

COLLABORATIVE ENTREPRENEURSHIP: ON THE INFLUENCE OF INTERNAL AND EXTERNAL COLLABORATION ON CORPORATE ENTREPRENEURIAL INNOVATION

Astrid Heidemann Lassen¹, Bjørge Laugen² & Rick Middel³

¹Center for Industrial Production, Aalborg University, Denmark

²Stavanger University, Norway

³University of Twente, the Netherlands

ahl@production.aau.dk, bjorge.laugen@uis.no, h.g.a.middel@utwente.nl

ABSTRACT

The present paper empirically tests the effect which internal/external collaboration has on innovation height and identifies characteristics of collaboration patterns leading to entrepreneurial innovation in particular. Doing so adds to the understanding of how corporate entrepreneurship best unfolds as interfirm activity, which here is termed collaborative entrepreneurship, and provides details on the particular patterns of Open Innovation. The empirical analysis is based on a data set with responses from 512 Danish engineers. The analysis finds that external collaboration has significantly different effects on innovation height depending on the type of partners involved, and furthermore suggests that the development of entrepreneurial innovation is not only dependent on high external involvement, but also on involvement and collaboration among internal functional departments and people.

Keywords: Collaboration, Innovation, Corporate Entrepreneurship

1. INTRODUCTION

The link between innovation and collaboration is often emphasized and increasingly acknowledged as potential sources of competitive advantage (Argote & Ingram, 2000). This is becoming progressively more important as fast-changing market conditions heighten the need for organizations to be able to sustain continuous innovative activities. Discussing the importance of integrating different sources of knowledge in the innovation process, Chesbrough (2003), amongst others, notes that it is no longer sufficient to focus on generating innovation in a closed innovation system existing solely within a firm's boundaries, but that innovation should happen in an open innovation system in collaboration with sources from the external environment. This observation has interesting consequences for the way corporate entrepreneurship should be perceived as it highlights the importance of considering the application of an interfirm perspective rather than merely an intrafirm perspective in this approach to creating innovation.

However, though many researchers point to the importance of external collaboration, and thereby imply a link between collaboration and the capability of being continuously innovative, few have empirically tested which effect this link in fact creates on innovation height¹ and through which patterns it may show itself. Doing so is potentially highly interesting as it will add to the understanding of how corporate entrepreneurship best unfolds as inter- *and* intrafirm activity. This is where the present paper takes its point of departure.

Firstly, the paper discusses the link between collaboration and innovation from respectively collaboration and innovation management perspectives. This outlines important elements to consider in relation to corporate entrepreneurship as an interfirm phenomenon. Secondly, entrepreneurial innovation is discussed in terms of innovation height in order to specify the innovation in focus for the subsequent analysis and discussion of patterns of internal and external collaboration inducing corporate entrepreneurship. Finally, the results are jointly discussed, conclusions are presented to the research question of the paper, and potential directions for further research are outlined.

2. COLLABORATION AND INNOVATION

Historically, firms have organized R&D internally and relied on outside contract research only for relatively simple functions or products (Mowery, 1983). Today, firms are executing nearly every step in the production process, from discovery to distribution, through some form of external collaboration. In particular, new market imperatives have led companies to this move from vertically aligned operations (Hayes & Wheelwright, 1984) to horizontally aligned operations (Goshall & Bartlett, 1995) and consequently changed competition from the level of the single firms to that of networks of companies. These various types of inter-firm alliances take on many forms, ranging from R&D partnerships to equity joint ventures to collaborative manufacturing.

An array of theories on interaction between companies has been developed over the last decades (Grandori & Soda, 1995; Olivers & Ebers, 1998). Theoretical approaches studying inter-organizational relationships include; transaction cost approach (Coase, 1937; Williamson, 1985), resource dependency (Pfeffer & Salancik, 1978), network approach (Håkansson, 1989; Håkansson & Snehota, 1995; Ford *et al.*, 2003), and organizational learning (Levitt & March, 1988; Cohen & Levinthal, 1990). All these theories attempt to explain, from different angles, how a company can look outside its own borders to find the resource and competencies needed to produce its products and deliver its services, and to establish close relationships with other companies in order to gain a competitive advantage (Middel, 2008). The most common rationales offered for this increase in collaboration involve some combination of risk sharing, obtaining access to new markets and technologies, and coupling complementary skills (Kogut, 1989; Kleinknecht & Reijnen, 1992; Hagedoorn, 1993; Mowery & Teece, 1993; Eisenhardt & Schoonhoven, 1996). Littler *et al.* (1995) further argue that the different perspectives on collaboration can largely be classed into three broad categories:

¹ Innovation height is in the literature also referred to in terms of *degree of innovativeness* or *radicality of innovation*. We use the term innovation height as applied by e.g. Duguet (2006) referring to how incremental/radical the innovation is.

