articles written about the firm's development. Moreover, information about the background of the interviewee is collected by means of LinkedIn. Having this information helps to understand the development of the firm more in-depth, and the interviewer is able to remind the interviewee of events that may be of interest. However, the interviewees are also asked to provide background information about the firm, their past experiences, and other developments because this enhances the comprehensiveness of the narrative. To clarify the content of the interview, the following topics are explored in all the interviews:

- The phase the firm is operating in at the moment
- Past experience of the interviewee, and/or the past experience of the (co-)founders
- Start of the firm, how was the idea found and transformed into a prototype
- Development of the firm, how does/did the firm gain needed resources
 - o If through collaboration, then the following topics were discussed:
(dis)advantages of collaborating and trust
- People involved in the development of the firm
- Interaction with customers, obtaining information on customer needs
- Commercializing the product
- Customer segments, niche market or mass market
- The development of the product during the commercialization phase

Recurrent questions throughout the interview are about the people that are involved, how they know these people or firms, and the way knowledge is obtained. The detailed interview script with all the interview questions based on the conceptual model is presented in appendix I in Dutch and in appendix II in English. It is important to note that not all the questions in the script are asked during all interviews; the interviewer used the script as a guide to ensure that all the topics are covered.

3.5 Data preparation

After conducting the interviews, the interviews are recorded and transcribed to make sure all the information given by the interviewee is stored and to be able to analyze the data thoroughly. The transcripts are sent to the interviewee to give the interviewee the possibility to verify whether the transcript is complete or additions need to be made. Subsequently the narratives are rewritten (if necessary) to place the actions in a chronological sequence, because when people are telling stories they do not always present them chronologically (Creswell, Hanson, Plano Clark & Morales, 2007). Thereafter, the interviews are clustered into four firm categories: Consumer electronics firms operating in the prototype phase (Cons-New), consumer electronics firms operating in the commercialization phase (Cons-Old),

clean technology firms operating in the prototype phase (Clean-New), and clean technology firms operating in the commercialization phase (Clean-Old).

By making a distinction between firms that operate in the prototype phase and the commercialization phase memory recall biases can be assessed. For some firms active in the commercialization phase, the prototype phase is a while ago and therefore there is a chance that these firms lack a complete memory recall. Limiting the recall bias is necessary because detailed information of the development of firms is needed to draw solid conclusions. Therefore, the firms that are active in the prototype phase can be used to analyze the first phase of the PLC and to assess biases in the memory recall of the firms active in the commercialization phase.

3.6 Data analysis

When the interviews are categorized, the data is analyzed. To analyze data gathered from narratives, two approaches can be used: The paradigmatic mode and the narrative mode (McCance, McKenna & Boore, 2001). Using a paradigmatic analysis, important themes that appear across stories and concepts can be derived from the narratives (Polkinghorne, 1995). The narrative mode provides insights into the sequence of the story and creates context for understanding meaning and uses a timeline or plot that *“serves to recognize the contribution certain events make to the development and outcome”* (McCance et al., 2001).

In this study both types of data analysis are combined. The analysis starts with the paradigmatic analysis, in which the analysis is guided by reasoned propositions based on theory. The data is analyzed deductively by using the propositions as predetermined patterns. With the concepts derived from the theory in mind the transcripts are coded. However, important findings, which do not fit into one of the predetermined codes, are retained in memos. According to Polkinghorne (2005), memos capture and store ideas and thoughts of researchers as they come to mind. After the interviews are fully analyzed, cross-case analyses of the cases within the same category are made, to examine the cohesion between the findings among several cases. Eisenhardt (1989) states that examining a single case can result in conclusions that are idiosyncratic to a particular case. Conducting a cross-case analysis ensures that more generic conclusions can be extracted from the data.

After the cross-case analysis, a summary of each firm category is made. It does not mean that only findings supported by the majority of cases are mentioned in the summaries. Also new case-specific insights are included, if interesting to highlight. The construction of summaries suits the narrative analysis principles, which states that plots need to be developed to tie together individual experiences and those plots help to create a context for understanding meaning (McCance et al., 2001). Due to the coding process prior to the creation of the summaries, the summaries contain all the information that is needed to provide evaluations of the propositions. However, also additional information and background information can be stored in the summaries, which helps to gain a deeper understanding of the answers given by the interviewees. Besides, the summaries contain quotes taken from the interviews to strengthen the arguments given by the interviewees. It needs to be taken into account that most of the interviews are conducted in Dutch; therefore the quotes are translated into English. Besides, the interviewees wanted to remain anonymous to prevent spillover of knowledge to competitors, or to prevent that a current partner can read about the negative opinion of the interviewee on partnering. Therefore, the interviews are indicated with an IN#(number of interview) code, when a quote from an interview is used³.

³ When an interview was conducted the transcript was labeled with a number. The numbers are ascending from one to twenty-eight. The number in the code corresponds to the number given to the interview.

When the summaries are created, the propositions can be evaluated. The firm categories 'cons-new' and 'cons-old' as well as the categories 'clean-new' and 'clean-old' are compared to examine the propositions in the prototype phase. If there is no notable difference between the younger and older startups of an industry, the narratives are clustered and compared to the other industry. When the narratives of the younger and older startups of the same industry contain a difference, the two firm categories are independently compared to the other industry. Besides, the difference between these two categories will be analyzed in the discussion section. Subsequently, the propositions in the commercialization phase are evaluated by examining and comparing the firm categories Cons-Old and Clean-Old.

After the evaluation of the predetermined propositions, the new explored relationships are described and explained. Thereafter, the usage of the push- and pull-strategy by both industries during the different phases of the PLC is shown. Subsequently, additional insights are presented. These insights may influence the conceptual model. Finally, the results are aggregated to create two new conceptual models that show the narratives of the startups from both industries, one model about the prototype phase and one model about the commercialization phase. Due to the combination of both industries in one conceptual model, the differences between the industries become apparent.

4. Overview of the case results

In this section a comprehensive overview of the results gathered from the twenty-eight interviews is presented. First a summary per category is given to provide insight into the stories told by the interviewee. Thereafter, the propositions are evaluated and the new discovered paths are explained. Subsequently, the push- and pull-strategy are combined, and additional insights are provided. Finally, a new conceptual model is developed based on the findings.

4.1 Summary per category

4.1.1 Consumer electronic startups in the prototype phase (Cons-New)

General information

The firms in this category are all active in the prototype phase of the PLC. However, there is a difference in the activities the firms are performing at this moment. The firms IN#2, IN#22 and IN#27 have already developed a prototype, are searching for market opportunities and are thinking about how to enter these markets. IN#2 expects to sell its first products in October or November 2015. The firms IN#1, IN#3, IN#20 and IN#23 are still developing the product.

The past experience of these entrepreneurs or co-founders is of main importance to understand the starting point of the firms. All seven entrepreneurs have gained work experience before the startup was established. Some entrepreneurs were already active in the industry they started to operate in (IN#1, IN#20, IN#27). Besides, some interviewees have developed entrepreneurial competences, as they worked in startups before (IN#2, IN#20, IN#23).

Summary

As the RBV describes, a startup needs to gain resources to be able to develop and to commercialize the product. Being an entrepreneur in a startup implies that you need to deal with the shortage of resources. Therefore, the entrepreneurs make use of all the resources that are available. This means that family, friends, former colleagues, and other weak or strong personal and firm ties are used during the development of the firm. As IN#22 said *“you have to see it like this, I started using my warm contacts. Then I used the contacts that were less warm, such as former colleagues or old classmates, and thereafter LinkedIn connections were used”*. The personal and firm networks of the interviewees differ in size and suitability. However, this does not influence the usage of the networks at the starting point, since all the firms used their connections to find assets, knowledge or new connections. According to IN#20, it is not strange that entrepreneurs act like this, *“If you have a question, even if you are not an entrepreneur, you start looking into your network to find out who is able to provide an answer”*. This means that the personal and firm networks of the founders are used as a starting point from which the firm is build.

Only the firms that have been active in the same industry, or in a market related to that industry, make use of former strong firm ties when starting the firm (IN#1, IN#20, IN#27). Knowing the firm makes it easy to get in contact, take a possible collaboration into consideration, share more easily knowledge about the development of the product, and the entrepreneur has knowledge about the reliability and track record of the firm (IN#1, IN#20, IN#27). Therefore, the entrepreneur can make an informed decision about the appropriateness of the party as an alliance partner. The entrepreneurs that did not have any experience in the industry, started to deploy their personal network to find new connections and resources (IN#3, IN#2, IN#20, IN#22, IN#23). Besides, three startups in this category

are affiliated to an incubator or an accelerator program (IN#2, IN#3, IN#22). These programs provide a large network due to the involved mentors or firms, which can be used by the startup to find new ties. The mentors and firms, who become part of the personal network of the entrepreneur, are able to give the knowledge about the parties, which accelerates the search process and increases the chance to be invited by potential new alliance partners.

Personal strong ties serve different aims. These ties are often used throughout the prototype phase, to gain insights in adjustments that need to be made (IN#1, IN#3, IN#23, IN#27). These persons can easily be asked for information and their opinion, because there is no commercial interest and they are willing to help. However, the information from these ties is not always of high quality. The feedback or information can be socially desirable (IN#27), or the ties offer information that is outdated due to the fact that these people are not active in the industry (IN#23). If a strong personal tie possesses important information or knowledge it becomes a firm tie, because there is a commercial interest in the information or knowledge. However, it does not happen often that former strong personal ties become new firm ties.

In this firm category, weak personal ties are used to find new ties. This is important, because finding a new tie through an existing tie provides the possibility to get in contact with people who cannot easily be approached due to their position in the firm (IN#3). If you enter a firm at the right department and the new tie is entitled to make decisions, the chance that the party understands the importance of the relationship and is interested to collaborate increases (IN#20). However, since not all of the resources can be obtained through the current network or the network of their network, also new ties need to be formed by approaching new persons. The way in which the new connections are found varies per firm; it depends on the entrepreneur's preference. As one interviewee stated: *"We are like hookers, we pitch everywhere throughout the country and beyond to meet new people"* (IN#2). Other firms make use of network events, LinkedIn, or e-mail to get in contact with potential firm ties (IN#1, IN#2, IN#20, IN#22). All startups have done some targeted searches on the Internet to find connections that are highly necessary for the development of the product.

The new connections play several roles; it has happened multiple times that a new connection becomes an employee or team member (IN#3, IN#23, IN#20). Besides, new connections are also used as collaboration parties that can provide the needed resources. When the connections are made and the firm is willing to talk, the process from new personal tie to firm tie, and even unto a new alliance partner can go really fast. In a few meetings, when there is chemistry and the party is open for new innovations, a new alliance can be created (IN#20).

Several times it is said that it does not matter what tie is used to establish the new alliance. If there is chemistry between the persons, and both firms understand the relevance of the collaboration, the alliance can be based on a new tie (IN#1, IN#20, IN#22, IN#23). The difficulty of collaborating with a firm that is new to the entrepreneur, is that it is hard to check whether the party can be trusted and is capable to deliver the promised input. Most of the failed collaborations started as cold contacts. After a few meetings the new tie and the entrepreneur found a commercial interest for both firms. The ties became firm ties in the form of a buyer-seller relation or a new alliance partner. After the contracts were signed, the relationship needed to be developed into strong firm ties. However, in the end, the firm was not able to deliver what was agreed upon resulting in a failed partnership (IN#2, IN#20, IN#23, IN#27).

New ties, which start as weak personal ties, serve not only as potential alliance partners. These ties also provide new knowledge to startups. The knowledge provided by new personal ties is similar to the knowledge obtained from former weak personal ties. The knowledge gained from weak personal ties is partly similar to the knowledge gained from strong personal ties. Both types of personal ties give feedback on the product. Besides, also

the information from weak personal ties needs to be handled with care, because, in most cases, the weak tie is not active in the industry. Therefore the information is often irrelevant or the person does not give proper feedback because it is not usual in their relationship to criticize work of the other person (IN#20, IN#23).

However, weak personal ties extend well beyond the knowledge a startup can gain from personal strong ties. It can be the case that a former classmate becomes active in the firm, or does a personal investment into the firm. Besides, weak ties – especially new ties – give knowledge about potential niche markets. This can happen in two different ways: When the product of the startup is promoted in the news or media, it happens that a person from a different market contacts the entrepreneur to give insights about the potential of the product in their market. The other way is that a person, for instance during a network event, connects the product to another market in which that other person has connections. Both ways ensure that firms are provided with unique market knowledge (IN#2, IN#3, IN#20, IN#27).

All the interviewees argue that a startup needs to collaborate; otherwise the product cannot be developed. However, some interviewees are not eager to enter into new alliances. There is no primary reason why these startups prefer to do it independently. The reasons differ from ensuring the quality of the product, losing the intellectual property of the product, to cost efficiency considerations (IN#2, IN#22). However, most firms are not afraid for knowledge leaking or losing the intellectual property. These firms collaborate to increase the time-to-market, to gain a stronger position on the market or during negotiations with other firms, and to obtain the missing resources (IN#1, IN#3, IN#20, IN#23, IN#27). This does not mean that a startup gives all its knowledge about the product to the partner; most startups are careful and conceal important knowledge to retain the control over the product and the startup.

Thus, as figure 2 shows visually, all seven firms used their personal networks, which are gained from former experiences, to start building the firm and develop the network. Besides, three firms that were already active in the industry also used their firm network. Strong personal ties are not used to extend the firm network; only knowledge is gained from these ties. New ties, and to a lesser extend former personal weak ties, play an important role, if startups lack an extensive firm network. These new ties provide feedback and market knowledge, become firm ties and even new alliance partners. However, the new tie becomes a strong firm tie after the alliance is established. These ties are found through the former weak personal ties of the entrepreneur or via targeted searches on the Internet. In the beginning of the prototype phase, the former firm network is used by three firms to find alliances partners (black path from 'firm network' to 'strong firm ties'). When time passes, alliances partners are gathered through new ties (red path from 'firm network' to 'strong firm ties'). Generally, alliances are not seen as dangerous for the development of the firm, alliances are necessary to be able to develop the product. Therefore, all seven startups have alliance partners in the prototype phase.

