The effects of inducements and opportunities of start-ups relevant in alliance formation on the continuation of alliances

An analysis of alliance (dis)continuation of startups in the biotechnology sector in the Netherlands

Master Thesis (45ECTs)
Science and Innovation Management

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Contents

Introduction

In complex industries resources are fragmented amongst different parties, meaning that most parties have a deficit of particular resources. This is especially the case for start-ups that lack the financial, technical and social capital required to further develop their knowledge assets (Baum, 2000). The developing field of biotechnology is characterized by a high number of starting ventures and is an illustrative example of such a complex industry. The biotechnology field has developed rapidly, seeing a growth spurt of new firms in the United States in the 1990's (Hochman and Zilberman, 2009; Hagedoorn and Schakenraad, 1990). The present day definition of biotechnology is the manipulation of genetic material through recombinant DNA technology, cell fusion and monoclonal antibodies (Stuart et al., 1999).

Because of the complexity and the fragmentation of resources among different parties, alliances are essential for the growth of biotech ventures, as the set of needed configuration of resources can only be acquired through alliances. Some of these resources, such as patented technical knowledge, are only available to the party holding the patent. Ahuja (2000) defines resources which are not available within a venture as inducements of alliance formation. Furthermore, opportunities result from a venture's resource endowment attracting potential partners to form an alliance. For the formation of an alliance, a combination of opportunities and inducements that satisfies both parties involved is needed. An example would be a startup which has a new idea for a product but lacks the R&D facilities necessary for development and forms an alliance with an established firm, which is in search of a new product and has R&D facilities available. While Ahuja (2000) introduced the concepts of inducements and opportunities as reasons for alliance formation, later empirical research confirmed this role of resources as inducements and opportunities for alliance formation (Meeus et al., 2001; Sakakibara, 2002; Meeus et al., 2004).

Additionally, the literature has been abundant in describing the process of alliance formation itself from a theoretical point of view (Powell et al., 2005; Borys and Jemison, 1989; Oliver, 1990; Powell, 1990; Ring and Van de Ven, 1992, Stuart et al, 1999; Baum et al., 2000; Belderbos et al., 2004), as well as empirically (Chesbrough and Crowther, 2006; Heide & Miner, 1992; Osborn and Baughn, 1990; Parkhe, 1993; Seabright et al., 1992). Besides general research on alliance formation, more specific research has been done on firm aspects that influence alliance formation, such as corporate performance (Powell et al., 1996), innovative speed (Hagedoorn, 1993), organizational learning (Hamel, 1991), management team diversity (Eisenhardt & Schoonhoven, 1996), venture capital (Stuart et al., 1999), patents (Stuart, 1998), R&D facilities (Fernandez et al., 2000) and network positions (Gulati, 1999).

This research body has provided a clear picture of what different resources (i.e. assets and competences) in terms of inducements and opportunities lead to alliance formation. Another, less extensive area of research focuses on the duration of alliances, which is found to be related to its success. The larger the positive outcome of an alliance is for all parties, the higher their willingness is to reinvest in the alliance and continue it. This mechanism represents a performance-behavior-feedback model (Lunnan and Haugland, 2008). Whenever an alliance is not beneficial to any or all parties involved, it is in the interest of these firms to discontinue the alliance (Olk and Young, 1997).

Unbeneficial outcomes and thus a discontinuation of the alliance can be caused by opportunistic behavior or competing interests (Parkhe, 1993; Baum et al., 2000; Anad and Khanna, 2000). Performance-behavior-feedback explains why alliances are continued based on their previous success. However, it does not address whether the success of an alliance is already contained in the factors leading to the formation of that alliance.

In the literature on alliances, a gap exists regarding whether the (dis)continuation of an alliance depends on specific inducements and opportunities relevant in its formation. As described above, preexisting conditions in terms of financial, technical and social capital have been found to be related to alliance formation. However, it is of great interest to see if these factors also determine the continuation of the alliances formed. In other words, which inducements and opportunities relevant in the formation of alliances of start-ups and partner organizations also determine their continuation or termination? By combining the existing literature on alliance formation and alliance continuation, this research contributes to current knowledge about alliance dynamics and may lead to more insight into the effects of start-ups' inducements and opportunities found relevant for starting alliances on their (dis)continuation.

Problem definition

Firms in crowded positions in high-tech sectors with high prestige form alliances at the highest rates (Stuart, 1998). The biotech sector is considered to be of such a nature and alliances are formed on a frequent basis. However, established alliances by startups seem to have a short life and are terminated prematurely (Lunnan, 2008). In the Netherlands, this trend was also observed by Van der Valk (2007). Over the period 2002-2005, a strong increase of the numbers of biotech ventures and new alliances between those ventures and partner organizations has been observed, but also a high turnover of alliances. During this observation period, more than half of the alliances were terminated within one year, showing a fast changing network (Van der Valk, 2007). However, it is unclear whether the (dis)continuation of alliances determining the rate of alliance turnover within the sector is already contained in the inducements and opportunities of biotech start-ups to form alliances. In other words, do the inducements and opportunities found in the literature to stimulate start-ups to form alliances also affect their continuation (and success) and termination (and failure).

Boundaries

The available time for this research is limited. Therefore, it is necessary to impose some constraints. Boundaries have been set on geography, time, industry and network level. The research covers the biotech sector in the Netherlands in the period of 2002-2005. These geographical, time and industry limitations result from the data available for the biotech sector in the Netherlands in those years. The Dutch biotech industry grew tremendously after the implementation of the BioPartner program by the Ministry of Economic Affairs in 2000. Data from the yearly BioPartner Monitor describe the development of bio-tech start-ups during the early period of the Dutch biotech industry. This situation has hardly changed since the number of firms with more than five employees grew slowly during the years 2005-2010 (i.e. 20%), while the firms with less than five employees increased by 80% (The Decision Group, 2011). These figures indicate that Dutch biotech start-ups have large problems with generating growth in terms of employees, and thus revenues. Biotechnology is still a rather new technological field within the Netherlands. The data for the years 2002-2005 can thus be

conceived as representative for the startup period of the Dutch biotechnology industry because start-ups since 2000 represent 56% of the response to the BioPartner Monitor 2002. With the BioPartner Monitor 2004 and 2005 the response rates of start-ups since 2000 are 64% and 72% respectively. So, Dutch biotech industry boomed after the introduction of the BioPartner program in 2000. This study has been further narrowed to alliances already formed by startups and partner organizations in the biotech industry that are either continued or terminated. Consequently, the inducements and opportunities for alliance continuation mirror those relevant for alliance termination.