1. *Benefits of collaboration.* Collaboration can affect a firm's innovative output positively by providing three substantive benefits: knowledge sharing, risk reduction and speed of development. Through collaboration each partner can potentially receive a greater amount of knowledge from project than it would obtain from a comparable investment made independently (Berg *et al.*, 1982). Resource sharing between two or more organizations is furthermore one of the ways of achieving a reduced cost of product development and decreased risk of failure (Hagedoorn, 1993). Kent (1991) additionally argue that collaboration also permits firms to react swiftly to market needs through increased speed of development and heightened responsiveness to customer needs.
2. *Risks of collaboration* There are several risk inducing factors mentioned in connection with collaboration, such as; leakage of a firm's skills, experience and knowledge (Hamel *et al.*, 1989), reduction of the direct control held by one company over e.g. the development process (Håkansson, 1989) and additional costs connected to the management of the collaboration and harmonization of differences between the collaboration partners (Farr & Fischer, 1992).
3. *Factors that increase the success of collaborative efforts.* There is considerable research into the factor affecting the success of collaborative projects. Considerations on setting up the collaboration (choice of partner based on compatibility, establishing ground rules and limits to the collaboration) (Bleeker & Ernst, 1991), process management (frequent monitoring of progress, frequent meetings between partners, and development of trust) and past experience with collaboration are factors linked to increase of success in collaboration (Anderson & Narus, 1990).

This in total creates a substantial body of literature on the relationship between network and innovation. The principal focus has largely been on the adoption or diffusion of innovations based on network positions, strengths of ties (Granovetter, 1985) or from human resource/social capital perspective. In this sense, primary emphasis is on understanding the collaboration, and innovation is used in wider terms as the output variable.

Also within innovation management literature, the topic of collaboration has been subject of much interest. This interest lays the foundation for Chesbrough's (2003) observation that a shift from the closed innovation principles to open innovation principles is necessary for business survival. The closed innovation system is based on the premise that firms can develop competitive advantage by building in-house research and development competencies which effectively enable the development and commercialization of new products, processes or services. Clear organizational boundaries enable the careful protection of ideas. Business development strategy is normally based on clearly defined objectives and justifiable product/market trajectories, and new ideas are screened to fit the organizational psychology and culture.

Contrary to this, and in accordance with the dynamic capability view of the firm (Teece *et al.*, 1997; Zott, 2003), an open innovation system considers the firm essentially a knowledge processing and utilizing entity focusing on inter-firm performance. Openness to using external sources of information and ideas in the firm's innovation processes and interaction among different partners are considered to be of high

importance both in order to explore and build up new capabilities (von Hippel, 1988; Chesbrough, 2003). In particular the organizational capabilities of sensing weak signals and seizing opportunities (Teece, 2000) are highlighted as essential contribute to innovative performance and long-term competitiveness.

In this sense, research on innovation management has focused on topics comparative to the different perspectives on collaboration. However, the primary focus has mainly been on how to successfully manage the innovation process when collaborating with one or more partners. Innovation is in this sense evaluated in terms of the *ability to innovate* (realized or potential) achieved through collaboration. The nature of the innovation itself (i.e. the degree of innovation achieved or different types of innovations created) is of less interest in this literature.

3. ENTREPRENEURIAL INNOVATION

In order to further pursue the topic of the nature of the innovation created, focus is turned to the literature on entrepreneurship, where both innovation and collaboration has been of central focus and innovative output is a primary object of interest. Entrepreneurship, as a scholarly field, seeks to understand how, by whom, and with what effects opportunities to create future goods and services are discovered and exploited (Shane & Venkataraman, 2000), and most authors accept that all types of entrepreneurship are based on innovations (Stopford & Baden-Fuller (1994).

In entrepreneurship research it is found that in particular breakthrough innovation has been theoretically linked to entrepreneurship at a macro level in terms of creative destruction (Schumpeter, 1934; Baumol, 2002). However, at a meso or micro level of analysis the linkage is yet poorly understood (Lassen *et al.*, 2006).