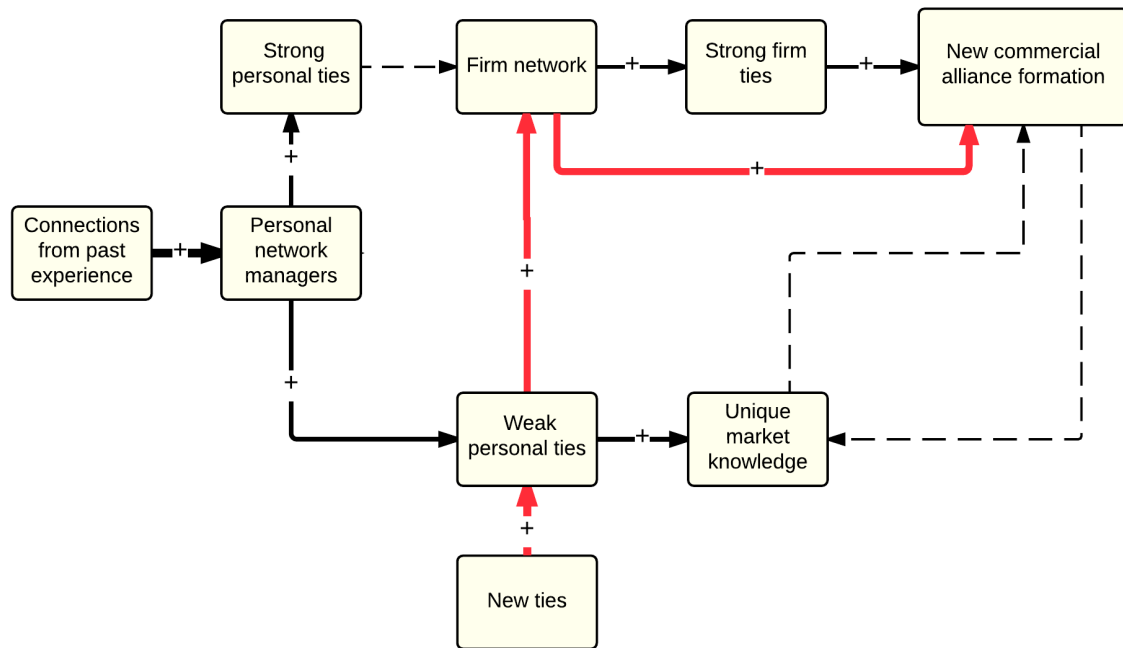


Figure 2. Conceptual model about the prototype phase based on the findings of category Cons-New⁴. The red lines are new paths, the dotted lines are paths that are not supported by category Cons-New. The thickness of the lines show how often the path is chosen by a startup.

4.1.2 Consumer electronic startups in the commercialization phase (Cons-Old)

General information

The firms are all active in the commercialization phase of the PLC. However, the activities that these firms perform differ. All seven firms are improving their current product by making incremental improvements. Additionally, some firms are developing new products for the same market (IN#4, IN#8), or are developing a new product for a different market (IN#8, IN#13, IN#25).

The situations from which the startups have emerged are different per case. Two firms were started almost immediately after the founders left or finished their education (IN#4, IN#8). The products of two firms were invented and partly developed within another firm, and based on the potential of the products the new startups were constructed (IN#7, IN#9). Besides, another firm is established when a larger firm divested the product; it became a spin-off (IN#13). In addition, the founders of two other companies had another firm before creating the new startup (IN#19, IN#25). The former startups of both founders were active in industries related to the industry the new firm is currently operating in.

Summary

Due to the different backgrounds of the seven startups, the size of the networks is also different. The startups that started their firm in the same industry, in which they have been active before, have already developed a firm network and a personal network that could be used as a point of departure. These firms use their former collaborating partners or former employers to establish partnerships right from the start (IN#7, IN#9, IN#13, IN#19, IN#25). For three interviewees the new partnerships were of such importance that they only wanted

⁴ The new concept 'connections from past experience' is added to the conceptual model. However, this concept is not new, but gives a visual description about the usage of the concept 'personal network'. Therefore, the path is not given in red but in black.

(or were able) to start their firm when the collaboration was signed (IN#7, IN#9, IN#25). As an interviewee states, *“Before I started the firm, I visited the four largest retailers in this industry. I told them, if I continue with this idea, it would cost me a lot of money, time and energy. Can I count on your support?”* (IN#25). After the approval of the retailers – retailers that were already in the firm network of the entrepreneur – the entrepreneur started the firm.

Even though the starting position between the firms differs, almost all seven firms have used their personal networks to develop the startup. The strong personal ties are mainly used to support the entrepreneur. This means that these ties provide knowledge about entrepreneurial skills (IN#25), or help with the establishment and negotiations of the contract between the startup and partner firm (IN#9). The support gained from these strong personal ties has helped the entrepreneur starting the firm, and are without commercial interest. Not only the strong personal ties have played a role at the early start of the firm, the former weak personal ties of the entrepreneurs, such as old classmates, former colleagues, or contacts from a long time ago, are also used. In this firm category, the former weak personal ties assist the entrepreneur to find new skillful people, which can become new team members (IN#4, IN#13, IN#19).

It seems that the former weak personal ties already played a role in the prototype phase. However, the role is limited to gathering team members. New ties, on the other hand, are of importance, in particular to extend the firm network (IN#4, IN#7, IN#8, IN#19, IN#25). For example, these ties are needed to find firms that have production and assembly facilities, design expertise and skilled workers. The new ties are found in several ways: through events, cold calling, or by means of selecting and targeted approaching. As an interviewee explains *“we met the party during a business event, they were doing a lot of things, things we needed. We had several conversations, and in the meanwhile we searched for other parties. However, at a certain moment we decided to collaborate with that firm. They had an office nearby, it felt right and they were willing to help improve and invest in the product”* (IN#8). Most of the new ties transform into firm ties, because the connection is often based on a commercial interest. Generally, the connection becomes a standard buyer-seller relationship, and in three cases the firms become new alliance partners (IN#7, IN#8, IN#25). The new alliances are not based on strong firm ties, since the relationship is developed after the partnership was already established.

During the development of the product, the personal network and firm network also expand. For example, firms that are located in a multitenant business building explain that the location has helped to build a personal network (IN#8, IN#19). Besides, when the startup is active in the industry for an extended period of time, others in the same industry get to know the firm. This results in other firms approaching the startup (IN#4, IN#9, IN#13, IN#19, IN#25). *“We have developed an extensive network in the industry, and we had close contacts with a consultancy firm that is active in the same market. At a certain point in time a firm that wanted to collaborate contacted us. They were searching for a solution, and heard about our products and expertise from the consultancy firm”* (IN#13).

This is especially the case in the commercialization phase, because the products are available on the market. Besides, most startups focus on a niche market in which the amount of active firms is limited. According to (IN#9) *“the world were are operating in is relatively small. So, people heard about our activities and fairly quickly these people contacted us and asked us what we do, and how we do it”*. The majority of firms that contacted the startups wanted to become a reseller or dealer of the product (IN#4, IN#9 IN#19, IN#25).

All the firms that needed to develop the product from scratch made use of alliances in the prototype phase. They all agreed that alliances are indispensable, and are useful for the development of the product. Most of the firms only have a positive opinion about partnerships and state that alliances are needed to enhance the quality of the product or decrease the

time-to-market (IN#8, IN#13, IN#25), or to strengthen the position of the startup in the market (IN#9). The motto of one of the firms is: *"If you cannot divide, then you cannot multiply"* (IN#25). Some firms experienced difficulties with partnering, such as communication issues, or the partnership needed to be terminated due to a change in the strategy of the partner, or the partner is not able to achieve the agreed quality (IN#7, IN#8, IN#25).

In the commercialization phase, there is no harmony among the firms about using partners or not. However, all startups use other firms to sell the product in one way or another. Some startups state that the parties are used, because they possess many distribution channels that can easily reach an enormous market. However, a difference needs to be made between alliancing and buyer-seller relationships. In the cases IN#13 and IN#25, the distribution and reselling partners also test the product, give feedback, and provide resources to help the firm develop the product. Both firms argue that they enter into these collaborations to save time and to be able to focus on the development of products. The other five firms also make use of distribution and reselling firms, however, the relation is based on a standard buyer-seller contract (IN#4, IN#7, IN#8, IN#9, IN#19). The partners are found through events, the partner approached the firm, or the firm was already part of the firm network of the entrepreneur. However, in addition to the sales through partner firms, two firms also sell the product via their own online shop (IN#8, IN#9).

In the prototype phase the firms already knew which markets they would serve. This knowledge is obtained through past experiences and former employers (weak personal ties). The only market knowledge gained in the prototype phase, through the validation of the product on the market, is about adjustments to the product that need to be made. In the commercialization phase, three startups started to search for new niche markets to increase their sales (IN#8, IN#13, IN#25). Two entrepreneurs have used their personal weak ties to find a new niche, while another firm has conducted a market research.

Thus, the starting point was different, but all the firms used their personal network to develop the firm. Especially strong personal ties are used to support the entrepreneur, while the former weak personal ties are used to obtain new team members. New ties help to expand the firm network. Since the startups become more commonly known in the industry, their network also expands due to firms that approach the startup. In the prototype phase, almost all firms use alliances to develop the product. In the commercialization phase there is no unilateral decision to collaborate or to use buyer-seller relations. Only two firms collaborate in this stage of the PLC, while five firms are only using buyer-seller relationships for several reasons. However, firms are not influenced by the fear of knowledge leaking or losing unique market knowledge. Before the firm was founded the unique market knowledge was already gathered through former weak personal ties or past experiences. In the commercialization phase, only three firms needed extra unique market knowledge to serve new markets. Figure 3 visualizes the narrative of the prototype phase, figure 4 displays the commercialization phase.

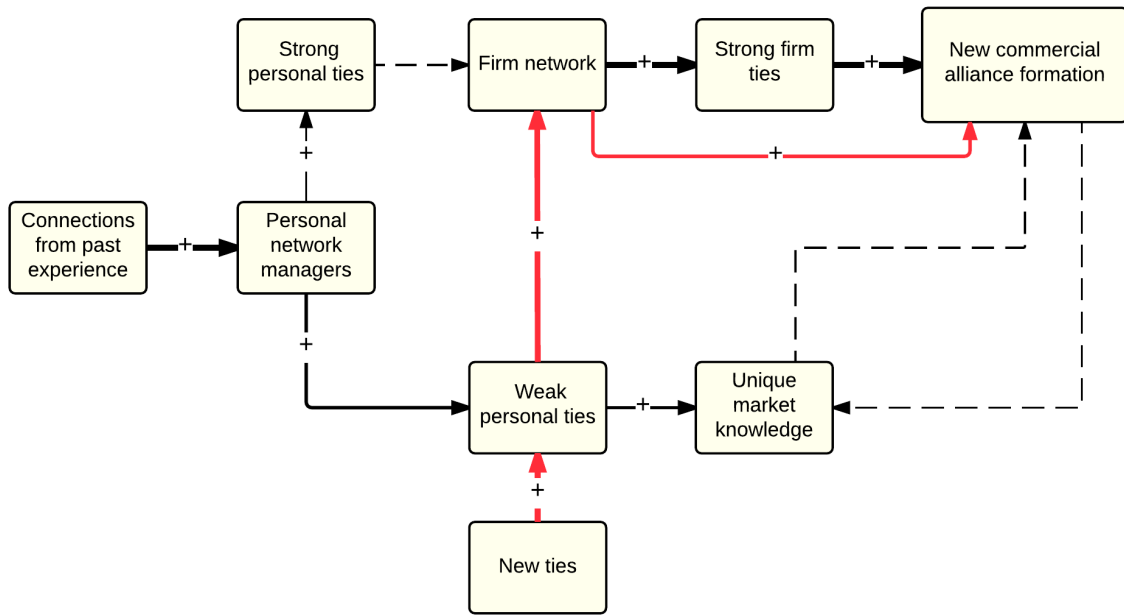


Figure 3. Conceptual model about the prototype phase based on the findings of category Cons-Old. The red lines are new paths, the dotted lines are paths that are not supported by category Cons-New. The thickness of the lines show how often the path is chosen by a startup.

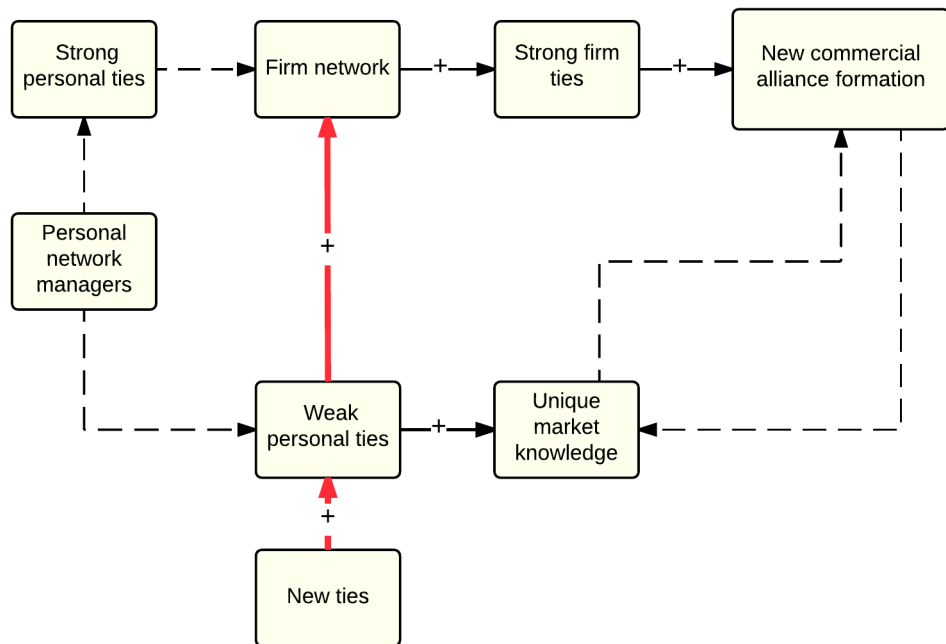


Figure 4. Conceptual model about the commercialization phase based on the findings of category Cons-Old. The red lines are new paths, the dotted lines are paths that are not supported by category Cons-Old. The thickness of the lines show how often the path is chosen by a startup.