Research question

After analysis of the literature it seems that the most prudent gap in this field of research is whether (dis)continuation of an alliance is the result of a certain configuration of inducements and opportunities of biotech start-ups already found relevant in the literature for starting that alliance. This leads to the following research question:

To what extent are inducements and opportunities of start-ups, identified before to stimulate alliance formation, related to the (dis)continuation of existing alliances in the biotechnology sector in the Netherlands in the period 2002-2005?

Objective

The goal of this research is twofold. Understanding of why alliances are (dis)continued will result in a better insight into alliances which can aid management in upfront decision making process regarding partner selection in order to improve the chance of starting alliances with a better chance of continuation. Secondly, it contributes to the existing literature on alliances in general. By adding insight into start-up characteristics stimulating alliance formation concerning the (dis)continuation of alliances, start-ups' operations can be improved resulting in a performance improvement of the biotech industry itself. It is clear that a better understanding of the dynamics of alliances beyond their formation in the biotech industry may have valuable theoretical as well as policy and managerial implications.

Relevance

As indicated before, the current literature on alliances deals extensively with the necessity, formation and success of alliances. However, it has not addressed which inducements and opportunities relevant for alliance formation influence the (dis)continuation of alliances. But whether the (dis)continuation of alliances is a result of initial partner selection is of particular interest because of the limited resources available to biotech start-ups. When an alliance is formed, resources and time are dedicated to the alliance that in case of premature discontinuation could have been spent more efficiently. Furthermore, the turnover rate of alliances in the Dutch biotech sector is so large that it might have a negative influence on the performance of the entire industry as is indicated by its stagnating growth (The Decision Group, 2011). This research specifies a predictive model that may help to prevent the start of unsuccessful alliances and thus lower the turnover of alliances and waste of invested resources in the Dutch biotech sector.

Theoretical Framework

Resource based view

According to evolutionary economic theory, firms are different from one another and develop their firm specific resources and capabilities over time, and accordingly become path dependent. So, the history of a firm enables it to achieve advantages over others while functioning in the same sector (Dosi, 1982). This implies that firms differ in their development and that some firms are better able to innovate than others. The assets and capabilities that firms develop are resources, which are tied semi-permanently to a firm (Wernerfelt, 1984; Combs and Ketchen, 1999). These resources range from physical equipment, tools and machinery to intangible goods such as knowledge, competencies and organization, which can be used to implement value creating strategies (Wernerfelt, 1984). [1] These resources have been categorized into various types of so called capitals (Bueno and Salmador, 2004) and form the foundation of the uniqueness of a firm and differentiate it from its competitors in the way it operates. Differences in resources lead to long term competitive advantages for particular combinations of resources. Resources necessary for creating a competitive advantage that are not in-house and difficult to produce internally have to be obtained externally via an exchange of money, in the form of purchase, exchange or hire, or other resources in the form of an alliance.

As described above, heterogeneously distributed resources stimulate ventures to search for essential resources externally because for product development they depend on acquiring access to internally missing resources. However, start-up firms often lack the financial resources for obtaining necessary resources externally on an equity basis. Furthermore, some resources are not exchangeable, such as the R&D facilities or the embedded experience and competences of the employees. The only way to access these resources is by cooperating with the organization holding the necessary resource, i.e. by forming an alliance. This means that the venture becomes dependent on the organization holding the desired resource (Pfeffer and Salancik, 1978). This is described by the resource dependence view, which builds upon the resource based theory by taking the heterogeneous distribution of resources over different parties explicitly into account, which results in legally independent organizations being dependent on other organizations.

Through alliances firms gain access to resources without having to specialize, differentiate or expand. However, they also need to offer resources to their partners in return in order to make the alliance attractive for both parties. These are called the opportunities of a firm (Ahuja, 2000). The problem exists that the more opportunities a firm has the less it needs, and the more inducements a firm has the less it has to offer. This is a paradox in alliance formation. So, a balance between inducements and opportunities is needed for an alliance to be formed. The resources relevant for alliance formation have already been subjects of research in many studies referred to before.

[1] Note: Dynamic capabilities theory facilitates the creation, evolution and recombination of resources into new sources of competitive advantage over time (Teece, 1997). However in this research the resources relevant for the start of the alliance are the subject of interest, and not the reconfiguration of those resources. Therefore dynamic capabilities theory has not been applied.

In a complex knowledge based industry, like the biotech industry, one of the most important resources is knowledge. Knowledge is a special kind of resource because when it is shared with others it cannot be taken back. So, in order to protect these resources, Intellectual Property Rights (IPRs) will be applied via patent applications. Patents are a recorded form of knowledge to ensure that the original developer can appropriate the resulting benefits. Patents are a source of opportunity for firms as well. If a venture has more patents, it is more attractive to partners because the knowledge is not usable without the owner's permission. The venture becomes also more attractive because patents are codified knowledge that can be looked at publicly at the patenting office. Van der Valk (2007) has demonstrated the importance of patents in alliance formation; this research highlights only its influence as a preexisting condition on (dis)continuation.
On the one hand, when an alliance has been formed, a venture with more patents can contribute more knowledge to the alliance, thereby stimulating the continuation of the alliance, because with more knowledge inputs more advanced product development can be accomplished. Discontinuation of the alliance will hamper that development. On the other hand, less patents also produce a larger inducement to continue an alliance because of the need for knowledge only available from the partner organization being the patent holder. Consequently, two competing hypotheses can be formulated:

H1a. The continuation of an alliance between a venture and a partner is stimulated when the venture has more patents. (opportunity)

H1b. The continuation of an alliance between a venture and a partner is stimulated when the venture has less patents. (inducement)