Attempts have been made at linking specific network activity to innovative output of corporate entrepreneurship (Noyes, *et al.* 2008), and research has shown that e.g. social networks play a critical role in the entrepreneurial process (Aldrich & Zimmer, 1986; Stam & Elfring, 2008). Entrepreneurs with favorable positions in social structure identify innovative opportunities, secure privileged access to resources, and obtain endorsements that foster the legitimacy of their ventures. Yet while the importance of networks for the start-up of entrepreneurial ventures is widely acknowledged, still little is known about the actual impact of the innovations created through corporate entrepreneurship, as innovation and innovativeness is often referred to in a non-dichotomous fashion.

Yet, from the mere definition of corporate entrepreneurship we find evidence that entrepreneurial innovation is of a particular nature. For example, Vesper (1990) define corporate entrepreneurship as “*doing new things and departing from the customary to pursue opportunities*”, and Covin & Miles (1999) highlight that innovation in itself is not enough to identify a firm as being entrepreneurial; an *objective of rejuvenating or purposefully redefining organizations, markets, or industries in order to create or sustain a position of competitive superiority* (p. 50). This implies that a particular entrepreneurial behavior leads to a particular innovative output. Also, the well-established definition of Entrepreneurial Orientation (EO) by Lumpkin & Dess (1996) underlines this, as corporate entrepreneurship is conceptualized as *innovativeness, risk-taking, pro-activeness, competitive aggressiveness, and autonomy*.

Thus, we argue that the nature of entrepreneurial innovation should be viewed in light of the *height of innovation* created through the projects in question (Lassen, 2007). Height of innovation refers to how incremental/radical the innovation is (Duguet, 2006). Incremental innovation is critical to sustaining and enhancing shares in mainstream markets (Baden-Fuller & Pitt, 1996) and focuses on improving existing products and services (Bessant, 2003). Radical breakthroughs, in contrast, serve as the basis for future technologies, products, services and industries (Christensen, 1997; Hamel, 2000; Abetti, 2000). Terms such as “disruptive”, “radical”, “non-linear”, “discontinuous”, “breakthrough”, and “paradigm-shifting” have all been used to describe what in essence is breaking away from the customary, creating entirely new possibilities for growth.

For the purpose of this paper radical innovation is defined following the definition of O'Connor & Ayers (2005), as the commercialization of products or technologies that have a strong impact on 1) the market, in terms of offering wholly new benefits, and 2) the firm, in terms of generating new business. Thus, the key to radical innovation is the amount of new value added through exploration and exploitation of new opportunities.

4. RESEARCH QUESTIONS

The theoretical background establishes insight into the characteristics and particular contribution of collaboration, innovation and corporate entrepreneurship. This leaves us with an image of the gaps in the understanding of corporate entrepreneurial innovation as well as a range of interesting components, which could potentially influence the way corporate entrepreneurship should be perceived.

From collaboration literature, we deduct that it is increasingly important to consider the application of an interfirm perspective in the approach to creating innovation, as this involves some combination of risk sharing, access to new markets and technologies, and coupling complementary skills. From innovation management literature, and in particular Chesbrough's (2003) perspective on open innovation, we identify the necessity of integrating external partners throughout the innovation process. From corporate entrepreneurship we find evidence that the height of innovation which should be perceived as entrepreneurial equals radical innovation.

Miles *et al.* (2005) have introduced the term “collaborative entrepreneurship”, which begins to address some of these aspects. However, Miles *et al.* (2005) use the term in the sense of being a range of small entrepreneurial firms collaborating in order to achieve the positive effect of scale economies which arise when larger projects generate significantly more knowledge than smaller projects. Hence, entrepreneurship is in this definition related to the fact that the individual participating firms are emerging ventures. The logic of collaborative entrepreneurship is found highly adequate for the interest of this paper, as a terminology for the entrepreneurial outcome created through collaboration. However, in this paper the collaborating partners are not as seen in Miles *et al.* (2005) emerging ventures themselves, but are mature companies, which are able to generate entrepreneurial activity through collaborating with a range of different sources of knowledge. By using the term collaborative entrepreneurship in this sense, it integrates both Lumpkin & Dess's (1996) definition of Entrepreneurial Orientation and Chesbrough's (2003) definition of Open Innovation, as the creation of economic value through departure from the customary based on new, jointly created ideas or knowledge. This leads to the following phrasing of the interest of the paper:

RQ) Which patterns of collaboration induce corporate entrepreneurship?