4.1.3 Clean technology startups in the prototype phase (Clean-New)

General information

The firms in the new clean-technology category are all in the prototype phase of the PLC, but the daily activities differ due to the stage the product is in. A majority of firms are making the firm ready to enter the market (IN#5, IN#6, IN#17, IN#18, IN#26), while a minority is still

developing prototypes to improve the product (IN#12, IN#21). However, the firms that are almost entering the market are also still improving the product.

All the entrepreneurs have gained experience related to the startup before starting the firm. Most of the entrepreneurs were already active in the same or in a related industry (IN#5, IN#6, IN#12, IN#17, IN#21). Some of them already worked with similar technologies or products (IN#5, IN#6, IN#12, IN#17, IN#21), or with the material that plays a significant role in the product (IN#18, IN#26). Most of the entrepreneurs have a long career; only two founders were recently graduated and have only several years of experience (IN#12, IN#21).

Summary

Due to the experience the entrepreneurs have acquired in the industry, the personal and firm network were of main importance during the foundation of the firm. The former firm ties are used to gain knowledge and to find alliance partners. Four firms made active use of the strong firm ties, two startups formed new alliances right from the beginning (IN#5, IN#6), and two startups gained knowledge from firms that are in their firm network (IN#17, IN#21). The knowledge is about the product and is mainly of a technical nature. The possession of such a network at the start does not only help the entrepreneur to obtain knowledge, the firms in the network are also often willing to help the entrepreneur. As an interviewee stated *“possessing the connections makes it easier to get things done...and sometimes, as a starter, you need an helping hand and these firms are doing that by giving you a reduction on the cost price, for example (N#5).*

However, not only the firm ties are providing the helping hand, also personal ties are willing to assist. Both strong and weak personal ties played a role. The strong personal ties, for example close friends or former colleagues that became friends, are used to conduct feasibility studies (IN#26), or to think along about technical issues and how to build a firm (IN#5, IN#12, IN#17, IN#18). The weak personal ties are also used to obtain knowledge about the technique or the market (IN#5, IN#12, IN#17). Through both the strong and weak ties, startups have found team members in the first phase (IN#5, IN#6, IN#12, IN#18, IN#21). For example, the neighbor had its own firm, but became a co-founder of the new startup (IN#18).

The entrepreneurs that already possess a large personal and firm network in the industry are able to develop the product together with these connections, or find new ties via the existing ties. The existing connections do not only provide knowledge. Through the relationships the startups can also make use of research and development facilities (IN#6, IN#21, IN#26). Besides, the new weak personal ties are used to expand the firm network, which can result in the construction of alliances (IN#12, IN#17). An interviewee argues: *“It is definite that warm contacts speed up the process”* (IN#21). This is especially the case for finding new ties, because that can be a time-consuming task. First, the firm needs to be found, and then the information about the new ties needs to be gathered, and finally a comparison between the firms must be made. Since all firms use their former network to find new ties, the process is faster because the firms are known and the information is easily collected.

Even the younger entrepreneurs were able to select new ties through their current network, which is developed in a short period of time (IN#12, IN#21). These startups were able to extend their personal network, because they were accepted in one of the incubator or accelerator programs. These programs increase the network of the firms, and introduce the startups to firms that possess the needed resources. For example, one of the startups wanted to get in contact with the CEO of a large Dutch company. Through a weak personal tie of the startup – obtained via the incubator program – a meeting with the CEO was arranged.

When time passes, the firms become more known in the industry. This entails that the firms gain reputation, which implies that other firms also approach the startup. These new ties have a commercial interest and often they provide insights in new market opportunities. In almost all cases, the new tie wants to benefit from the innovation and often these firms are active in another market than the startup is in (IN#5, IN#6, IN#17, IN#18). However, it is not strange that awareness can already be created in the early stages of the PLC. The focus of clean technology firms is often on small niche markets, within niches wherein only a few firms are active. As an interviewee argues: *“When visiting network events, you will see the same people over and over again after a while* (IN#26). Besides, another interviewee states: *“The industry is a relatively small world and everyone knows each other and talks to each other”* (IN#6).

Since most of the clean technologies are complex and require many components and expertise, all of the startups believe that it is not possible to develop the technology without alliance partners. Therefore, two of the seven startups already have an alliance partner from the start and the other five firms also found partnerships in the prototype phase. Almost all alliance partners are found through personal ties or firm ties of the startup. In later stages of the prototype phase, the new created weak personal ties are often used to find and create an alliance.

During the development of the firm, both the former weak personal ties and the new established weak personal ties are of main importance to gain unique market knowledge. In some cases the knowledge was obtained through former firm ties, because the knowledge was already gathered during the time active at the previous job (IN#5, IN#18), or the knowledge is gained from an acquaintance that is active in a related industry (IN#21). The new obtained weak ties, mostly found via former personal ties, are active in the same or a related market (IN#6, IN#18, IN#21, IN#26). Theoretically, startups do not want to collaborate with the party from which unique market knowledge is obtained, and who is part of the firm network of the startup. However, in several cases the startup starts a partnership with the party that provides the knowledge⁵, because the technology developed by the startup can extend the current technology of the knowledge provider (IN#6, IN#17, IN#21, IN#26).

Since most of the firms already have some experience in the industry, all the entrepreneurs used their former personal and firm network to develop the product and firm. The firm ties often provide technical knowledge and assist the entrepreneur during the starting phases. Strong personal ties are always willing to help and give entrepreneurial knowledge. The weak personal ties provide technical and market knowledge. Besides, former networks are used to find new ties; ties that help to build the firm network since there is (in most cases) a commercial interest. When time passes, the new ties become more important and these ties expand the firm network and can become alliance partners. Moreover, other firms approach the startup to take advantage of the knowledge and the technology developed by the startup. All firms are in agreement that collaboration is essential to become a successful firm. Besides, the startups are not afraid to lose market knowledge; they are even willing to collaborate with the parties that provide the knowledge. In figure 5 the summary is visualized.

⁵ The unique market knowledge is applied after the collaboration was established. Therefore, the sequence of actions assumed in this study is that the unique market knowledge is obtained from the new alliance partner, not from the new weak personal tie.

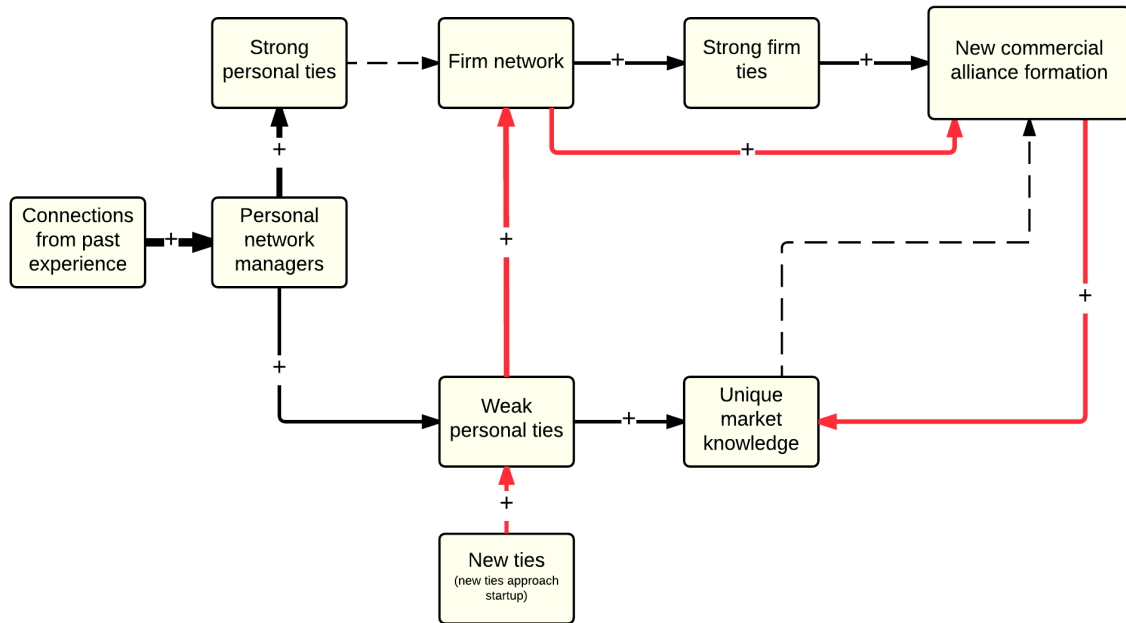


Figure 5. Conceptual model about the prototype phase based on the findings of category Clean-New. The red lines are new paths, the dotted lines are paths not supported by category Clean-New. The thickness of the lines show how often the path is chosen by a startup.

4.1.4 Clean technology firms in the commercialization phase (Clean-Old)

General information

All seven firms are actively commercializing their product or technology. However, there is a difference in the time the startups are active in the market. Three firms have just started selling their technology or product. This means that these firms are exploring the market and developing their first projects (IN#10, IN#15, IN#24). The other four firms are already in the commercialization phase for a longer period of time (IN#11, IN#14, IN#16, IN#28).

The past experience of the startups is quite different. Two of the startups have obtained entrepreneurial skills, because the founders have worked in one or more startups before (IN#10, IN#14). However, the entrepreneurs were not active in the same industry. Besides, three startups have been active in the industry for several years, but as employees (IN#11, IN#15, IN#28). Therefore these entrepreneurs have no experience in starting and developing a firm, as one interviewee said: *"I have developed a large network, but I lacked the entrepreneurial skills"* (IN#15). Additionally, one of the entrepreneurs was an employee in a different industry, but he could use the technical study he followed to develop the product (IN#24). Another startup is created right after finishing education and therefore the founders did not have much experience in the industry (IN#16).

Summary

The past experience of the entrepreneurs affects the starting position of the startup. In this firm category the past experiences of the entrepreneurs are divergent, therefore the role played by the personal network and firm network differs between the startups. At the beginning, some startups did not yet develop a firm network, since these startups lack working experience (IN#14, IN#16), or there was no need to use the firm network (IN#28). However, the other four firms have been using their firm network for several purposes. Three firms have used their strong firm ties to enter into a new partnership (IN#10, IN#11, IN#15), while one firm has used the firm network to find new firms to expand their firm network and to find potential collaboration partners (IN#24).

The personal network of the entrepreneur or co-founder is used in several ways. The strong personal ties are used to gather new team members (IN#16, IN#28), which are close friends or family members. Besides, one of the entrepreneurs made use of the strong ties to obtain general knowledge about the industry (IN#10). Additionally, the ties played a role as sparring partner, to check whether the plan developed by the entrepreneur is feasible (IN#24). Three entrepreneurs did not mention the role of strong personal ties during the first stage of the development. Therefore it seems that the strong ties did not make any contribution at the start of these firms (IN#11, IN#14, IN#15).

Weak personal ties are also used to gain knowledge. However the knowledge is more aimed at technical development. These ties can provide technical knowledge, because they are active in the same or related industries, or the entrepreneur is connected to these ties through their former job or study (IN#10, IN#11, IN#24). Besides, weak personal ties give information about potential new connections, which can become new firm ties and even team members (IN#16). One startup has used the weak personal ties to obtain information about secondary matters, issues with which an entrepreneur needs to deal (IN#28). Additionally, the weak ties of two firms are committed to the startup as advisors, which can be contacted when information is needed (IN#10, IN#11). Two firms state that the former weak personal ties did not contribute to the startup at the start of the firm (IN#14, IN#15).

The role of the personal and firm network is limited and therefore, when the development of the firm continues, new ties need to be found. To acquire these new connections, several channels are deployed. The Internet is often used (IN#10, IN#11, IN#14, IN#15), or via the connections that already exist (IN#16, IN#24). However, when a personal network was build through new ties obtained via the Internet, the startups strive to use the network of these new weak personal ties to find new connections (IN#11, IN#14). Besides, some firms are selected for an incubator program, which assist the startup in finding new ties (IN#14, IN#15, IN#16, IN#24). These new ties only have a commercial interest and therefore, if interesting for both parties, the connection becomes a firm tie.

When the networks develop and grow and the firm becomes more known in the industry, new firms are also approaching the startup (IN#10, IN#11, IN#14, IN#24). In most cases these firms want to extend their current portfolio, offer the firm insights into new markets, and therefore want to collaborate with the startup. All the seven startups in this category have alliances in the prototype phase, and argue that it is not possible to develop a firm in the clean technology industry without partnering. Several alliances are established through the former firm or personal network of the entrepreneur (IN#10, IN#11, IN#15, IN#24), and all of the startups have collaborations based on new weak personal ties. Even though all startups collaborate, the firms state that there are also disadvantages of collaborating. Three firms are cautious when it comes to partnering, because of the risk of losing their intellectual property (IN#14, IN#15, IN#24). As an interviewee, which had a bad experience with partnering, said: *“you have to collaborate, you do not have a choice. However, I am really careful when I enter into a new alliance. Paranoid, maybe that is the wrong word, but I am really cautious to promise irreversible things”* (IN#15).

When time passes and the startups approach the commercialization phase, new decisions about alliances need to be made. In this stage of the process, not all startups have alliance partners. Several interviewees state that it is impossible to sell the product via a partner, because of the complexity or innovativeness of the product (IN#10, IN#11, IN#24). Furthermore, another reason to not enter into an alliance in the commercialization phase is to keep the price of the product as low as possible. Several firms are active in a market that is driven by competitive pricing. Therefore, if it is not necessary to collaborate the startup can gain the entire margin, which keeps the price as low as possible and increases the profit of the firm (IN#10, IN#16, IN#28). However, one firm needs to collaborate since the firm is not

at the end of the supply chain, which means that vertical collaborations are essential (IN#15). Besides, another firm decided to collaborate with a firm that develops complementary products and possesses the production, distribution, and sales facilities. Due to the collaboration, the startup can make use of these units to create and sell their own products (IN#14).