Patents can be conceived as tangible technical capital. Another form of technical capital, more intangible, are the R&D facilities of a venture, which also play an important role in alliances. Every high-tech venture has a limited capacity for R&D in terms of employees and laboratory facilities. This means that choices have to be made on how to use this capacity most effectively and efficiently. A large R&D capacity forms an opportunity for ventures to be attractive to partners (Fernandez et al., 2000). And a venture with a large R&D capacity has more possibilities for joint research. On the other hand, no or a small R&D capacity also leads to an inducement to cooperate. Then an alliance is continued by a venture, because it has little or no R&D capacity necessary for further product development. The following two hypotheses relate to this issue:

H2a. The continuation of an alliance between a venture and a partner is stimulated when the venture has a large R&D capacity. (opportunity)

H2b. The continuation of an alliance between a venture and a partner is stimulated when the venture has a small R&D capacity. (inducement)

Besides technical capital, financial capital is needed by a venture for product development. Biotech ventures in the start-up phase often have not launched a product on the market yet and therefore lack turnover necessary for creating financial capital. In order to pursue their activities these ventures turn to venture capitalists for external funding. The acquired financial capital is based on the trust of venture capitalists in the biotech start-up (Stuart et al., 1999). With more venture capital the venture can invest more in an alliance and becomes more attractive for a partner to continue an alliance with. Therefore, more venture capital acquired by the venture provides better opportunities

for alliance continuation. However, when a venture lacks venture capital it also is more induced to continue an alliance because it needs the financial resources of the partner for in-house development. This leads to the following competing hypotheses:

H3a. *The continuation of an alliance between a venture and a partner is stimulated when the venture has acquired more venture capital. (opportunity)*

H3b. *The continuation of an alliance between a venture and a partner is stimulated when the venture has acquired less venture capital. (inducement)*

For finding an appropriate partner the venture depends on its social capital. Social capital consists of two components: the venture's management team and its network position, representing its internal and external sources of information on potential partners possessing the needed resources. With respect to the internal generation of information three aspects of the management team are important: size, diversity and experience of the management team (Eisenhardt and Schoonhoven, 1996). These three aspects of the management team may influence the continuation of previously formed alliances. The bigger the management team is, the more personal and professional links there are between the team and other organizations. Consequently, there is more of information available on a larger number of potential partners stimulating the selection of a more appropriate partner. A larger diversity of the management team leads to better quality of the information about potential partners, because of the different fields of expertise available among the managers. Judging those potential partners from more perspectives stimulates the selection of a more appropriate partner. Furthermore, experience within the management team is a solid basis for decision making. More experience within the management team leads to a better judgment of the available information on potential partners. By selecting a more appropriate partner based on the management team's experience and expertise it is more likely that once an alliance is formed it will be continued. This leads to the following hypotheses:

H4-1. *The continuation of an alliance between a venture and a partner is stimulated when the venture has a larger management team.*

H4-2. *The continuation of an alliance between a venture and a partner is stimulated when the venture has a more diversified management team.*

H4-3. *The continuation of an alliance between a venture and a partner is stimulated when the venture has a more experienced management team.*

Besides the management team, network position is another important aspect of social capital. A network can be defined as a group of three or more legally autonomous organizations, which cooperate with each other in order to achieve not only their own goals but also a collective goal, or to attain outcomes that normally could not be achieved by each participant individually (Provan and Kenis, 2007). Inter-organizational relationships have become a necessity to access complementary assets (Dyer and Singh, 1998; Baum et al. 2000). Because of the complexity of biotechnology, it is beyond the capability of most single firms to develop a technology on their own, and consequently inter-organizational alliances are used by them as sources of necessary complementary technological knowledge (Hagedoorn and Duyster, 2002). But this implies that the prior position of a venture in the network influences whether a venture will become successful with starting another alliance (Gulati, 1999).

A firm's network position can be seen as being part of its social capital as the more links it has to other parties, the more information it can acquire about other organizations and their resources via direct and indirect ties (Baum and Silverman, 2004). Also with a better network position ventures have more possible choices of partners to acquire the needed resources from. The number of alliances of a venture determines its importance in the network. For alliances to be formed in such a network, firms make an initial assessment of each potential partner based on its perceived credibility and reputation. The perceived credibility and reputation of a firm is based on its prior accomplishments, which for startups are little or non-existent. This makes the formation process for start-ups more difficult, because they suffer from the liability of unconnectedness (Powell et al., 1996), which may result in an unequal split of the benefits of an alliance in favor of the established partner organization (Hill, 1990). In order to prevent opportunistic behavior, because the prior opportunistic behavior of a potential partner is unknown due to the unconnectedness of the start-up, alliances can bring about complex negotiations, monitoring and enforcing contingent claims.

So, a better network position of a venture not only stimulates its alliance formation but can be expected to contribute to alliance continuation as well because the venture can obtain more and better information on potential partners allowing a better choice of a partner. A better choice of a partner increases the chance of continuation of the alliance because there is a better chance that the needed resources can be accessed via the alliance. However, when the partner organization is well connected it also has more information on potential partners and can make a better choice of whom to start an alliance with. Accordingly, an alliance formed with a well-connected partner also stimulates the continuation of the alliance. This leads to the following hypotheses:

H5-1. The continuation of an alliance between a venture and a partner is stimulated when the venture has a highly connected network position.

H5-2. The continuation of an alliance between a venture and a partner is stimulated when the partner has a highly connected network position.