The benefit of corporate entrepreneurship in terms of innovation height is of particular interest in this paper, as it has been identified as an underdeveloped yet valuable perspective in both collaboration literature and entrepreneurship literature. Building in particular on the work by Chesbrough (2003) on open vs. closed innovation systems and, this study aims to extend and refine the proposed framework, by investigating how internal and external collaboration influence the innovation height of innovation projects. Thus, we have further divided the research question into two workable sub-questions, which frame the empirical analysis:

- a) What is the influence of internal collaboration on innovation height?*
- b) What is the influence of external collaboration on innovation height?*

By addressing these questions we are able to determine not only how Chesbrough's (2003) suggested Open Innovation paradigm affects the height of innovation created, but also to provide evidence on the patterns of collaboration which favors corporate entrepreneurship.

5. METHODS

This section provides an overview of the empirical data based on which the research is conducted. This includes a data description, an explanation of how the applied variables are operationalized, and the account for the analytical methods used

5.1 DATA DESCRIPTION

To empirically investigate the research questions, a quantitative research methodology has been applied. The data was collected in 2005, using a web-based survey sent to 3.000 engineers employed in privately owned firms. The respondents were selected from the member database of IDA (the Danish Society of Engineers). The respondents are employed in a wide range of sectors, including for example service, batch manufacturing, and food and process industry

The survey resulted in a total of 803 responses (26 %). Of the in total 803 responses, 512 (17 %) indicated that they had participated in such a development project, and are considered useful questionnaires for the research at hand.

5.2 OPERATIONALIZATION OF VARIABLES

COLLABORATION

The patterns of collaboration are analyzed in two steps; 1) based on the degree of *internal* collaboration between departments/functions (manufacturing, R&D, sales/marketing and management), 2) based on the degree of *external* collaboration

(customers, competitors, suppliers, partners, research institutions, and networks). The respondents were asked to indicate on a 1 (not at all) –5 (to a very high extent) Likert-scale the extent the internal and external actors were involved in the innovation project.

ENTREPRENEURIAL INNOVATION

Innovation height is measured in terms of degree of radicality in the development projects, in which each respondent indicate to have been involved. The respondents were asked to indicate whether this project was characterized as a product, process or technological development project. These were not mutually exclusive options as many projects have characteristics of all three. In addition, they were asked to indicate, for each of the types, the degree of radicality for the respective project. The scale, which is based on the work by Garcia & Calantone (2002), includes four categories of degree of innovation, ranging from new to the respondent (1), via new to the firm, new to the market, to new to the world (4). At the analytical stage, a refined variable is devised indicating the average newness of all three types of innovation projects. The reliability of the new scale is satisfactory, Cronbach's alpha = 0,554.

CONTINGENCIES

In the analyses we controlled for company age and size. The respondents were asked to indicate the age of the organization on the following scale: 0-5 years, 6-10 years, 11-15 years, 16-30 years, 31 or more years. To measure organizational size, the respondents were asked to indicate the number of employees in the company. We used the following scale: 0-10, 11-50, 51-100, 101-300 and 301 or more.

5.3 ANALYTICAL METHOD

To investigate the relationships between the variables we performed regression analyses using SPSS 15. The degree of radicality of innovation projects was used as dependent variable. The extent of internal and external collaboration was used as independent variables. In addition, we controlled for the direct effects from company size and age on the dependent variable.

6. RESULTS AND DISCUSSION

This section presents the results of the analyses. The findings are consecutively described and discussed in order to address each sub-question separately, providing evidence for the general research question of the paper.

6.1 COLLABORATION IN INNOVATION PROJECTS

Firstly, a joint analysis of the degree of involvement in the innovation project of both internal and external partners is illustrated.

Of the internal functions in the organization, R&D is mostly involved in the innovation projects, followed by management, as indicated in table 1. Thereafter production and sales/marketing are involved to an approximately similar degree.

		Degree of involvement in the innovation project
		Average (1 = not at all, 5 = to a very high extent)
Internal	R&D	4,13
	Production	3,35
	Sales/marketing	3,34
	Management	3,83
External	Suppliers	2,83
	Customers	3,02
	Competitors	1,48
	Partners	2,46
	Universities and research institutions	1,66
	Networks	1,77

Table 1: Involvement in innovation projects

Considering external involvement, customers and suppliers are those being mostly involved. Competitors, universities and networks were involved to a very low degree. The involvement of internal functions is higher than the involvement of external actors.

6.2 THE INFLUENCE OF INTERNAL COLLABORATION ON INNOVATION HEIGHT

Secondly, we analyze the influence of internal collaboration on the height of innovation created through the projects. Table 2 illustrates this analysis, as well as the following analysis of the influence of the external collaboration.

We find a positive and significant relationship between the involvement of R&D and the radicality of the innovation project (Beta = 0,182, $p < 0,01$). This indicates that projects in which the R&D function is involved have a more radical output. We do not find a significant relationship between involvement of the other internal functions and the radicality of the projects.