The majority of startups that do not collaborate have buyer-seller relationships to produce, sell, or install the product or technology. Some firms develop scalable products and use production firms to produce the goods (IN#11, IN#16). Besides, some products are complex and/or sold around the world. To be able to install the products, partner firms are used (IN#11, IN#24, IN#28). However, these firms do not only install the products, they also provide insights into new market opportunities. This information is not provided deliberately, but these firms are active in the (new to the firm) market, and therefore due to the buyer-seller relationship the startup is drawn into the new market. These firms often approach the startup or are already part of the firm network of the startup. Besides gathering knowledge by means of ties, knowledge about markets is also obtained through observations of the market to get a clear understanding of the dynamics in the market (IN#15, IN#16), by conducting a market research to gather the information (IN#10), by using literature (IN#11), or by analyzing the match between the technical features and the market to get a clear view about what the best market is to operate in (IN#14).

If the firm possesses a former firm network, it is actively used in the beginning stages of the process. The role of strong personal ties is limited and often used as sparring partners, or to solve secondary matters, such as bookkeeping. Former weak personal ties, in some cases, provide technical knowledge. Both the strong and new weak personal ties are used to find new team members. New ties are important for the development of the product, and often become firm ties and even alliance partners. Furthermore, the new weak personal ties are used to expand the network with more new ties. In the prototype phase all the firms have collaboration partners, while in the commercialization phase partnering is less used. The main reasons to refrain from collaboration is the loss of the intellectual property or the rise of costs. Unique market knowledge does not influence collaboration activities of the startups. The knowledge is mainly obtained through new ties; ties that become part of the firm network of the startup. Figure 6 visualizes the paths that are taken in the prototype phase and figure 7 provides the visualization of the commercialization phase.

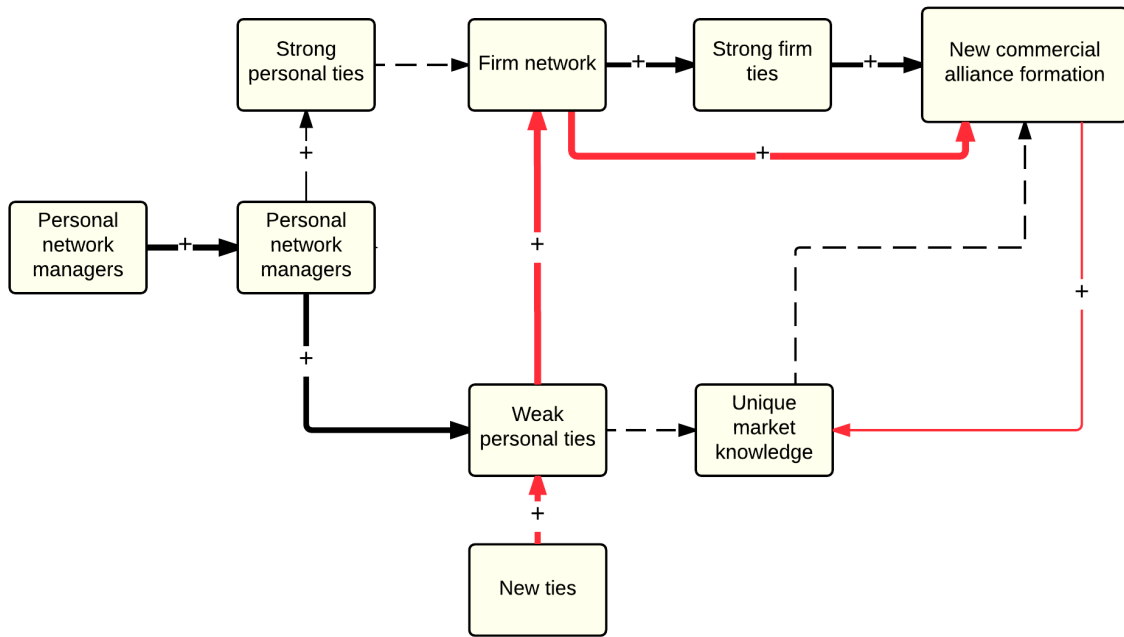


Figure 6. Conceptual model about the prototype phase based on the findings of category Clean-Old. The red lines are new paths, the dotted lines are paths that are not supported by category Clean-Old. The thickness of the lines show how often the path is chosen by a startup.

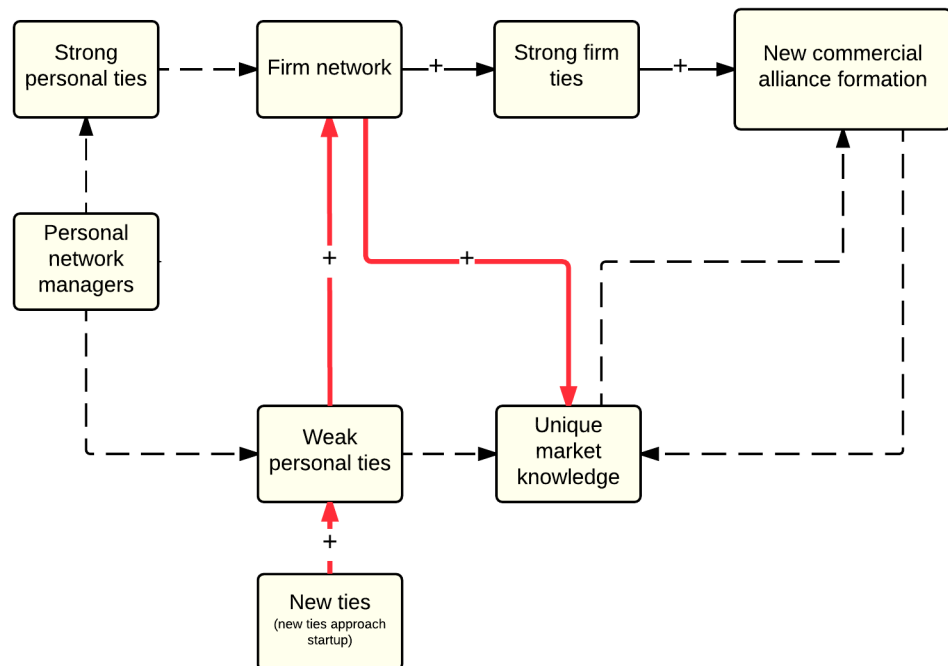


Figure 7. Conceptual model about the commercialization phase based on the findings of category Clean-Old. The red lines are new paths, the dotted lines are paths that are not supported by category Clean-Old. The thickness of the lines show how often the path is chosen by a startup.

4.2 Assessment of the propositions

In this section each proposition is discussed in turn to learn whether the firm categories comply with or do not comply with the propositions. First the new alliancing activity of the firms is given, then the discussions per proposition are provided. It is important to note that

the two firm categories active in the prototype phase (Cons-New and Clean-New), are only used as a control group for the answers given by the categories Cons-Old and Clean-Old about the prototype phase.

4.2.1 Dependent variable: Collaboration activity

Before the propositions are evaluated, the dependent variable is measured, by analyzing the formation of new alliances by the firm. In the prototype phase, all seven firms of the category Clean-New and Clean-Old have searched for and entered into one or more new alliances. In the prototype phase of the consumer electronics industry, all the firms in category Cons-New do have new alliance partners. In Category Cons-Old six out of the seven firms have formed new alliances with other firms to develop the product. One firm did not need to find new collaboration partners, since another firm already developed the product; the startup only had to make small adjustments and was allowed to sell the product in another market.

In the commercialization phase only a few firms have found new collaboration partners. In total four firms, two of each industry, have found a new alliances, which give the startup access to resources and their distribution and production facilities. All the other firms of both industries have used buyer-seller relationships to commercialize the product.

4.2.2 Independent and intermediate variables

P1. Firm network to strong firm ties

The first proposition is about the importance of the possession of a former firm network of strong firm ties – repeated ties with whom the entrepreneur has collaborated in the past – on finding and establishing new alliances. It depends on the past experience of the entrepreneur if a former firm network is developed. Based on the analysis of the firm categories Cons-New and Cons-Old, it can be stated that the firms that possess a former firm network, in the same industry or a related industry, made use of these strong firm ties, since the relation with these ties is already based on trust. This means that the former firm network of strong firm ties is of importance in this industry, to create new alliances. In the Clean technology industry, many startups also possess a former firm network of strong firm ties. In both Clean-New and Clean-Old, for three of the four firms the possession of repeated firm ties was of importance to establish new alliances. Therefore, the proposed relationship cannot be denied for both industries.

Even though the proposition is based on the situation in the prototype phase, the path in the commercialization phase is also measured. In the Cons-Old category, only one firm has used their former firm network of strong ties to find a new alliances partner. Other cases, which have formed new alliances in the commercialization phase, in the Cons-Old and Clean-Old firm category did not use strong firm ties to establish new alliances, the ties on which the new alliances are built become strong firm ties after the alliance is established. Therefore, it can be argued that proposed relationship cannot be assessed in the commercialization phase for both industries.

P2. Strong firm ties to new commercial alliance formation

The second proposition is about new alliance formation based on strong firm ties in the prototype phase. Almost all twenty-eight firms agreed on the need of alliancing when a product with a physical component is developed. However, the way the alliance partners are obtained differs between the industries. The past experience of the entrepreneurs causes the difference. In the clean technology industry, most entrepreneurs have already been active in the same market or a related market. Besides, in this industry the technology is often developed in collaboration with a university, where the entrepreneurs have obtained a network during their studies. Therefore, these firms can make use of a proper personal and former firm network and these connections are used to find alliancing partners.

In both categories of the consumer electronic industry four out of the seven firms have had a bad experience with an alliance partner, which was based on new ties that were not found via the network of the entrepreneur. Often it happened that the partners were not able to deliver the agreed input. In the category Clean-New, the firms have only established relationships with parties found through already existing ties and the startups have no negative experiences with alliance partners. In the Clean-Old category, partnerships are found via new ties, which are not part of the existing network. In contrast to the consumer electronic firms, none of the firms had a partnership that ended badly.

According to the interviewees at the startups that entered into a new partnership, which is based on a former strong firm tie, the decision to form a new alliance is easier to make since the entrepreneur already has knowledge about the trustworthiness of the partner. Besides, when a new alliance is based on a new tie that is found through a former strong or weak personal tie, knowledge about the new tie is gathered through the former personal tie. Without knowledge about the trustworthiness of the partner in advance, the startup does not know if the firm is reliable and must base their trust on the few meetings they have with the party. Therefore the decision is less grounded, which can result in partnerships that end up in a failure.

In addition to the advantage of gaining assets, knowledge, and reputation from the partners, all firm categories contain a few firms that are hesitant about the downsides of partnering. However, the reasons for this prudence differ per case and there is no unilateral argument among the categories or industries. In most cases, the firms are afraid of losing their intellectual property, or the startups are not sure if the partner is able to deliver the agreed quality. Besides, most partnerships do not last indefinitely due to a change in strategy of one of the parties. Therefore, as most of the interviewees state, it is important not to rely on only one option.

This proposition is based on the situation in the prototype phase, but the path is also analyzed for the commercialization phase. In this phase, only two firms of both industries make use of alliances to be able to focus on the development of products. Most of these new alliances are not based on strong firm ties, because after a few meetings the contracts were already signed. During the collaboration the connection between the two firms need to develop into a strong tie. The other firms that do not enter into new alliances do make use of buyer-seller relationships to distribute and sell the products.

Thus, the relationship cannot be denied, because in both industries strong firm ties lead to the formation of alliances, if strong firm ties are available. If not, new ties are used, but the risk of failure increases since these ties did not yet become strong firm ties. However, in the commercialization phase, alliances are not commonly used, what indicates that the relationship is of less importance in this phase of the PLC.

P3. Personal network to strong personal ties

The third proposition is about the creation of strong personal ties based on the personal network of the entrepreneur, which can be used to build the firm network. It is important to note that before the startup is founded, the entrepreneurs already possess a personal network of strong and weak ties. There is a small difference between the industries, when it comes to the usage of the strong personal ties and the amount of firms that deploy these ties. Besides, there is no noticeable difference between the firm categories of the same industry. In the clean technology industry, the majority of entrepreneurs use their former strong personal ties during the prototype phase to obtain knowledge about starting a firm, to gain technical knowledge that can be used to develop the technology or product, and to gather team members with the needed expertise. In the consumer electronics industry a minority of entrepreneurs use their former strong personal ties to obtain feedback on the product. In all the firm categories, the interviewees that have used strong personal ties argue

that the support from these ties is of main importance, since these ties assist the entrepreneur without a commercial interest and at all times.

Thus, it can be stated that the third proposed relationship cannot be denied, since the increasing intensity with the personal tie results into a strong personal tie and the strong personal ties do assist the entrepreneur, but it needs to be taken into account that the strong personal ties are hardly used to develop the firm network (this will be explained below). In the commercialization phase of both industries, strong personal ties do not play any role.

P4. Strong personal ties to formal firm network

The fourth proposition is based on the argument that startups lack a former firm network and therefore use their former strong personal ties to develop the firm network, from which alliance partners can be found. However, in none of the cases was found that strong personal ties nourish the firm network in the prototype phase or commercialization phase. The role of strong personal ties is different, as explained above.⁶ Strong firm ties are not used to find new alliance partners; therefore, the proposed relationship is not supported by the startups.

P5. Personal network to weak personal ties

The fifth proposition is about the possession and utilization of weak personal ties obtained from the personal network in the commercialization phase. During life, the entrepreneur has developed a large network of weak personal ties. However, the usage of these ties in the commercialization phase is limited. Only two entrepreneurs in the consumer electronics industry have deployed the former weak personal ties to obtain knowledge.

Even though the usage of weak personal ties in the commercialization phase is limited, these ties are of importance in the prototype phase. The input of these ties differs per category, but firms in all firm categories have acquired useful knowledge and new connections from weak personal ties. In the firm category Cons-New, weak personal ties are used to find new ties, but also to obtain unique market knowledge. The startups in firm category Cons-Old found new team members and unique market knowledge through these ties. Besides, the startups in the Clean-New firm category describe that weak personal ties provide technical knowledge, new ties, team members, or unique market knowledge. The firms in the last firm category, Clean-Old, only mention the role of weak personal ties in obtaining technical knowledge.