Besides the network position of the partner organization also the type of partner organization may be relevant for alliance (dis)continuation. Research in biotechnology takes long periods of time because of its complexity. Therefore, publicly funded research organizations (PROs) with large knowledge bases can offer good opportunities to potential partners. Ventures that have an alliance with PROs are stimulated to continue the alliance because of the inducement for knowledge acquisition by the venture. As the development of knowledge takes a lot of time, alliances between ventures and PROs are stimulated to continue. This is especially the case when the venture is in the testing phase of product development (i.e. clinical trials). If a venture has moved to the commercialization phase, where it does have products, it seems more likely that the needed alliances are with established firms having production facilities and distribution and marketing channels of their own. These alliances for commercialization will only last if the revenues of sales of the new product are satisfactory. However, as many biotechnological products only serve niche markets, like orphan drugs, they may not result in the expected revenues and are withdrawn from the market soon after market introduction. Accordingly, many commercialization alliances will only survive over rather short periods of time. (Olk and Young, 1997) So, the continuation of an alliance not only depends on the type of partner organization but also on the phase of product development the venture is in. This leads to the following hypotheses:

H6 *The continuation of an alliance between a venture and a partner organization is stimulated when the partner organization is a public research organization.*

H7 *The continuation of an alliance between a venture and a partner organization is stimulated when product development by the venture is in the pre-commercialization phase.*

Control Variables

For the purpose of testing the hypothesized influences of the various aspects of social, technical and financial capital on alliance (dis)continuation between biotech ventures and their partner organizations, other differences in characteristics of ventures need to be controlled for. Size, age, being a spin-off, having an alliance with the parent organization and previous alliance continuation are additional differentiating characteristics of ventures that will be controlled for.

Size

As described before alliances tend to last longer as they deem to be more successful. The bigger a venture is the more possibilities it has to develop alliances; it has more resources to invest in the continuation of the alliance.

Age

Furthermore, the older a venture is the more experienced it may be with continuing alliances. Additionally, the age of a venture strengthens its reputation. The longer a venture exists the more credibility it builds up on being able to survive and is therefore deemed more successful.

Spin-off

When a venture was started as a spin off it suffered less from the liability of unconnectedness compared to ventures that started independently. Therefore, spin offs are expected to have an advantage over independently started ventures regarding partner selection and alliance continuation.

Parent organization

When a venture has an alliance with its parent organization this may have an indirect influence on the continuation of alliances with other partners. It has less inducement to continue other alliances due to the strong ties with the parent organization. However, when a venture lacks an alliance with its parent organization, it is stimulated to continue alliances with other partner organizations.

Previous alliance continuation

When a venture already continued an alliance with the same partner, it is more likely to continue that alliance due to the experience gained in the alliance. This is called performance feedback as described by Lunnan and Haughland (2008).

Conceptual model

The hypothesized effects constitute the conceptual model depicted below as a preliminary answer to the research question of this study. In order to estimate the magnitude of these effects and test them for their significance, the applied methods of data collection, measurement and analysis will be described next.

Figure 1: Conceptual model

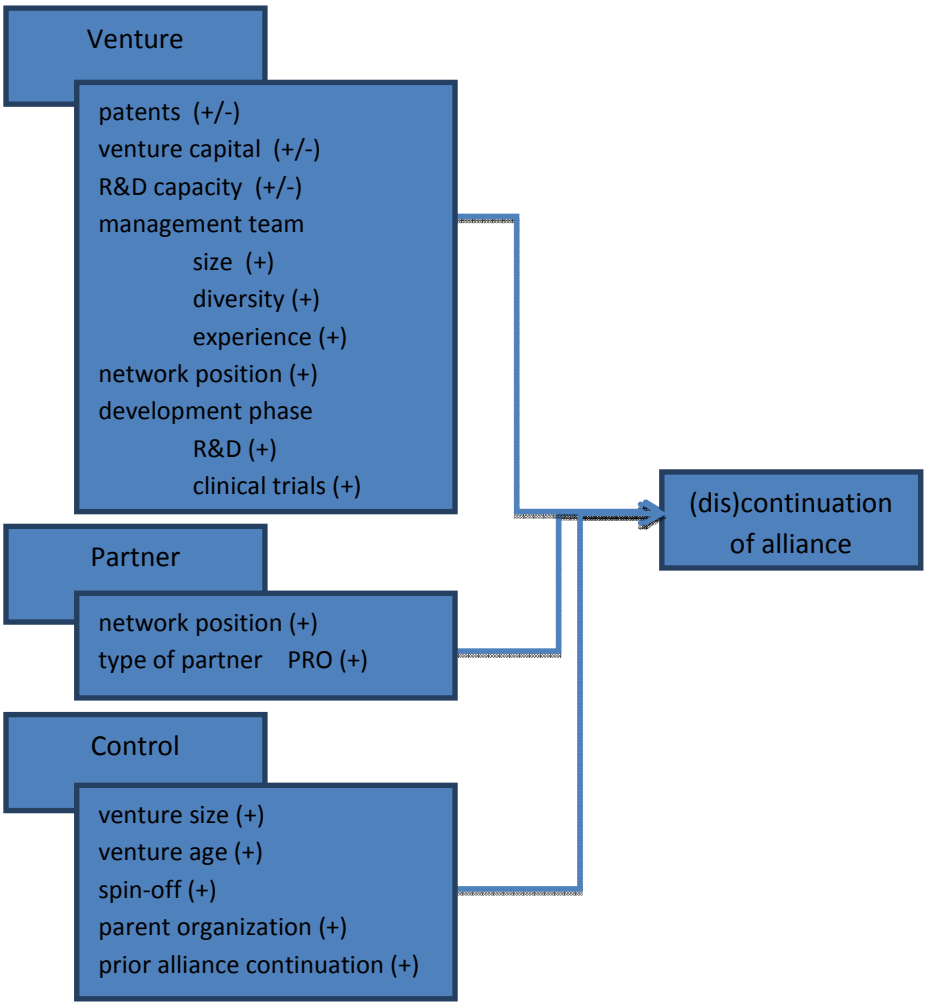
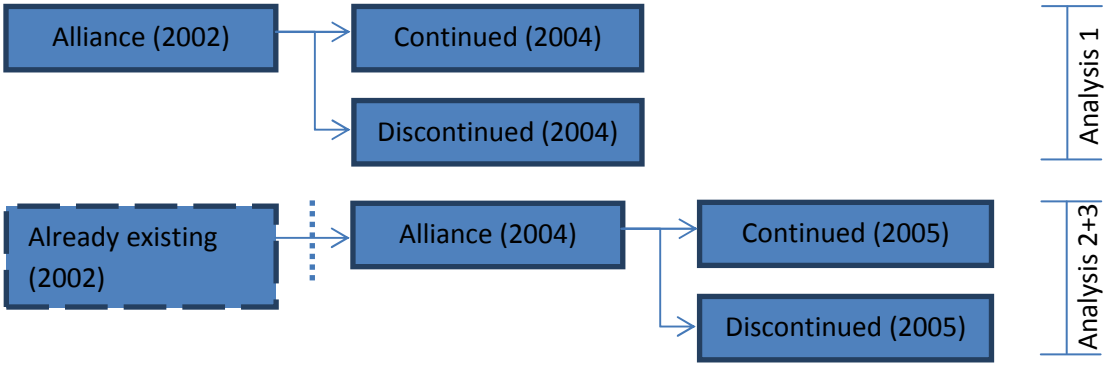