These findings are hardly surprising. R&D is normally active in development of e.g. new technologies, which will add to the novelty of products and processes. This, again, increases the radicality of the projects. The lacking relationship between radicality and the involvement of manufacturing indicates that the companies have understood the importance of integrating manufacturing in all types of innovation projects, not only for the radical ones. The insignificant relationship between radicality and the involvement of sales/marketing indicates that the companies use market input in all types innovation projects.

6.3 THE INFLUENCE OF EXTERNAL COLLABORATION ON INNOVATION HEIGHT

As also illustrated in table 2, we next analyze the influence of external collaboration on the height of innovation created through the projects.

Considering the external collaboration, involvement of suppliers seems to reduce the radicality of innovation projects (Beta = -0,200, $p < 0,01$). On the contrary, involvement of universities seems to increase the radicality of the projects (Beta = 0,156, $p < 0,05$).

The negative relationship between radicality and involvement of suppliers suggests that suppliers primarily are involved in incremental innovation projects. This could indicate that suppliers primarily can contribute with knowledge within the areas already known to the company, and to a little extent with knowledge that is radically new.

		Beta	t	sig
	<i>constant</i>		11,674	0,000
<i>Internal collaboration</i>	R&D	0,182	3,258	0,001
	Production	0,005	0,083	0,934
	Sales/marketing	-0,060	-0,988	0,324
	Management	-0,049	-0,821	0,412
<i>External collaboration</i>	Suppliers	-0,200	-3,503	0,001
	Customers	-0,042	-0,723	0,470
	Competitors	0,028	0,502	0,616
	Partners	0,054	0,894	0,372
	Universities and research institutions	0,156	2,454	0,015
	Networks	0,034	0,534	0,594
<i>Contingencies</i>	Company age	-0,171	-2,353	0,019
	Employees	0,082	1,124	0,262
	adjusted r^2	0,096		
	F	3,800		
	sig	,000(a)		

Table 2: Internal and external involvement in innovation projects

The positive relationship between radicality and involvement of universities could indicate that companies search for research-based knowledge when they are developing radical projects. As indicated in table 1, the involvement of universities overall is very low, but the latter findings suggest that industry/university collaboration pays off in terms of higher radicality of the innovation projects.

The weak and insignificant relationships between radicality and involvement of competitors, partners, and networks, suggest that these actors are involved irrespectively in both incremental and radical projects. All to a relatively low degree, though, as shown in table 1.

The involvement of customers does not seem to be related to the radicality of innovation projects, either. This could suggest that the customers are involved in all types of innovation projects. It could also indicate that existing customers in general are unable to provide ideas regarding radical and disruptive innovations. This is suggested by authors such as Christensen (1997), Bessant *et al.* (2005) and others, and is pointed to as a limitation of the increasing focus on user innovation in research as well as on policy level.

The negative and significant relationship (Beta = -0,171, $p < 0,05$) between company age and radicality suggests that older companies are less radically innovative than younger firms. We find no significant relationship between radicality and company size, suggesting that size does not determine the radicality of the innovation projects.

6.4 INTERNAL AND EXTERNAL INVOLVEMENT IN INNOVATION PROJECTS

When the internal functions and external actors are grouped, representing broad internal and external collaboration respectively, the analysis suggests a somewhat different picture from when the functions and actors are analyzed separately. This is reflected in table 3.

	Beta	t	sig
(Constant)		23,271	0,000
Sum internal collaboration	-0,137	-2,566	0,011
Sum external collaboration	0,070	1,301	0,194
Adjusted r ²	0,010		
F	3,294		
sig.	,038(a)		

Table 3: Internal and external involvement in innovation projects

Broad internal involvement is significantly and negatively related to radicality of innovation projects (Beta = -0,137, $p < 0,05$). This is somewhat surprising, considering the relatively strong positive effect from the involvement of R&D on radicality. An explanation for this could be that when several different internal function are involved in innovation projects, there might have to be compromises between the different interests that might reduce the radicality of the project to a state all can agree upon. The result of this seems to be more incremental type innovation.

On the contrary, we find no such indication of broad involvement of external actors (Beta = 0,070, sig. > 0,1). The finding shows a weak and insignificant tendency towards more radical output from innovation projects when a broad number of external actors are involved. This could indicate that broad involvement of external actors can result in all types of innovations, from incremental to radical.