Thus, in the commercialization phase the role of weak personal ties obtained from the personal network of the founders is limited in both industries. Therefore the proposed relationship seems not of importance for the development of the firm. However, weak personal ties are of importance in the prototype phase. Therefore, the relationship needs further examination.

P6. Weak personal ties to unique market knowledge

The sixth proportion is about acquiring unique market knowledge from weak personal ties in the commercialization phase. In the consumer electronics industry, three of the seven firms have switched to a new niche market, and the decision to approach the new niche market is based on the unique market knowledge that was acquired. Two of the three firms have used the weak personal ties from their personal network to find new market knowledge. In the commercialization phase of firms in the clean technology industry, none of the firms have obtained unique market knowledge from weak personal ties. Therefore, due to the lack of

⁶ One way of deploying the strong personal ties is to find new team members. Even though the strong personal ties do complement the founding team of the startup (which can be seen as a relationship based on a commercial interest), the ties do not become part of the firm network; the firm network is about the relationship between firms.

firms that have used their weak personal ties to find unique market knowledge in the commercialization phase, the proposed relationship does not correspond with the findings.

Instead of gathering unique market knowledge in the commercialization phase, the knowledge is often already obtained in the prototype phase. Several firms in the firm category Cons-New, Cons-Old and a few startups in the firm category Clean-New describe that unique market knowledge is obtained from weak personal ties. The startups in the firm category Clean-Old do not deploy their weak personal ties to find unique market knowledge in the prototype phase. Therefore, the findings imply that weak personal ties are of greater importance in the consumer electronics industry, than in the clean technology industry. Due to the difference between the firm categories Clean-New and Clean-Old the relationship cannot be assessed for the prototype phase of the PLC.

P7. New commercial alliance formation to unique market knowledge

The seventh proposition is based on the argument that new alliances can lead to knowledge leaking, which reduces the uniqueness of the possessed market knowledge. Besides, due to the new partnership, the flexibility of the startup will be reduced to respond to new market opportunities. Therefore, new alliances are negatively related to the possession of unique market knowledge in the commercialization phase of the PLC. Based on both industries, only a few startups enter into new alliance partners in the commercialization phase; the majority of firms prefer the do-it-alone strategy. In the Clean-Old category, the startups state that new alliances are not useful to sell a complex product, since installation requires specific skills. Moreover, the price of the product increases, because the other party also wants to gain margin.

However, two firms in the Clean-Old category have established new alliances in this phase of the PLC. These firms wanted to get access to the resources that the alliance partner possesses. Gaining access to these resources gives the entrepreneur time to focus on the development of new products. Additionally, in the consumer electronics industry, the startups also do not often use new alliances. However, in a few cases this is not an intended choice, since these startups have not yet found an appropriate partner. Besides, in most cases a buyer-seller relation can do the job. Only one interviewee mentions the loss of flexibility as a problem. Therefore, it can be stated that the proposed negative relationship of alliances on the possession of unique market knowledge is hardly found in the commercialization phase.

In the prototype phase, six of the seven startups from the consumer electronics industry entered into new alliances, but these firms state that the downside of these partnerships is the loss of the control on the quality of the product. In the clean technology industry, all startups started collaborating. Three firms from the clean technology industry argue that alliances reduce the flexibility, due to the dependency on the other party. Additionally, several startups in this industry fear the loss of the intellectual property when alliances are established. However, in both industries the partnership is of main importance and therefore the firms enter into new alliances, even if the entrepreneur knows the disadvantages of partnering. Thus, it can be stated that in both phases the proposed relationship can be denied, since it is not frequently supported.

4.2.2.8 P8. Unique market knowledge to new commercial alliance formation

In the commercialization phase most of the firms do not have partnerships. However, as explained in the previous paragraph, firms are not refrained from entering into alliances due to the possession of unique market knowledge. Therefore, the proposed relationship can be denied, because the relationship is not supported by the startups.

In the prototype phase, all firms have entered into new alliances. Besides, not all firms do possess unique market knowledge in this stage of the process, since this knowledge seems more important in the commercialization. However, the startups that already possess unique

market knowledge in this phase of the PLC do enter into alliances, what implies that having unique market knowledge does not refrain startups from entering into alliances in the prototype phase. Thus, the proposition does also not correspond to the findings in the prototype phase.

4.2.2.9 summary

Based on the data, it can be argued that the findings of the first three propositions are in line with the proposed relationships. A majority of startups recognize the three paths, and state that the proposed relationship helps to develop the product. Besides, it can be stated that the proposed relationship of proposition four does not exist. Strong personal ties are used to obtain knowledge and to complement the founding team, but do not extend the firm network.

In the commercialization phase, the situation seems different than was expected with the proposed relationships. None of the proposed relationships were supported by a majority of startups of both industries. Weak personal ties are not of importance in the commercialization phase, but in the prototype phase. Besides, in the clean technology industry, these ties are hardly used to obtain unique market knowledge, but to gain technical knowledge and to find new firm ties. In the consumer electronics industry, more firms deploy their weak personal ties to obtain unique market knowledge. Moreover, the expected negative effects of alliance formation on the possession of unique market knowledge, and vice versa are both rarely observed. Several startups state that alliance formation can be risky, but these firms refer to other issues and the firms are not refrained from entering into alliances. Besides, the opposite effect is found; alliance partners can provide unique market knowledge.

4.3 New paths

During the analysis of the narratives of the startups, important new paths are discovered. These paths are already shown in the figures, which are based on the summaries, and will be explained in the next section (if an explanation is required). It is important to take into consideration that the propositions analyzed above are based on the former personal and firm network of the startup and ties that are found through these former networks. The new paths are mostly about new ties (ties that are not found via other connections) that became part of one of the networks of the firm.

4.3.1 Weak personal ties to firm network

As explained in the summaries, to develop the firm, entrepreneurs make use of new ties. These new ties start as weak personal ties. In most cases in all firm categories a connection with a new weak tie is made to extend the firm network of the startup. The interaction in the relationship based on a new tie does increase a little, to get information about the other party. However, the entrepreneurs do not mention the relationship as a strong tie. Due to the commercial interest, the newly found weak personal ties become firm ties.

The role of these new firm ties is twofold; on the one hand the ties can be used to establish buyer-seller relationships, or on the other hand to enter into new alliances. The only new weak personal ties that do not become firm ties are obtained through incubator or accelerator programs. The mentors that are active in such programs become part of the personal network of the entrepreneur.

4.3.2 Firm network to new commercial alliance formation

The former firm network can be used, which contain strong firm ties, to find and develop new alliances. However, the new ties that became firm ties are also used to establish new alliances. In most cases, the firms already enter into a new partnership when both sides understand the value and relevance of the collaboration, but at this point the relationship between the firms is not yet developed into a strong one. The process to become a strong firm tie continues after the firms signed the contracts. In the clean technology industry, most

startups obtain knowledge from former personal of firm ties about a potential new alliance partner. Besides, these connections help to establish the first contact. Through their help, the startups approach potential new alliance partners at the right department. Moreover, due to the recommendation the former tie gives to the potential new alliance partner, the partner is more willing to listen to the startup and the first foundation of trust between the startup and the potential alliance partner is already established by the former firm or personal tie. Therefore, the tie can become more quickly a strong firm tie.

4.3.3 Acquiring unique market knowledge

In two firm categories of the clean technology industry the unique market knowledge is gathered through a new path. However, the paths from which the unique market knowledge is gathered differ between the phases of the PLC. In the prototype phase startups have obtained market knowledge from alliances partners, which were found through new ties. Besides, in the commercialization phase, startups in firm category Clean-Old also used ties from the firm network to obtain unique market knowledge, however the startups are connected to these firms by means of a buyer-seller relationship. In the consumer electronics industry, most of the firms use their weak personal ties to obtain unique market knowledge.

4.4 Push- and pull-strategy

4.4.1 Combination of strategies

In the theory section the concepts are related to the technology-push or the demand-pull strategy. It was expected that the firms use another approach in the prototype phase than in the commercialization phase, which means that the push-strategy seems dominant in the prototype phase and the pull-strategy in the commercialization phase. As can be read in the previous subsections, startups make use the push-strategy in the prototype phase. The goal of the startups is to gain resources, which are heterogeneously divided among firms, and therefore the startups search for new alliance partners.

However, there is a difference between the firms from the consumer electronics industry and clean technology industry in the origin of the idea for the product or technology. Most of consumer electronic firms started their firm when they ran into an undiscovered business opportunity. This has happened during their former job, when the entrepreneur was doing a particular activity, or when a problem in a market remains unsolved. For example, an interviewee told that the idea was born during a holiday, when an unpleasant incident occurred. This happening gave the entrepreneur food for thought. Once at home, the entrepreneur started to search for a solution, to make sure that the incident would never happen again. A proper solution did not yet exist, and therefore he decided to start a firm to develop the solution. Almost all consumer electronics startups have started their firm based on a market demand. Therefore, these firms had a market focus right from the beginning.

In the clean technology industry, the majority of startups did not start with a market opportunity, but the ideas emerged from research or a technological development. During the process of development, the findings are translated into a product that could be sold. However, the market need was not yet taken into account in the early developments; the strategy is mainly technology-push focused. When the features of the technology become clear, the entrepreneur has some ideas about where the product or technology can be used. Therefore, it can be stated that the two industries differ in the combination of strategies at the start of the firm.

When time passes and the startups are at the end of the prototype phase, the firms of both industries started to test their products. The consumer electronic startups test their product on potential users, to check whether the product works and is in line with the requirements of the users. The startups in the clean technology industry also want to obtain feedback on the product or technology. Besides, these firms need to test whether the technology is able to

achieve the expected output. However, both industries need to have some market knowledge to obtain feedback from users in that market. Therefore, at the end of the prototype phase, the strategies are more combined.

In the commercialization phase, it was expected that the pull-strategy is dominant. Based on the interviews, this strategy is important in this phase, since new niche markets are sought or adjustments to the products are made based on information gained from the market. However, to be able to make these adjustments, new resources need to be gathered too; therefore the push-strategy is also of importance for the startups in both industries in the commercialization phase. Besides, entering a new market goes along with the adaptation of the product to the requirements of the new market. Startups that develop complex products, in the clean technology industry, have to make major adjustments to be able to serve a new market, since the products needs to be edited to the requirements of a specific niche. These adjustments are based on a market demand, however new resources are also often needed. Therefore, in the commercialization phase the push-strategy seems more dominant in the clean technology industry than in the consumer electronic industry.

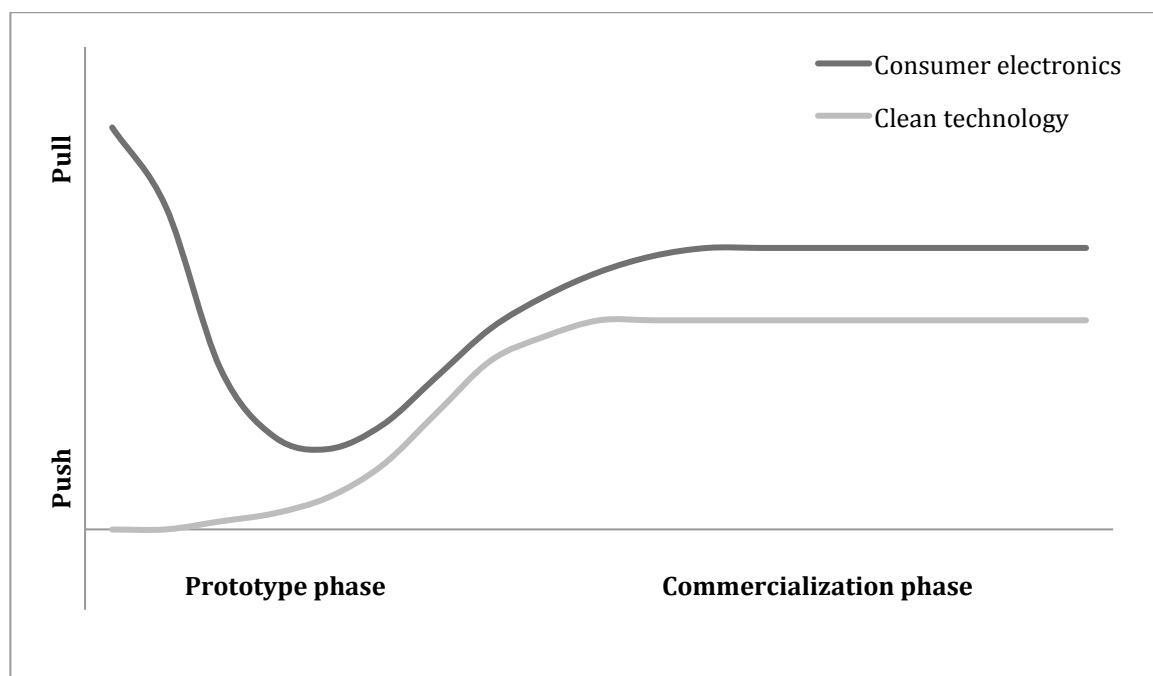


Figure 8, Conceptualization of the combined usage of the push- and pull-strategy by the consumer electronics industry and the clean technology industry during the different phases of the PLC.

4.4.2 Concepts related to the strategies

Weak personal ties were related to the pull strategy, since it was expected that these ties could be used to gather unique market knowledge. However, the weak personal ties are already of importance in the prototype phase, and not only to obtain market knowledge, also to gather resources. Especially new weak personal ties are used to expand the firm network, the network from which resources can be accessed. Therefore, weak personal ties are not only related to the pull-strategy, but also fit in the push-strategy.

The unique market knowledge is not only gathered from the personal weak ties, because in two firm categories the former firm network, or alliance partners are used. It is argued that alliance formation and the firm network are part of the technology-push strategy. Moreover, alliances seemed to have a negative effect on the possession of unique market knowledge. However, instead of a negative effect, alliances formation positively affects the possession of unique market knowledge, since this type of knowledge can be obtained from collaboration

partners. This means that these concepts support the demand-pull strategy, to gain new knowledge and make use of the heterogeneity of the market.