Figure 2: Analyses



Methodology

Research type

The research will be of a quantitative nature using statistical methods described below to analyze the data gathered from questionnaires. The questionnaires with data have already been collected. Therefore the methodology will focus on the analysis and a brief description of the data set.

Data gathering

The data used in this analysis was collected through yearly surveys of Dutch biotech firms in 2002, 2003, 2004 and 2005, covering all start-up biotechnology ventures registered in the Netherlands. These BioPartner Monitors were part of the BioPartner program, which was launched by the Ministry of Economic Affairs in 2000 to stimulate entrepreneurship in the biotech industry in the Netherlands (Hu & Mosmuller, 2008). The BioPartner program supplied consulting services and seed capital for startup ventures, and additionally monitored the active organizations. The program was terminated in 2005.

As the ventures that received funding from the BioPartner program were obliged to participate in the surveys, a high response rate of on average approximately 69% was achieved. For four consecutive years, data on different aspects of the ventures was collected. These ventures also listed their five most important partner organizations and their total number of alliances. Through combining these partner organizations it is possible to reconstruct most of the alliances. Unfortunately, in 2003 the specific data on alliances was not asked for in that BioPartner Monitor. Consequently, alliance (dis)continuation between Dutch biotech ventures and their partners is investigated over two periods of time of unequal length, namely 2002-2004 and 2004-2005.

Validity and reliability

The internal validity is high because all the effects of all independent variables specified in this research have been empirically tested and confirmed before. The external validity of the data is high as well. The response rates of the surveys in 2002, 2004 and 2005 where respectively 87%, 69% and 54%. With the five most important alliances of each start-up resulting in a total of 340 alliances, approximately 80% of the total numbers of alliances reported can be reconstructed. Accordingly, the data sample is more than sufficient to generalize the results obtained from them towards the whole Dutch biotech industry. Construct validity is also high because the theoretical constructs and their indicators used in this research are based on prior empirical studies. The indicators used to measure the different aspects of the ventures are mostly directly related to the questions in the survey.

The reliability of the data set is high because the data is verifiable. The questions in the surveys were repeated every year and combined with the high response rate this forms a solid basis for analysis. If this research would be repeated similar results would emerge.

Operationalization

Based upon the hypotheses and the conceptual model the following variables are identified. These variables will be measured using the indicators listed below.

Table 1: Operationalization of variables

Concept	Indicator	Scale
Dependent variable	*Period 2002-2004 / 2004-2005*	
(Dis)continuation of alliance	Discontinued alliance = 0 Continued alliance = 1	Binary
Independent variables	*Year 2002 / 2004*	
Number of patents	Number of patents owned	Discrete
R&D capacity	Amount of R&D employees of the start-up divided by total employees	Continuous
Venture capital	Amount of venture capital acquired by the start-up	Continuous
Size management team	Number of managers	Discrete
Diversity management team	Number of different areas of expertise of the management team	Discrete
Experience management team	Average number of years of experience of the managers	Continuous
Network position venture	Number of alliances of the start-up	Discrete
Network position partner	Number of alliances of the partner	Discrete
Partner type	Private=0 Public=1	Binary
Development phase	Nr of products in: • R&D phase (preclinical trial phase) • Clinical trial phase • Commercialization phase	 Discrete Discrete Discrete
Control variables		
Size	Number of fulltime employees equivalent (fte)	Discrete
Age	Number of years the start-up exists	Discrete
Spin-off	Whether the startup is a spin-off or independent start-up No spin-off = 0 Spin-off = 1	Binary
Parent organization	Whether an alliance is present with the parent organization Not present = 0 Present = 1	Binary
Previous alliance continuation *(only for period 2004-2005)*	Newly formed alliance = 0 Alliance existed in prior period = 1	Binary

Data analysis

Due to the different types of independent variables and the dyadic nature of the dependent variable '(dis)continuation of an alliance', polychoric and polyserial correlations have been used to estimate the unbiased correlations of the underlying unobserved normally distributed standardized continuous variables (Olsson, 1979; Olsson et al., 1982). With these correlations as input linear regression analysis can be applied. This resulted in the following standardized regression coefficients for the periods 2002-2004 and 2004-2005. The third column is an analysis over the period 2004-2005 that incorporates the control for performance feedback.

Results

The results shown below are the estimated standardized regression coefficients of the independent variables. The numbers depict the influence of each independent variable on alliance continuation. Numbers marked by one or two asterisks represent statistically significant effects; *) $p < 0.10$ and **) $p < 0.05$.