7. IMPLICATIONS AND CONCLUSION

As illustrated above, internal collaboration and external collaboration are widely discussed, but mainly in two separated streams of literature, largely disregarding the effect the of collaboration height of innovation. This creates certain limitations to for instance the Open Innovation paradigm (Chesbrough, 2003), as it essentially does not address whether this new approach to organizing the innovation process will represent an increase, a decrease or a status quo in innovation height created. Through empirical analysis, this paper provides a more detailed understanding of the collaboration patterns related to the development of highly entrepreneurial innovation in existing organizations.

The empirical analysis addresses the discussion on the different influences achieved through collaboration with different external partners. In answer of sub-question B, it is this way found that involvement of suppliers reduces the radicality of innovation projects, the involvement of customers has no significant influence on the height of

innovation projects, and the involvement of universities increases the radicality of the projects. This has important implications;

The result supports the stream of arguments suggesting that collaboration with external partners who have similar wishes, technological knowledge and/or market insight may indeed lead to innovative activity, but that this innovative activity will most likely not be entrepreneurial in the sense of departing from the customary, breaking with the existing patterns and introducing radically new products and/or technologies. This has interesting implications for the extensive focus on user-driven innovation, as the impact hereof, in terms of innovation height, will be of a more incremental nature.

Following this argumentation, the results thus pinpoint that important selection criteria to consider, when entering into a collaboration effort with the intent of creating something radically innovative, should be not only the complementarity of the partners, but also the essential differences. This is illustrated through the identification of a number of firms collaborating with universities on innovation projects and the positive impact this has on innovation height. Universities differ on a range of parameters, such as e.g. primary interest and short vs. long-term perspective.

The empirical analysis however also suggests that the development of entrepreneurial innovation is not only dependent on high external involvement and collaboration between different external actors, but also on involvement and collaboration among functional departments and people. This creates a more detailed perspective on the implementation of an open innovation perspective. In particular the development of entrepreneurial innovation is still highly dependent on the involvement of the internal R&D function. This suggests that while openness to external collaboration is increasingly important, the lead of the project must still reside internally in the organization in order to create a focus in the development of radical innovation. The loss of direct control held by one company over the development process is often mentioned as a risk in connection with collaboration (Håkansson, 1989). This aspect may very well be of further importance to consider when developing radical innovation, which per se involves a more non-linear and discontinuous process. Maintaining a focused internally competence driving the process, will this aid in creating a certain stability in an otherwise potentially chaotic process. This explanation is in line with the conclusions of Middel (2008), in relation to collaborative improvement, that internal collaboration is an important prerequisite for being able to efficiently collaborate with external partners, and thus absorbing and exploiting the beneficial competencies of other firms, enhancing the firm's own knowledge base and thereby improving the innovation performance.

In answer to sub-question A, the results however also show that broad internal involvement is significantly and negatively related to radicality of innovation projects. This could be interpreted as support of Chesbrough's (2003) argumentation that a closed innovation system based solely on the use of internal competences is inadequate for developing significant competitive advantages in today's markets. An explanation hereof could be that developing multiple, broad competencies and/or maintaining them in the face of rapid technological changes is difficult for firms, and the effort thus departments with primary focus on existing competences or existing market needs will significantly influence innovation projects in an incremental direction if involved to a large extent in the innovation project.

These results have created insight into the particular patterns of collaboration which induce corporate entrepreneurship, and thus give foundation to the development of the

term collaborative entrepreneurship. The particular characteristics of collaborative entrepreneurship identified include:

- High importance of collaboration with external partners with distinct interest and skills.
- Low reliance on existing customers and suppliers for the development of radical innovation
- Narrow and focused internal involvement rather than broad internal involvement

The results of this research are valuable for the insight into the effect of collaborative efforts on innovation, as they refine and expand existing knowledge, and in particular the perspective on open vs. closed innovation (Chesbrough, 2003). Additionally, this more detailed insight into the collaboration patterns involved in corporate entrepreneurship will also be of managerial interest as it provides insights on how to construct the collaboration strategy of the organization in order to best facilitate an environment conducive to highly entrepreneurial innovation.

Limitations and further research

The findings presented in this paper suggest that involving different actors in innovation projects results in different heights of innovation of the output. Although not elaborated in this research, there are reasons to believe that there are configurational effects between the involvement of internal and external actors. Further investigations into appropriate mixture or configuration of internal and external collaboration, and the effects of these is a natural extension of this research. In addition, different actors may be involved differently in different phases of the innovation projects. Internal R&D functions and universities might be heavily involved in the initiation phase and less in later stages. Functions such as manufacturing might be heavily involved in the implementation phase of the innovation projects. Further research could study the benefit and relevance of different involvement in different phases of innovation projects.