4.5 Additional insights

4.5.1 Incubator and accelerator programs

Three of the four firm categories contain firms that are part of an incubator or accelerator program. In the clean technology industry six firms are part of a program, while in the consumer electronic industry only three firms are affiliated with a program; all three firms are from category Cons-new. These programs stimulate the networks of the entrepreneurs and firms, since the programs possess an extensive network of mentors and firms that are in search of young potential startups. Startups in such programs have the possibility to take advantage of the networks of the mentors and firms related to the program. This speeds up the search process and helps to develop the product, since technical and market knowledge can be obtained from the mentors and other related parties.

In the clean technology industry the firms have obtained many new firm ties through such programs, two firms even found a partner firm. Besides, several firms state that the program helped them to get in contact with someone in a management position of a large company. In some cases these firms become alliance partners of the startups, and otherwise the firms become part of the firm network and provide knowledge about new market opportunities. In the firm category Cons-New of the consumer electronics industry the firms use the programs to build the firm network and to find alliance partners.

It can be stated that these programs speed up the time to find appropriate partners, since the search time is reduced and knowledge about a potential alliances partner is available. Another advantage is the possibility to choose the right alliance partners. Normally, when the network is small the startup does not have an extensive choice. However, due to the program and the possibility to deploy the networks of all the people that are related to these programs, the startups can decide with whom to collaborate. In all cases, the alliances based on ties obtained through one of the programs are doing well, and none of the firms have had problems with the partnerships obtained through a program.

4.5.2 Complex sustainable products

In the clean technology industry a difference can be made between firms that develop scalable products and firms that produce complex systems, which are developed in small quantities. Due to the uniqueness of these complex technologies or products, these firms are already contacted after the first prototype is built. As one interviewee told: *“A week after we published our first prototype on the Internet, a project manager of a large university came along to check whether our product could be used in Africa. He was exited about the product and thought it could be of importance in some programs they are running (IN#24).* Almost all firms that produce complex products told the same kind of stories, about how other parties contacted them to see if there is a common interest in collaboration. Another firm explained that they were writing an article about the industry they wanted to operate in, and the value their technology could add to the industry. An organization active in Curacao contacted them, since they had a problem and the technology could be used to solve this issue (N#10).

These startups do not have the difficulty of gathering new ties, but their challenge is about choosing the right parties with whom to collaborate. This is important because there is no time to transform all the new weak personal ties into firm ties. Therefore, the right decisions about potential partners need to be made. Besides, through the complexity of the technology or product, several partners are needed. However, due to the lack of knowledge about the parties, these firms need to invest many hours to obtain knowledge about the trustworthiness of the firms. These new firm ties are not only helpful with gaining access to resources, but also unique market knowledge is gained from these ties.

Often the products or technologies can be used in many markets, but all these markets are small niches. Due to the firms that approach the startup, which are active in a different industry, a new market opportunity is easily found. In most cases, when the startups understand the opportunities of the new market, the startups approach the market in collaboration with the party that provided the market knowledge. These parties become contractors or alliance partners of the firm, since these firms have knowledge about and experience in this new (to the startup) market. Besides, there is less competition, because the products or technologies create new markets. For example, sustainable solutions are established in places where in former times no solution existed. Moreover, these products or technologies can complement existing products, which results in collaboration instead of competition.

4.6 Merge of narratives into a new conceptual model

4.6.1 Prototype phase

In both the consumer electronics industry and the clean technology industry, the path to find alliance partners is almost the same. In both industries, the firms that possess a former firm network start searching in this network of strong firm ties to find appropriate partners. It is easier to search for firms with whom you have collaborated before, since the knowledge about the partner is available. Besides, if the firm network cannot be used to find an appropriate partner, the firms started to search for new ties. This is done through their current network or by means of cold calling. Startups that participate in an incubator or accelerator program can speed up the search process by making use of the comprehensive network of the program. When there is a common interest in a partnership the tie turns into a firm tie, and in some cases the ties become alliance partners based on a contract. In most cases, after the alliance is established the relationship needs to be intensified to create a strong tie.

The former personal network is scantily used to find possible alliance partners. However, strong personal ties support the entrepreneur limitless and help the entrepreneur without a commercial interest. Weak personal ties are used to find new ties, obtain technical knowledge, and in some firm categories to gather unique market knowledge. Additionally, in the clean technology industry, collaboration partners are commonly used to obtain unique market knowledge. Therefore, unique market knowledge is already of great importance in the prototype phase. Figure 8 illustrates the sequence of actions in a new conceptual model based on the prototype phase of both industries.

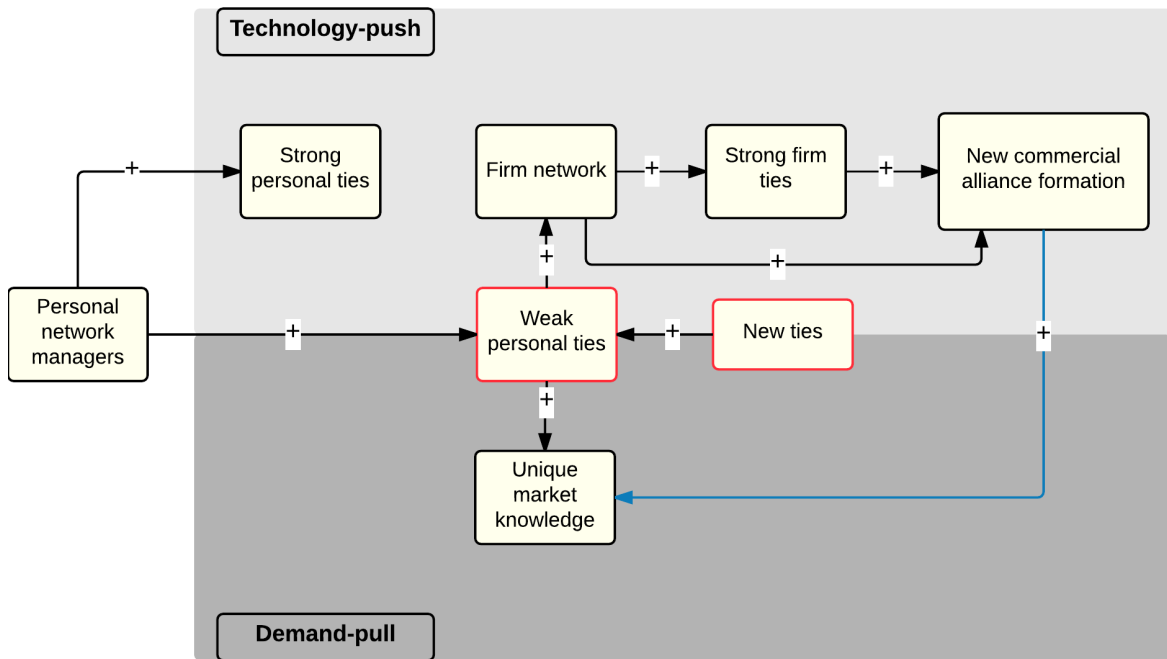


Figure 9. New conceptual model of the prototype phase. Blue lines are relations only supported by clean technology firms. Red marked concepts are new concepts or concepts that are repositioned in the model.

4.6.2 Commercialization phase

In the commercialization phase, the firm network has grown and new alliances become less important. The firm network is of importance since the firms need to get access to resources, such as production parties, distribution channels, and in some cases resellers. These parties are often connected to the firm in a buyer-seller relationship. However, in some cases new alliances are created to give the entrepreneur time to focus on new product development. These alliances are found through their firm network, which was developed during the prototype phase.

The role of the former (strong) personal ties is negligible, because the new developed firm network can offer more value to the firm. (New) weak personal ties are often used to extend the firm network. In some cases in the consumer electronics industry, the former weak personal ties are used to obtain unique market knowledge. In the clean technology industry new firm ties provide unique market knowledge, since these firms are active in new-to-the-firm industry. None of the firms in both industries describe a relation between alliance formation and unique market knowledge. Figure 9 visualizes the new conceptual model based on the commercialization phase of the PLC.

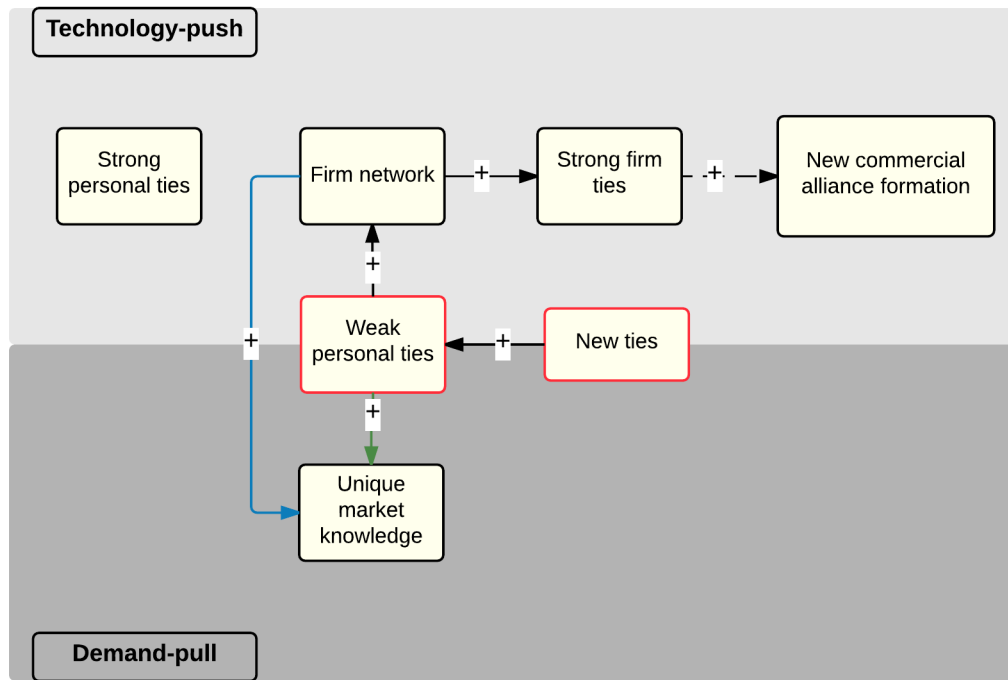


Figure 10. New conceptual model of the commercialization phase. Blue lines are relations only supported by clean technology firms. Green lines are relations only supported by consumer electronics firms. Dotted lines are relations supported by a small amount of firms. Red marked concepts are new concepts or concepts that are repositioned in the model.

5. Discussion

In this chapter a reflection on the research process is given and the limitations are discussed. Additionally, the theoretical and managerial implications are provided and finally future research directions are described.

5.1 Quality and limitations of the research

The aim of this study is to examine the influence of the push- and pull-factors on new alliance formation in several phases of the PLC. To be able to get an in-depth understanding, the narratives of a small set of firms needed to be analyzed. Therefore an exploratory research is conducted. However, this research method has some implications for the validity and reliability of the research.

5.1.1 Internal validity

To enhance the internal validity of this study, several actions are undertaken. This study is based on a theoretical framework, which is derived from empirically sustained theories and concepts. Based on this framework, propositions are created. To examine the concepts in the propositions, established definitions are used to operationalize them. The propositions are investigated with the help of semi-structured interviews. Structuring the interviews ensured that all the topics are treated in every interview. The coding process prior to merging the interviews into summaries ensured that all the required data was incorporated in the summaries. Due to the narratives, also additional data was gathered to get a better understanding of the conditions and factors that influenced the new alliancing activities of the firms, and to decrease the researcher bias of misinterpretation. By initially describing the narratives of each firm category of seven startups (Cons-New, Cons-Old, Clean-New, Clean-Old) in one summary, it is attempted to stay close to the raw data in order to limit the derivation of unreliable conclusions. The comparison of data of firms within one category filters out politically correct or socially desirable answers. Besides, the comparison of the 'younger' startups with the 'older' startups increases the validity of the data. Based on the evaluation of the propositions in conjunction with the additional insights, an adjusted conceptual model based on the observed narratives and theoretical concepts could be developed, which enhances the match between the observations and the theoretical ideas developed (Bryman, 2008).

Several studies have been conducted to examine differences between weak ties and strong ties (Granovetter, 1973; Hansen, 1999, Krackhardt, 1992; Marsden & Campbell, 1984). Besides, Marsden and Campbell (1984) researched the different indicators that can be used to measure tie strength. According to Granovetter (1973, p. 1361), *"the most intuitive notions of the "strength" of an interpersonal tie should be satisfied by the following definition: the strength of a tie is a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie."* However, Marsden & Campbell (1984) examined the usage of this definition and concluded that this definition was not applied in any research. Most studies rely on a single indicator when analyzing tie strength. According to Marsden and Campbell (1984), the best indicator of tie strength is the measure of closeness/emotional intensity. However, this measure is also not free of interpretation (Krackhardt, 1992). Some people will interpret a relation as a 'close friend' after a few meetings, while others are hesitant with classifying someone as a 'close friend'. To reduce the differences between the interpretations, the interviewees were asked to clarify the relationship by explaining the way they interact. Besides, the difference between partnering and a buyer-seller relationship was not always clear. During the interviews, some interviews were hesitant with using the word partner, while others describe all the relationships as partners. These different concepts are subject to

interpretation. Using a clear definition of these concepts and ask clarifying questions have helped to reduce the misconception of the data.

Conducting a narrative analysis can result in some validity threats, which need to be taken into account. It can happen that an interviewee leaves out aspects of the meaning of an experience (Polkinghorne, 2007). This can occur because the event took place a while ago. Therefore the interviewee needs time to stay with the reflective gaze, which helps to reproduce the happening in completeness. In a few cases time was limited, resulting in a decrease in the comprehensiveness of the narrative. Before an interview was conducted, background information about the current state of the firm, the past experience of the team members of the firm, and the development of the firm was gathered through the Internet to be able to help the interviewee remembering certain events. Besides, the interviewees received an email about the intention of the interview and the topics that would be treated during the interview. Due to this information, the interviewee was able to reflect on the past experiences in advance, which increases the validity of the answers given.