Table 2: Estimated standardized regression coefficients

	Standardized regression coefficients (Beta)					
	DV2002-2004 N=189		DV2004-2005 N=181		Adj. DV2004-2005 N=181	
IV1 –Patents		-0.135*		-0.112		-0.179**
IV2 – R&D capacity		0.189**		0.287**		-0.008
IV3 – Venture capital		0.081		0.127		0.050
IV4-1 – Size mgmt. team		0.125		-0.130		-0.049
IV4-2 – Diversity mgmt. team		0.002		-0.042		-0.128**
IV4-3 – Experience mgmt. team		-0.099		-0.079		-0.169**
IV5-1 – Network position venture		0.369**		-0.071**		0.154*
IV5-2 – Network position partner		0.319**		0.189		0.127*
IV6 – Type partner		-0.004		-0.039		0.532**
IV7-1 – R&D phase		-0.261**		-0.004		-0.867**
IV7-2 – Clinical phase		0.159*		-0.013		-0.040
IV7-3 – Commercial phase		0.080		-0.025		0.148**
C1 –Size	0.069	0.015	-0.272**	-0.171*	-0.224**	-0.149*
C2 – Age	-0.103	-0.177*	0.058	0.128	-0.051	-0.026
C3 – Spin off	-0.035	-0.202	0.050	-0.074	0.065	0.431**
C4 – Parent alliance	0.255**	0.269**	0.159**	0.128	0.023	-1.108**
C5 – Previous alliance continuation					0.460**	0.665**
R square	0.072	0.239	0.117	0.274	0.305	0.489
Adj. R square	0.052	0.168	0.097	0.203	0.285	0.436
F-value (all p<0.01)	3.575	3.373	5.813	3.872	15.353	9.176

IV=independent variable, C=control variable, DV=dependent variable

The standardized regression coefficients presented above together with their levels of significance indicate which inducements and opportunities have a significant effect on alliance continuation. As can be seen in the first column for the period 2002-2004, the network positions of both the venture and the partner are relevant. Furthermore, the early phases of product development the venture is in, the number of patents and the available R&D capacity belong to the set of significant inducements and opportunities. For the following period of 2004-2005 it shifts towards the available

R&D capacity and the network position of the venture. Apart from these significant inducements and opportunities, especially small firms having an alliance with their parent organizations continue their alliance(s) with partner organizations. However these results may be blurred because of the effect of previous alliance continuation representing the effect of earlier performance feedback on alliance continuation. By controlling for the effect of performance feedback, a more diverse result appears and the explained variance of alliance (dis)continuation increases from 27% to 49%. Performance feedback in the period of 2002-2004 is less relevant since the majority of the ventures in that period did not exist before the year 2000. Therefore the effects of performance feedback are unlikely to be present among these very young start-ups since they only started recently without a track history of alliance continuation. So, by controlling for this effect in the period 2004-2005 where performance feedback does influence the results, the two analyses become comparable. The fit of the various analyzed models to the input correlation matrices is in all cases excellent ($p < 0.01$).

The results show that the more patents held by the venture the less likely it is to continue an alliance. This is shown by the standardized regression coefficients of -0.135 and -0.179 showing a structural significant influence on alliance continuation. Start-ups are induced to search for a suitable partner because of a lack of in-house technological knowledge. This is contrary to the amount of R&D capacity, because R&D capacity shows to be a structural opportunity. Ventures that have more R&D capacity are more likely to continue alliances as shown by the estimated regression coefficient values of 0.189 and 0.287. R&D capacity is not a restraining factor when it comes to alliance continuation. The R&D capacity is a resource that the start-up can contribute to an alliance thereby stimulating the alliance continuation.

After time, in the period 2004-2005 the continuation of alliances is negatively influenced by the management team. The size of the management team does not seem to be influential in this research, but the diversity and experience are. This is shown by the estimated regression coefficient of -0.128 and -0.169. An explanation for the negative influence is that when the management team gets more diverse and experienced it has more information about other potential alliances. This leads to a critical assessment of the current alliances and when this alliance is perceived not to be beneficial enough it will be terminated. The network position shown by the estimated regression coefficient of 0.154 for the venture and 0.127 for the partner shows that when ventures and partners have a better network position they are more likely to continue alliances. This is also demonstrated in literature. New ventures are more likely to suffer from a liability of unconnectedness (Powel et al,. 1996) and a liability of newness (Stinchcombe, 1965). So a better network position stimulates alliance continuation. Besides the network position also the partner type becomes significant. A positive estimated regression coefficient of 0.532 indicates that ventures having an alliance with a public research organization are more likely to continue their alliances. This is because public research organizations tend to have long research programs. Furthermore there is a difference in the main objective for public research organizations and private ventures which avoids competing interests. The research phase has a negative influence on alliance continuation shown by the estimated regression coefficients of -0.261 and -0.867. Furthermore the results show that ventures entering the commercialization phase are more likely to continue alliances. This is because product concepts that transition from the R&D phase towards the clinical trials will start a long term process of testing, and thus collaboration, before the product will be ready for commercialization.

Having an alliance with the parent organization shows a positive influence on alliance continuation in the early period. However, during the later period being a spin-off has a positive influence on alliance continuation while an alliance with the parent organization hampers alliance continuation. When a start-up has an alliance with the parent organization it has the possibility to explore potential partners in the network of the parent organization. However, when the start-up matures and diversifies it will be able to select partners from its own network without the help of the parent organization.

These results lead to the following table concerning the hypotheses.

Table 3: Accepted and rejected hypotheses

	Hypotheses												
	H1a	H1b	H2a	H2b	H3a	H3b	H4-1	H4-2	H4-3	H5-1	H5-2	H6	H7
Accepted		X	X							X	X	X	
Rejected	X			X	X	X	X	O	O				O

Hypotheses H1b, H2a, H5-1, H5-2 and H6 are not disconfirmed as influential on the outcome of alliance continuation of start-ups in the biotech industry. However the effects specified in hypotheses H3a, H3b and H4-1, were not significant in this research and are rejected. Since both H1 and H2 were hypothesized in two ways, the confirmation of H1b and H2a automatically lead to the disconfirmation of H1a and H2b. H4-2 and H4-3 were shown to be relevant for alliance continuation. However the estimated effects differ from the effects specified in the hypotheses. This is also the case for H7. H7 was not disconfirmed as relevant but was shown to be of importance in the pre-clinical and commercialization phase instead of in the hypothesized R&D phase. So the effect of the development phase is present however it differs from initial expectations.