Another line of future research could be to expand the research to other countries/cultures in order to increase the generalizability of the findings. The current questionnaire was sent to engineers in Danish companies. Different countries/cultures might highlight similarities or differences in internal and external collaboration in relation to the innovation height.

REFERENCES

- Abetti, Pier A. (2000) Critical Success Factors for Radical Technological Innovation: a Five Case Study, *Creativity and Innovation Management*, Vol. 9 No. 4.
- Aldrich, H. & Zimmer, C. (1986) Entrepreneurship Through Social Networks, In: Sexton, D. & Smilor, R. W. (Eds) *The Art and Science of Entrepreneurship*, Massachusetts: Ballinger Publishing, pp.3-23.
- Anderson, J. C. & Narus, J. A. (1990) A Model of Distributor firm and manufacturer firm working partnerships, *Journal of Marketing*, Vol. 54 No.1, pp. 42-58
- Argote, L. & Ingram, P. (2000) Knowledge Transfer: A basis for competitive advantage in firms, *Organisational Behaviour and Human Decision Process*, Vol. 82 No.1, pp.150-169
- Baden-Fuller, C. & Pitt, M. (1996) *Strategic Innovation*, Routledge, London
- Baumol, W. J. (2002) *The Free-Market Innovation Machine: Analyzing the Capitalist Growth Miracle*, Princeton: Princeton University Press
- Berg, S. V., Duncan J. & Friedman, P. (1982) *Joint Strategies and Corporate Innovation*, Oelgeschlager Gunn & Hain, Cambridge, MA

- Bessant, J. (2003) *High-Involvement Innovation: Building and Sustaining Competitive Advantage Through Continuous Change*, Wiley
- Bessant, J., Lamming, R., Noke, H. & Phillips, W. (2005) Managing innovation beyond the steady state, *Technovation*, Vol. 25, pp. 1366-1376
- Bleeker, J. and Ernst, D. (1991) The way to win on cross-border alliances, *Harvard Business Review*, Vol. 69 No. 6, pp. 127-136
- Chesbrough, H.W. (2003) The logic of open innovation: managing intellectual property, *California Management Review*, Vol. 45 No.3, pp.33-58.
- Christensen, C.M. (1997) *The Innovators Dilemma: when new technologies cause great firms to fail*, Harvard Business School Press, Boston, MA
- Coase, R.H. (1937) The nature of the firm, *Economica N.S.*
- Cohen, W.M. & Levinthal, D.A. (1990) Absorptive capacity: a new perspective on learning and innovation, *Administrative Science Quarterly*, Vol. 35 No.1, pp.128-52.
- Covin, J.G. & Miles M.P. (1999) Corporate Entrepreneurship and the Pursuit of Competitive Advantage, *Entrepreneurship: Theory and Practice*, Spring: pp. 47-63
- Eisenhardt, K. & Schoonhoven, C.B (1996) Strategic alliance formation in entrepreneurial firms: Strategic needs and social opportunities for cooperation, *Organization Science*, Vol. 7 No. 7, pp. 136-150
- Duguet, E. (2006) Innovation height, spillovers and the growth at the firm level: Evidence from French manufacturing, *Economics of Innovation and New Technology*, Taylor and Francis Journals, Vol. 15 No. 4-5, pp. 415-442
- Farr, C. M. & Fischer, W.A. (1992) Managing international high technology cooperative projects, *R&D Management* Vol. 22 No.1, pp. 55-67
- Ford, D., Gadde, L., Håkansson, H. & Snehota, I. (2003) *Managing Business Relationships*, John Wiley & Sons, Chichester.
- Garcia, R. & Calantone, R. (2002) A critical look at the technological innovation typology and innovativeness terminology: a literature review, *The Journal of Product Innovation Management*, Vol. 19, pp. 110-132.
- Goshall, S. & Bartlett, C. (1995) Changing the role of top management: Beyond structure to processes, *Harvard Business Review*, Vol. 73 No. 1, pp. 86-96
- Grandori, A. & Soda, G. (1995) Inter-firm networks: Antecedents, mechanisms, and forms, *Organization Studies*, Vol. 16 No.2, pp. 183-214
- Granovetter, M. (1985) Economic Action and Social Structure: The Problem of Embeddedness, *American Journal of Sociology*, Vol. 91 No.3, pp. 481-510
- Hagedoorn, J. (1993) Understanding the rationale of strategic technology partnering: Interorganizational modes of cooperation and sectoral differences, *Strategic Management Journal*, Vol.14, pp. 371-385.
- Hamel, G. (2000) *Leading the Revolution*”, HBS Press (e-book)
- Hamel, G., Doz, Y.L. & Prahalad, C.K. (1989) Collaborate with your competitors and win, *Harvard Business Review*, Vol. 67 No.1, pp. 133-139
- Hayes, R.H. & Wheelwright, S.C. (1984) *Restoring our competitive edge competing through manufacturing*, John Wiley, New York.
- Håkansson, H. (1989) *Corporate technological behavior: co-operation and networks*, London, Routledge
- Håkansson, H. & Snehota, I. (1995) *Networks in Technological development*, London Routledge
- Kent, D. H. (1991) Joint ventures vs. non-joint ventures: An empirical investigation. *Strategic Management Journal*, Vol. 12 No.5, pp. 387-393.
- Kleinknecht, Alfred, & J. O. N. Reijnen (1992) Why do firms cooperate on R&D? An empirical study, *Research Policy*, Vol. 21, pp. 347-360
- Kogut, B. (1989) The Stability of Joint Ventures: Reciprocity and Competitive Rivalry, *Journal of Industrial Economics*, Vol. 38 No. 2, pp. 183-198
- Lassen, A.H. (2007) *Corporate Entrepreneurship: Towards an Understanding of the Importance of Radical Innovation in Knowledge Intensive Firms*, PhD dissertation, Center for Industrial Production, Aalborg University.
- Lassen, A.H, Gertsen, F. & Riis, J.O. (2006) The Nexus of Corporate Entrepreneurship and Radical Innovation, *Creativity and Innovation Management*, Vol.15, No. 4, pp. 359-372
- Levitt, B. & March, J. (1988) Organizational learning, *American Review of Sociology*, Vol. 14, 319-338.
- Littler, D., Leverick, F. & Bruce, M. (1995) Factors affecting the process of collaborative product development: a study of UK manufactures of information and communications technology products, *Journal of Product Innovation Management*, Vol. 2 No. 1, pp. 16-23.
- Lumpkin, G.T. & Dess. G.G. (1996) Clarifying the entrepreneurial orientation construct and linking it to performance, *Academy of Management Review*. Vol. 21, No. 3, pp. 135-172
- Middel, H.G.A. (2008) *Collaborative Improvement: Action Learning in the Extended Manufacturing Enterprise. An Action Learning Approach*, PhD thesis, Enschede
- Miles, R.E., Miles, G. & Snow, C.C. (2005) *Collaborative Entrepreneurship: How Communities of Networked Firms use Continuous Innovation to create Economic Wealth*, Stanford University Press, Stanford, California
- Mowery, D. C. (1983) The relationship between intrafirm and contractual forms of industrial research in American manufacturing, 1900-1940, *Explorations in Economic History*, Vol. 20, pp. 351-374.
- Mowery, D.C., & Teece, D.J. (1993) Strategic alliances and industrial research. *Unpublished manuscript*