Another possible threat is the resistance of people to reveal negative events or their personal feelings to strangers (Polkinghorne, 2007). It can happen that the interviewee filtered out these negative parts of the description of events, to retain the social desirable status. In this study it may occur that the meaning of the negative alliancing experiences, the lack of a personal or firm network, or the dependency on alliance partners are not shared in detail to prevent damage to their self-image. Conducting several interviews with the same interviewee can solve this issue; the interviewee can gain trust in the researcher. However, due to time constraints of both the interviewee and researcher, only a single interview could be conducted. In this study other techniques are used to reduce this threat. The interviewees are contacted by phone to have a moment of contact before the interview is conducted. Besides, the anonymity of the interviewees is guaranteed, which give the interviewees the possibility to tell their story without the risk of losing their social desirable status. Moreover, the anonymity increases the storytelling, since the participants do not have to be afraid of leaking knowledge to competitors and can speak about the alliancing experiences without restrictions.

5.1.2 External validity

Both industries studied contain technology-based startups that develop a tangible product or technology. Due to multiple case analyses and the comparison between the firm categories within an industry and between the industries, it is attempted to increase the validity of the conceptual model by triangulating the data, so that the theoretical framework can be more generally used. Even though it is strived to increase the generalizability by analyzing two industries, the theoretical framework needs to be tailored to industry specific conditions. Besides that, the cases are not randomly selected as only firms with a LinkedIn profile were asked to participate in this study. It is tried to increase the random selection of cases, but the contact details of some startups were not available and other startups did not want to participate. Moreover, time was limited, resulting in a database of cases that were willing to participate and could be found on the Internet. Additionally, the focus of this study is not only on finding generic results, but also case specific insights to gain a deeper understanding of the storyline of a particular case. This will also cause a decrease of the applicability of the findings (Burke, 1997). Thus, based on these arguments, the findings cannot be generalized beyond the industries analyzed in this study, and also not within the analyzed industries. The findings only concern the cases analyzed in this study.

5.1.3 Internal reliability

Since no other researchers have been involved in this study, the internal reliability has to be safeguarded differently. Throughout the results section, the findings are supported with quotes from the interviews, to clarify and underpin the conclusions of this study. Besides, it is attempted to be transparent about the decisions made during the research process.

Additionally, the transcripts and recordings of all interviews are saved and can be obtained from the researcher, which can be used as prove of the consistency of the research process.

5.1.4 External reliability

Even though it is difficult to replicate a qualitative study, due to changing social setting and circumstances (Bryman, 2008), it is strived to enhance the external reliability. The comprehensive explanation in the method section about the way the cases are selected, the data is gathered, and analyzed, will help another researcher to understand and replicate the steps that are taken during the process. Additionally, a database is developed of the cases that are approached. This database can be requested from the researcher to replicate the study based on the same participating startups. Besides, in appendix I, the interview script is given. However, it is important to note that the interview script is only used as a guide during the interview, what implies that not all the questions are asked during an interview. This approach has been applied to enhance the storytelling of the interviewees. Therefore, it cannot be assured that all interviewees will tell the same elements of their story; moreover, the bond of trust between the interviewee and the interviewer also influences the former's willingness to express their story.

5.2 Theoretical implications

Throughout the analysis, it became clear that the role of the weak personal ties is partly different than previously expected. Granovetter (1973) stated that in a network of strong ties, the ties are all connected to each other; *a large number of actors in the strong tie network also know each other, as well as knowing the focal actor*" (Ruef, 2002. P.430). Therefore, the novelty of the knowledge scattered throughout a network of strong ties will decrease. Based on this argument, it was expected that weak personal ties needed to be used to gather unique market knowledge, since these weak ties bridge local networks resulting in an efficient diffusion of novel knowledge (Granovetter, 1973). In this study only startups from the consumer electronics industry have frequently used weak personal ties to obtain unique market knowledge. In the clean technology industry not weak personal ties but the firm network or new alliance partners provide the unique market knowledge. The explanation of this discrepancy can be twofold. On the one hand, it needs to be taken into account that new alliances of the clean technology firms are based on new weak personal ties. Accordingly, the knowledge about potential new market opportunities possessed by these new ties (on which the new alliance is built) is still new to the firm; knowledge about market opportunities of a new product is not yet disseminated among partners.

On the other hand, the discrepancy between the industries can partly be explained by means of the difference between creative accumulation and destruction. Breschi, Malerba & Orsenigo (2000) argue that there is a difference between industries in the way the innovative activities are structured and organized, and therefore a distinction can be made between the Schumpeter Mark I and Schumpeter Mark II patterns. They state that Schumpeter Mark I fits to the creative destruction patterns conducted by entrepreneurs entering a new industry, creating new innovations and thereby challenging established firms. Schumpeter Mark II is characterized by creative accumulation patterns, where the accumulated stock of knowledge by established firms create barriers to entry to new firms. As is assumed, new firms do not want to collaborate with firms active in the same industry, since these startups strive to destruct the established firms with their innovative ideas, and the uniqueness of the market knowledge may diminish through the partnership. However, in the clean technology industry, several startups entered into partnerships with competitive parties (at first glance) active in the same industry. In most cases, these parties contacted the startup to establish a partnership. The Schumpeter Mark II patterns describe that the accumulative knowledge of established innovative firms form the building blocks of the innovations of tomorrow (Breschi et al., 2000). However, several interviewees argued that the established firms were not able to develop the innovations, which are needed to create a

cleaner world.⁷ Therefore, startups complement the existing technologies to achieve the desired result. This implies that startups in this industry do not create destruction, but contribute to the accumulative knowledge, which is used for future innovations. Besides, due to the experience acquired through the years, established firms have extensive knowledge of the different markets and their opportunities. Therefore, startups can make use of this knowledge, which will help to speed up the diffusion of their technology.

Weak personal ties are not only used to obtain unique market knowledge in the commercialization phase, this process already starts before the firm is founded. At the beginning of the prototype phase the consumer electronics startups started with a pull strategy, since the first step was to find a unique market opportunity. In the clean technology industry, the unique market knowledge is often obtained in a later stage of the prototype phase from new alliance partners. These new alliance partners in the clean technology industry provide the unique market knowledge by means of a pull approach, since these firms are active in a same or related industry as the startup and approach the startup to collaborate and to provide the knowledge. However, the precondition of obtaining the unique market knowledge is that the tie becomes a new alliance partner (in the prototype phase), or a firm tie (in the commercialization phase). Besides, these findings indicate that the activities expected to be performed in different phases of the PLC may not last, since both industries started searching for unique market knowledge in the prototype phase of the PLC.

The role of the strong personal ties found in this study corresponds to the argument of Granovetter (1983, p.209): “*strong ties have greater motivation to be of assistance and are typically more easily available.*” The strong ties retain their position of assistance during the development, but do not become firm ties as was expected in this study.

5.3 Managerial and policy implications

Managerial implications

When starting a firm, all assets and knowledge need to be gathered. Before this study, it was not clear which network ties need to be used to obtain the different kind of resources. Clarifying this helps entrepreneurs to focus their search for knowledge or assets on a specific network, which speeds up the search process. Besides, this research clarified which personal networks need to be used to build a firm network. Possessing an extensive firm network before starting a firm is of great importance, since new alliances need to be established in the prototype phase. A former firm network does not only reduce the search time for new alliances, also knowledge about the trustworthiness of the partner is already available to the firm. Entering into a new alliance based on a new weak personal tie is more risky, since the tie is not yet transformed into a strong firm tie; the ties lacks trust resulting in more failures. If a former firm network is lacking, the entrepreneur can try to find new ties via existing personal ties. Also personal ties provide knowledge about the trustworthiness of firms and can help to enter into a potential alliance partner at the right department. When an entrepreneur wants to establish a new alliance with a new tie (found through the existing network or newly discovered) it is important that time is invested to build a bond of trust to lower the risk of failure.

Due to the formation of new alliances in the clean technology industry, knowledge possessed by the startups (with complex products or technologies) accumulate at existing knowledge of the established firm, which leads to insights into new potential applications for their product or technology. Moreover, in the clean technology industry the new alliances provide unique market knowledge, which is needed to discover and serve new markets to increase the

⁷ In several sectors of the clean technology industry, for instance firms that clean wastewater, several products or technologies are needed in sequence to be able to purge the water to a standard so that the wastewater does not have to be incinerated.

revenues and profits of the firm. In contrast to the clean technology industry, the startups in the consumer electronics industry find unique market knowledge through weak personal ties. Based on this result it can be suggested that in industries, which are business-to-business oriented (clean technology industry), the firm network is of importance to find unique market knowledge, while in industries that are business-to-consumer (consumer electronics industry) oriented the personal network of the founders provide this type of knowledge. When establishing a new alliance from which unique market knowledge and knowledge about new applications must be obtained, it is important to note that the cognitive distance affects the usability of the knowledge. When the cognitive distance increases, the novelty of the information that is shared increases too. However, when this distance becomes too large, the firms lack mutual understanding. Besides, an alliance based on too much familiarity results in a lack of novelty of the knowledge (Nooteboom, Van Haverbeke, Duysters, Gilsing & Van den Oord, 2007). Therefore, startups need to take the cognitive distance in mind before entering into an alliance.

A majority of firms in the consumer electronics industry have negative experiences with alliancing. In most cases, the partner firms were not able to deliver the agreed quality. Several plausible explanations can be given about the failing alliancing experience. Again, also in the consumer electronics industry, the cognitive distance of the alliance partners needs to be taken into consideration. When entrepreneurs start a firm in the consumer electronics industry, they often lack experience in this industry. Therefore, to be able to transform the idea into a product, collaboration with a design party and/or manufacturing company is often needed, since these parties can help to create an achievable prototype. Due to the lack of experience of the entrepreneur, the cognitive distance between the designer or manufacturer and entrepreneur can be large. Another explanation is based on the newness of the ties. The consumer electronics startups often find design/manufacturing firms through new ties, ties that were not found via one of the networks of the entrepreneur. Therefore, the alliance is not based on a trustful relationship. Gulati (1995, p. 105) states that *"familiarity between organizations through prior alliances does breed trust"*. Besides, *"strong ties constitute a base of trust that can provide comfort in the face of uncertainty"* (Krackhardt, 1992, p.218). Establishing new alliances based on new ties seem at odds with these arguments where the lack of trust between the alliance partners can result in discomfort.

Besides the issue of a large cognitive distance or the newness of the ties, technologies and knowledge in the clean technology industry seems to accumulate, in the consumer electronics industry the innovations are more destructive; creating discontinuous technological change and a lack of accumulative knowledge (Bergeka, Berggren, Magnusson & Hobday, 2013). The destructive nature of these products seems to result in innovations that are more radical. The radicalness of these innovations increases the difficulty for designers/manufacturers to create a product that can be produced; it is also new to them. Therefore, the combination of a lacking experience that results in a larger cognitive distance between designers/manufacturers and entrepreneurs, the usage of new ties to form new alliances, and the disruptive and radical nature of the innovations, can result in alliances that fail more often in the consumer electronics industry. In other words, the failure can be caused by the difficulty for designers/manufacturers and entrepreneurs to understand each other, the lacking trust between the partners, and/or due to the inability of designers/manufacturers to accomplish the agreed output. Being aware of this difficulty can help entrepreneurs that lack experience and want to enter into the consumer electronics industry. Investing time in the relationship, creating a strong personal tie, can help to create trust and a mutual understanding, which can result in a partnership that lasts longer and becomes more successful.

Policy implications

Based on the findings of this research, the existing policy for stimulating the development of startups in the examined industries can be adapted. Firms active in incubator or accelerator

programs already experience the advantages of a party that provided the possibility to deploy an extensive network. Besides, such organizations do not only establish connections between startups and other firms, they also possess knowledge about the trustworthiness of firms; many firms are related to such programs and these firms have an abundant alliancing experience. Startups that are not allowed in such programs make more often mistakes when it comes to alliancing. Therefore, creating and subsidizing more incubator and accelerator programs will help the firms make more deliberate choices about with whom the contact needs to be intensified.

5.4 Further research

This research must be regarded as an overarching study that combines literature streams to clarify the process startups go through before entering into new alliances and to obtain unique market knowledge in the different phases of the PLC. Further research needs to be conducted to examine the level of impact of the researched variables on the development of startups. Moreover, the exploratory nature of this study provides the possibility to clarify which control variables need to be taken into account when analyzing alliancing and networking. Based on the findings, it seems that the model needs to be controlled for the size of the network and past experience of the entrepreneur (analyzed by means of the age of the entrepreneur). The size of the former firm network and personal network influences the process of obtaining new ties, knowledge, and alliance partners. Besides, the experience of the entrepreneur seems to influence the size of the network and the ability to make deliberate choices when it comes to new alliance formation. Therefore, in future research it must be examined to what extent the model is encompassing and explains the development of firms. Besides, further research is needed to examine the role of the newly discovered control variables.

In addition to the theoretical framework as topic for further examination, also new interesting subjects emerged from this research. In this study the role of personal and firm ties is examined and placed in a sequence of actions undertaken by the firm to establish alliances and obtain unique market knowledge. This provides insights into differences between the networks, what type of knowledge is obtained from these ties, and how these ties contribute to the development of the firm network of startups. The findings imply that the possession of an extensive network, in particular a firm network, accelerates the search process to find appropriate alliance partners or unique market knowledge. Being faster than other firms in the market provide the firm with lead-time over others. According to Levin, Klevorick, Nelson, Winter, Gilbert & Griliches (1987), gaining lead time is the primary method of appropriating returns. Based on this finding, further research can be conducted to examine the effect of former firm and personal networks on generating lead-time.

In a previous paragraph it was argued that the startups of the clean technology industry fit to Schumpeter Mark II, since collaborations are established to accumulate knowledge. However, startups are assumed to create destruction in a market and therefore fit to Schumpeter Mark I. It seems that the accumulation of knowledge not only takes place inside an established firm, but – in industries such as the clean technology industry – the knowledge needs to be accumulated beyond the boundaries of the firm, in collaboration with others. This can be in line with the era of open innovation, in which is stated that external knowledge is equally important as the internal knowledge of a firm (Chesbrough, 2006). This discrepancy with the existing literature must be further elaborated and investigated.

Besides, this study clarified what conditions belong to the push- and to the pull-strategy and how the strategies are related to each other during the different stages of the PLC. Based on the findings, it seems that the push-strategy is more important in research-based industries, such as the clean technology industry, and the pull-strategy in the market-based industries, such as the consumer electronics industry. However, due to the limited number of cases and

industries analyzed in this study, further examination of the ratio between both strategies is needed.