The results show some variables that have a structural effect on alliance continuation. For both periods fewer patents held by the venture stimulate alliance continuation (inducement). Furthermore, a better network position of both the venture and the partner stimulate alliance continuation (opportunity). Lastly, fewer products in the R&D phase stimulate alliance continuation (inducement). Other variables show an effect depending on the period. For the period 2002-2004 a larger R&D capacity stimulates alliance continuation (opportunity). More products in the clinical phase stimulate alliance continuation (opportunity). Younger ventures stimulate alliance continuation and having a parent organization stimulates alliance continuation. For the period 2004-2005 the management team has an effect on alliance continuation, however the size of the management team was irrelevant and a more diversified and experienced management team has a negative effect on alliance continuation. Furthermore, the partner type stimulates alliance continuation if the partner is a public research organization. In contrast to the period 2002-2004 the development phase stimulating alliance continuation has shifted towards the commercialization phase. This implies that products progress only slowly towards the commercialization phase. Furthermore, smaller firms have a positive effect on alliance continuation. Being a spin-off stimulates alliance continuation and having a parent organization hampers alliance continuation. Lastly, having a previous alliance continuation has a positive influence on alliance continuation. The variable venture capital did not show to have a significant effect on alliance continuation. What the variables having an effect in a specific period show is that the resource needs of ventures change over time.

Implications

Theoretical implications

Insights derived from the resource based view into alliance formation are confirmed in this study to be relevant for alliance continuation as well. Even when performance feedback exists the resource based view still holds, but the performance feedback described by Lunnan and Haugland (2008) is dominantly present in the results. Although this research confirms the presence of this influence it also shows that performance feedback by itself does not tell the complete story. The identified resource needs supplement performance feedback in explaining alliance continuation. This implies that even though performance feedback is present that because of possibly changing needs for resources alliances might still be terminated. A more dynamic resource based view would be desirable since this study shows that resource needs may change. This is derived from the inducements and opportunities that are period specific. This could be due to internal shifts in needs of resources but could also be an effect caused by the alliance continuation process itself.

The liability of unconnectedness described by Powell et al. (1996) is confirmed in this research as well as shown by the structural positive influence on alliance continuation of the network position of ventures. However, the liability of newness described by Stinchombe (1964) is not fully supported in this research. Shown by the control variable age, it can be derived that during the early phase the liability of newness was present. However, as time progresses the effect of the liability of newness disappears in the period 2004-2005. Since the majority of the ventures in this research where of a young age (roughly 68% is <4 years) this would indicate that the liability of newness in this research holds for the first period 2002-2004 of industry development but not for the later period 2004-2005. So, only the liability of unconnectedness is structurally present.

Policy implications

The policy implications derived from this research should focus on the negative influences of opportunities and inducements since they hamper alliance continuation. However, most of them cannot be influenced by policy makers, i.e. policy makers cannot influence the number of patents held by a venture or the management team selection. In this study it is shown that relevant for policy makers are the network positions of ventures and the type of partner. New ventures that the lack connectivity described by Powel et al. (1996) can be improved by policy makers by establishing platforms and brokers where new ventures can meet and look for potential partners. Such platforms should also incorporate public research organizations to maximize the connectivity in the industry. This would improve the network position of new ventures, thereby overcoming part of the liability of unconnectedness and thus stimulating better partner selection and (beneficial) alliance continuation.

Managerial implications

The implications on the managerial level are straight forward. This research identified a configuration of resources that have impact on the likelihood of alliance continuation. In order to decide upon alliance formation these configurations show the likelihood of future alliance continuation. Better informed management teams can produce better decisions thereby improving the chances of a better partner selection. By more efficiently forming alliances with a higher chance of alliance continuation, resources can be better attributed towards the highest chance of alliance continuation and thereby not investing in unsuccessful short term alliances. For instance the study shows that an alliance with a parent organization can be beneficial in the early stage, but will hamper alliance

continuation later on. Although the timing of separating from the parent organization is dependent on many factors, managers can take into account that the alliance with a parent organization should be seen as a tie to be abandoned after time.

Conclusion

The research question of this study was stated as:

To what extent are inducements and opportunities of start-ups, identified before to stimulate alliance formation, related to the (dis)continuation of existing alliances in the biotechnology sector in the Netherlands in the period 2002-2005?

The inducements and opportunities identified in previous studies as relevant for alliance formation are also relevant for alliance continuation as well. The results for period 2002-2004 show a tendency towards an alliance continuation based on the inducements of patents and early stage product development by a venture, combined with the opportunities offered by its R&D capacity and the network positions of the venture and the partner. This pattern is also demonstrated by the second analyses, with the addition of the diversity and the experience of the management team, which shows a negative relation. From these results it can be concluded that ventures with a few patents, a large R&D capacity, a well-developed network and entering clinical trials/the commercialization phase have a favorable configuration of resources for alliance continuation.

It can be concluded that these inducements and opportunities are related to the continuation of alliances and combined with performance feedback they explain 49% of the outcome in the (dis)continuation of alliances. These identified inducements and opportunities are responsible for 56% of the total explained variance of alliance (dis)continuation. This is a significant result showing that performance feedback alone as described by Lunnan and Haugland (2008) explains only partly whether or not alliances are continued. Furthermore, this research shows that inducements and opportunities of ventures, which were found relevant for alliance formation in previous literature, also help in predicting the likelihood of continuation of alliances.

Discussion

Dataset

The dataset which has been used in this research is slightly flawed in the sense that the period of data collection was short, namely four years. Of these four years the part about alliances misses one year of observation. This resulted in two periods of unequal length, namely 2002-2004 and 2004-2005. Although the difference in these periods could influence the results, the decision on taking two unequal periods of time has been solved by doing separate analyses for the different time spans. However a longer time span of data collection would be desirable. Furthermore, the dataset lacked a complete alliance overview, because only the five most important partners were given in the answers. This resulted in an incomplete network overview for ventures having more than five partners. However, because the total number of alliances was also asked for in the questionnaire it turned out that 80% of the network could be reconstructed. Furthermore, there was a declining trend in the response to the surveys, which could mean a selective response for companies no longer wishing to participate or unwilling to share company figures for the research. So, the dataset used is not perfect, but adequate for the type of research conducted. It covered an extensive amount of

different resources present at the ventures and, especially, for finding out whether these resources influenced alliance continuation the database sufficed.

Resource Based View

As stated before the opportunities and inducements for alliance formation identified in the literature based on the resource based view has resulted in an overview of possible opportunities and inducements relevant for alliance continuation. The theory has yielded a structure on which the inducements and opportunities could build upon. As shown in the results Ahuja's (2000) definition of inducements and opportunities yields support for the influence on alliance continuation. However, because of the dynamic nature of the resource needs, found in the variables that have period specific effects a more dynamic theory would be preferable, since the data used in this research is quite static. The changes these resources go through in time and the way in which the ventures handle these resources are of the interest. However, due to the nature of the dataset there was no possibility for taking these dynamics into account in this study. By taking the resource based view as a basis and making it more dynamic, incorporating the possibility for changing resource needs, a more comprehensive theory of alliance (dis)continuation can be developed.

Further research

It is clear that this research yields some preliminary results, which look promising to complement the theories of Olk and Young (1997) and Lunnan and Haugland (2008). But further research is needed to complement the inducements and opportunities studied and preferably over a longer time span. If more inducements and opportunities are identified a better understanding may be gained into alliance continuation. Furthermore, data on commitment could also supplement the dataset to further investigate the theory of Olk and Young (1997). Since the inducements and opportunities are measured for the period before the (dis)continuation takes place it results in a valuable predictive model. Future research should focus on identifying more possible opportunities and inducements and take the dynamic nature into account. With better data collection specifically designed for such a study more insight can be gained into the alliance continuation of biotech ventures. In order to continue along the lines of this study there should be more focus on alliance specific resources. These are resources that are relevant for a particular alliance. With more alliance specific data research can add more insight into alliance (dis)continuation.

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Appendix A: Research Syntaxes

2002-2004

```
MATRIX DATA VARIABLES=ROWTYPE_ DV2002 IV1 IV2 IV3 IV41 IV42 IV43 IV51 IV52 IV6 IV71 IV72 IV73 C1 C2 C3
        C4.
BEGIN DATA
MEAN 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
STDEV 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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CORR 1.000
CORR -0.028 1.000
CORR 0.197 0.138 1.000
CORR 0.204 0.322 0.244 1.000
CORR -0.056 0.348 -0.240 0.124 1.000
CORR 0.042 0.021 -0.096 0.224 -0.022 1.000
CORR -0.126 -0.132 -0.350 -0.142 0.126 -0.129 1.000
CORR -0.013 0.014 -0.142 0.083 0.003 0.224 0.148 1.000
CORR 0.158 0.018 -0.009 -0.002 -0.072 -0.074 0.042 -0.560 1.000
CORR 0.192 0.005 0.005 -0.046 -0.052 -0.093 -0.002 -0.118 0.493 1.000
CORR -0.162 -0.075 -0.073 -0.180 0.039 0.166 0.060 0.223 0.041 0.110 1.000
CORR 0.151 0.058 0.124 0.293 -0.100 0.323 -0.208 -0.068 0.066 0.049 0.067 1.000
CORR -0.055 -0.136 -0.224 -0.200 0.051 0.076 0.207 0.191 0.115 0.222 0.525 -0.065 1.000
CORR 0.024 0.365 -0.187 0.183 0.640 -0.070 0.039 0.063 0.044 0.054 -0.068 -0.157 0.033 1.000
CORR -0.094 0.089 -0.139 -0.210 0.133 -0.065 0.163 0.209 0.109 0.185 0.260 -0.108 0.409 0.232 1.000
CORR 0.072 0.049 -0.134 0.247 -0.045 0.163 -0.150 0.139 -0.102 -0.235 -0.198 0.427 -0.274 -0.204 -0.504 1.000
CORR 0.248 -0.038 -0.043 -0.026 -0.140 -0.068 -0.078 -0.186 0.201 0.296 -0.085 0.151 -0.087 -0.111 -0.097 0.272 1.000
END DATA.
REGRESSION MATRIX = IN(*)
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/DEPENDENT=DV2002
/METHOD=ENTER
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2004-2005

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STDEV 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
N 181 181 181 181 181 181 181 181 181 181 181 181 181 181 181 181 181 181
CORR 1.000
CORR -0.132 1.000
CORR 0.328 0.111 1.000
CORR 0.048 0.423 0.214 1.000
CORR -0.253 0.302 -0.076 0.302 1.000
CORR -0.157 0.093 -0.233 0.027 0.047 1.000
CORR -0.071 -0.066 0.064 -0.048 0.033 -0.050 1.000
CORR -0.156 0.195 -0.127 0.177 -0.026 0.031 0.065 1.000
CORR 0.297 -0.020 0.139 0.009 -0.114 -0.076 -0.120 -0.242 1.000
CORR 0.218 0.054 0.146 -0.009 -0.105 0.003 -0.143 -0.478 0.511 1.000
CORR -0.139 0.042 0.005 -0.024 0.036 0.074 -0.010 0.154 -0.124 -0.169 1.000
CORR -0.020 0.155 0.064 0.176 0.113 -0.014 -0.083 -0.006 0.010 -0.003 -0.008 1.000
CORR -0.117 -0.034 -0.138 -0.097 0.109 0.107 0.219 0.101 -0.160 -0.240 0.131 -0.010 1.000
CORR -0.294 0.392 -0.185 0.298 0.586 0.093 -0.017 0.203 -0.120 -0.129 0.078 0.150 0.051 1.000
CORR -0.116 0.217 -0.245 0.122 0.241 0.042 0.121 0.261 -0.137 -0.179 0.123 0.027 0.180 0.441 1.000
CORR 0.164 -0.037 0.451 0.122 0.063 -0.006 -0.112 -0.250 0.122 0.200 0.010 0.014 -0.199 -0.277 -0.342 1.000
CORR 0.221 -0.082 0.100 -0.017 -0.058 -0.075 -0.080 -0.256 0.320 0.586 -0.720 -0.019 -0.065 -0.210 -0.232 0.365 1.000
CORR 0.473 0.034 0.235 0.058 -0.087 -0.054 0.123 -0.010 0.141 0.158 0.032 0.031 0.091 -0.055 0.132 0.025 0.251 1.000
END DATA.
REGRESSION MATRIX = IN(*)
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 /METHOD=ENTER
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