Additionally, in future research an analysis based on cases selected via random sampling and in different industries must be conducted to increase the generalizability of the results. As explained, the goal of this study is to explore the paths travelled by the firms, creating a better understanding of this process. Through this research this process is clarified, which provides the opportunity of quantitatively examining the conceptual model with a random sample of startups in different industries.

6. Conclusion

In this study it is attempted to clarify what path is taken by startups to obtain the resources needed to develop a product. Based on the literature, new alliances seem of importance for starting firms due to their liability of newness and smallness. However, there was no clear answer about how startups find new alliance partners and if startups enter with weak or strong ties into a partnership. Using an alliancing or a go-it-alone approach depends on the strategy of the firm; push versus pull. When using a push-strategy, firms want to compete based on resource heterogeneity, while with a pull-strategy the market heterogeneity is central. If resources (technology-push) are inferior to market knowledge (demand-pull), partnering seems less appropriate. However, these strategies are not only contradictory, but can also be complementary over time. To be able to develop the product a technology-push approach seems more suitable, and when the firms enter into the commercialization phase, a demand-pull strategy seems preferable. Examining the paths taken by the entrepreneur can only be done using the sociological literature, since the networks of the entrepreneur are of main influence during the process. To examine all this, an answer on the following research question must be given: How do technology-push or market-pull conditions influence alliance formation by startups in the different phases of the product lifecycle?

The paradox discerned in this study of either – entering into alliances (technology-push) in the prototype phase or stay independent (demand-pull) in the commercialization phase – is not supported in this study. The startups do not refrain from partnering to retain the uniqueness of the market knowledge that is possessed. Instead, in the clean technology industry new alliance produces unique market knowledge, since the knowledge is obtained from new alliance partners. Additionally, it was expected that firms started to search for unique market knowledge in the commercialization phase, since the focus in this phase is on commercializing the products to the market. In the consumer electronics industry, the search started before the firm was established, while in the clean technology industry firms started to obtain unique market knowledge after the first prototype was disclosed to the public. Therefore, the classification of concepts to the prototype phase and commercialization phase is different from what was expected; in the prototype phase the product is developed and the unique market knowledge is also already obtained, in the commercialization phase the firms make improvements to the product and switch to new markets if sales disappoint or the firm wants to grow.

One of the pull conditions, weak personal ties, seems less pull oriented than was expected. Since the weak personal ties can assist the entrepreneur in finding new ties (ties that are used to extend the firm network) and also provide unique market knowledge, weak personal ties play in both the push- and pull-strategy an important role. Based on this argument in combination with the finding that unique market knowledge does not have a negative effect on new alliance formation, weak personal ties do not negatively influence the alliance activities of startups, but are complementary to these activities in order to find new alliance partners in both phases of the PLC.

Strong personal ties assist the entrepreneur with providing a helping hand with his product development. Knowledge gained from strong personal ties on the development of the product or firm differs between the industries; it can be feedback on the product (consumer electronics industry), or the provision of technological or strategic insights (clean technology industry). However, the strong ties do not extend the firm network of the startups. Therefore these ties do not affect new alliancing activities performed by startups.

Commercializing the product in a niche market in which a small amount of firms are active, increases the time to gain a reputation. Possessing a reputation implies that, instead of

actively searching for new connections, the startups are approached by other firms, which shortens the search process of finding potential alliance partners. Besides, entrepreneurs that have been active in the same or related industry before have already obtained a reputation and a firm network of repeated ties. This former firm network of strong firm ties is of great importance in finding and establishing successful new alliances. The likelihood of success increases, because a trustful relationship is already developed before the new alliance is established.

Throughout this study it has become clear that the demand-pull conditions used in this study do not – as was assumed – negatively influence but complement alliance formation of startups. With this in mind it can be stated that, in the prototype phase, almost all push conditions and the pull condition ‘weak personal ties’ positively influence alliance formation. Only the strong personal ties have no influence on new alliance formation. In the commercialization phase, both the push and pull conditions are not frequently used to establish alliances but are often deployed to create an extensive firm network. Besides, in both phases of the PLC, the firm networks of the clean technology startups are used to find unique market knowledge, while the consumer electronics startups used their personal network to obtain this knowledge. Therefore, the push conditions are also positively influencing the pull conditions. This leads to the conclusion that the push- and pull-strategy are not contradictory but complementary and can be used in a single conceptual model (as shown in figures 9 and 10) to explain the paths taken by startups to enter into new alliances or to stay independent. Even though the push- and pull-strategy are complementary, there is a difference between the industries in the way the strategies complement one another. Further research must show how this finding applies to other industries.

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Appendix I: Interview script in Dutch

Het onderzoek richt zich op factoren die de ontwikkeling van een startup beïnvloeden met de focus op het gebruik van samenwerkingen en netwerken tijdens de verschillende fasen van het proces. In dit interview zou ik het graag willen hebben over de start van uw bedrijf en over de ontwikkeling van de producten die zijn geproduceerd door uw bedrijf en het verkoop van deze producten in de markt. Het interview blijft anoniem en de citaten uit de verhalen worden zonder naam gebruikt in het uiteindelijke verslag. Voordat ik u wil vragen om te beginnen met uw verhaal over uw onderneming heb ik eerst 2 persoonlijke vragen.

Persoonlijke vragen

- Wanneer is het bedrijf opgericht?
- Hoe lang bent u al actief met dit bedrijf?
- In welke fase bevindt het product zich?

Start van bedrijf

- Hoe is het idee ontstaan om in deze industrie te gaan opereren?
- Bent u of een collega van u al eerder actief geweest in deze industrie?
 - o Ja, wat voor een ervaring heeft u of uw collega in deze industrie?
 - o Hadden u of uw collega veel contacten in deze industrie?
 - o Hoe vaak heeft u nog contact met deze relaties?
 - Is het een intense relatie? (hechte vriend, etc.)
 - Is het een formele of informele relatie?
- Hoe is het idee voor dit product ontstaan?
 - o Hebben hier relaties of contacten bij geholpen?
 - Zijn dit andere bedrijven, personen met specifieke kennis of gewoon bekenden?
 - Hoe kent uw bedrijf deze partijen?
 - Waren dit formele of informele relaties van het bedrijf?
 - o Zijn deze contacten betrokken gebleven bij de verdere ontwikkeling van het product?
 - Hoe ziet dit contact eruit?
 - Is het een contractuele samenwerking geworden?

Prototype bouwen

- Toen het idee was ontstaan, hoe ging de ontwikkeling verder?
 - o Had uw bedrijf alle benodigde kennis en middelen al in huis om het product te maken?
 - Welke resources moesten van andere partijen komen?
 - Hoe belangrijk was het verkrijgen van deze middelen voor het succes van het product?
 - Hoe zijn deze middelen verkregen?
 - Gekocht/intern ontwikkeld/samenwerking?
 - Is dit een bewuste keuze geweest om het op deze manier te verkrijgen?

Als er voor samenwerking is gekozen:

- o Waarom is er voor deze partij gekozen?
- o Hoe kwam deze samenwerking tot stand?

- Was er contact voordat de samenwerking was bewerkstelligd?
 - Hoe intensief was het contact met deze partij?
 - Was het een formele of informele relatie?
 - Was er een contract gesloten met deze partij?
- Hoe werd er kennis over deze partij vergaard?
 - Heeft u kennis van andere partijen verkregen?
 - Nee, hoe dan wel?
- Wanneer is vertrouwen belangrijk in een samenwerking?
 - Wanneer moet vertrouwen ontwikkeld worden, voorafgaand aan de samenwerking of tijdens de samenwerking?
 - Hoe is dat ontwikkeld?
- Hoe loopt de samenwerking tot nu toe?
 - Wat zijn de voordelen van een contractuele samenwerking?
 - Wat zijn de nadelen van een samenwerking?
 - Hebben deze voor- of nadelen invloed gehad op het succes van het product?
- Als er niet voor een samenwerking is gekozen:
 - Waarom is ervoor gekozen om geen samenwerkingen aan te gaan?
 - Waren er al wel partijen waarmee een samenwerking aan zou kunnen worden aangegaan?
 - Met wie dan?
- Is er belangrijke kennis verkregen in de ontwikkelingsfase van een partij waar geen verdere samenwerking mee is aangegaan?
 - Hoe waren deze contacten gelinkt aan uw bedrijf? (kennissen, vrienden, vrienden van vrienden, familie, onbekenden?)
 - Wat voor een soort kennis ontving uw bedrijf van deze contacten?
 - Was deze kennis belangrijk voor de ontwikkeling?
- Is er tijdens het ontwikkelen van een prototype al contact met potentiële klanten?
 - Was dit belangrijk voor de ontwikkeling van het product?
 - Op welke wijze werd de kennis over customer needs verworven?
 - Kwam dit van bestaande relaties of nieuwe relaties?
 - Hoe is deze relatie verder ontwikkeld na het eerste moment van kennisdeling?

Commercialisatie van product

- Toen het product was ontwikkeld, hoe is het product naar de markt gebracht?
 - Waren daarvoor nieuwe samenwerkingsrelaties nodig?
 - Waren het distributiekanaal, klantenbestanden, resellers?
 - Hoe is de samenwerking met deze partij tot stand gekomen?
 - Hoe kwam u bij deze partij?
 - Was het een formele of informele samenwerking?
 - Hoe intensief was de band voordat u ging samenwerken?
- Is er tijdens deze fase gezocht naar verschillende consumentendoelgroepen in de markt?
 - Is er gewisseld tussen deze doelgroepen?
 - Waren deze doelgroepen al bekend voordat het product werd geïntroduceerd?

- Hoe kwam uw bedrijf aan deze kennis over de verschillende doelgroepen?
 - Van contacten die een financieel belang hebben bij uw product, of juist niet?
 - Waren deze partijen al eerder betrokken bij de ontwikkeling van uw bedrijf?
 - Is deze samenwerking verder geïntensiveerd?
- Werden er tijdens deze fase nog producteigenschappen verder ontwikkeld?
 - Waar werden deze aanpassingen op gebaseerd?
 - Uit bestaande doelgroepen of nieuwe doelgroepen?
 - Waren hier nieuwe samenwerkingen voor nodig?
 - Met wie?
- Hebben de samenwerkingen die er zijn aangegaan om het product te ontwikkelen invloed gehad op het commercialiseren van het product?

Appendix II: Interview script in English

In this research factors that influence the development of startups are examined with the focus on the use of partnerships and networks during the different stages of the process. In this interview I would like to talk about the start of your company, the products produced by your company, and the way the products are sold. The interview will not be published and the quotes used in the report remain anonymous.

Personal questions:

- When did the firm activities start?
- When did you become active in this firm?
- In which phase of the process is the product at the moment?

Start of the firm

- How did the idea arise to start in this industry?
- Have you or a colleague been active in this industry, before starting the firm?
 - o Yes, what kind of experience do you or your colleague have in this industry?
 - o Did you or your colleague have many contacts in this industry?
 - o How often do you meet with this person?
 - What is the emotional intensity of the relation? (Close friend, etc)
 - Is it a formal or informal relationship?
- Where did the idea for the product comes from?
 - o Have relationships or contacts helped during the formation of the idea?
 - Is this a specific firm, a contact with specific knowledge, or just someone you know?
 - How did your firm know these contacts?
 - Was it a formal or informal relationship?
 - o Did these contacts remain involved during the development of the product?
 - How would you describe the contact between you two?
 - Is it turned into a contractual collaboration?

Building a prototype

- When the idea was born, how did the developments continue?
 - o Where all the necessary resources internally available to produce the product?
 - Which resources had to be obtained from other firms?
 - How important was it to obtain these resources for the success of the product?
 - How were these resources obtained?
 - Make/buy/collaborate?
 - Was it a deliberate choice to gain the resources this way?

If collaborating:

- o What was the reason to collaborate with this particular party?
- o How was this collaboration arranged?
 - Was there already contact before the collaboration was accomplished?
 - What was the intensity of the contact with this party?
 - Was the relationship based on business or was it a personal contact of yours/someone within the organization?
 - Did you sign a contract?
 - How did you obtain knowledge about this party?
 - Did other contacts of yours provide that knowledge?
 - o If not, how did you obtain the knowledge?

- When is trust important in collaboration?
 - When must trust be developed, before or during the collaboration?
 - In your case, how is it developed?
- What do you think about the collaborations you have so far?
 - What are the benefits of (contractual) collaboration?
 - What are the disadvantages of (contractual) collaboration?
 - Is the success of the product influenced by the advantages and disadvantages of collaboration?
- If not collaborating:
 - Why did you choose to conduct the development without partnering?
 - If you were willing to collaborate, did you know parties with whom to collaborate?
 - Who?
- Did you gain knowledge from a party in the first phase of the development process, with whom no further collaboration was established?
 - How were these contacts linked to your firm? (Acquaintance, friends, friends of friends or family, or unknowns)
 - What kind of knowledge was received from these contacts?
 - Was this knowledge important for the development of the product?
- During the development of the prototype, did you have contact with potential customers?
 - Did these contacts influence the development of the product?
 - How was knowledge about customer needs obtained?
 - From existing relationships or new ones?
 - How did the relationship develop after the first time knowledge was shared?

Commercialization of the product

- After the product was developed, how is the product commercialized?
 - Did you have to find new partnerships?
 - What was needed from these partners, distribution channels, customer databases, etc?
 - How did you find this partner?
 - Was the collaboration formal or informal?
 - Can you explain the intensity of the relationship before the collaboration was established?
- Did you search for different customer segments in this stage of the process?
 - Did you switch between these segments?
 - Did you already know the different segments before the product was introduced?
 - How did your firm gain knowledge about the different customer segments?
 - Did you obtain this knowledge from persons, which have a commercial in your firm?
 - Have these persons been involved before in the development of your firm?
 - Is the partnership intensified?
- During this stage, did your firm change existing or develop new product characteristics?
 - Based on what knowledge were these changes made?
 - Based on existing customer segments, or new ones?
 - Did you have to find new relationships?

- With whom?
- Have the partnerships, that were formed to develop the product, influenced the commercialization of the product?