- Noyes, E., Smith-Doerr, L. & Hatten, K. (2008) Learning to take risks: Corporate venturing capital investment as an acquired organizational practice” Conference paper, *Babson College Entrepreneurship Research Conference*, Chapel Hill, North Carolina
- O’Connor, G.C. & Ayers, A.D. (2005) Building a Radical Innovation Competency, *Industrial Research Institute, Inc, Journal of Research and Technology Management*, Vol.48 No. 1, pp.309-334
- Olivers, A.L. & Ebers, M. (1998) Networking network studies: An analysis of conceptual configuration in the study of inter-organizational relationships, *Organization Studies*, Vol. 19 No.4, pp. 549-583
- Pfeffer, J. & Salancik, G.R. (1978) *The External Control of Organizations: A Resource-Dependence Perspective*, Harper & Row, New York.
- Schumpeter, J. (1934) *The theory of economic development* Harvard University Press, Cambridge MA
- Shane, S. & Venkataraman, S. (2000) The Promise of Entrepreneurship as a Field of Research, *Academy of Management Review* Vol. 25 No.1, pp. 217-226.
- Stam, W. & Elfring, T. (2008) Entrepreneurial Orientation and New Venture Performance: The Moderating Role of Intra- and Extraindustry Social Capital, *The Academy of Management Journal*, Vol. 51, No. 1, pp. 97-111
- Stopford, J. M., & Baden-Fuller, C. (1994) Creating corporate entrepreneurship, *Strategic Management Journal*, Vol. 15 No.7, pp. 521-536
- Teece D.J (2000) Strategies for Managing Knowledge Assets: the Role of Firm Structure and Industrial Context, *Long Range Planning*, Vol. 33 No. 1, pp. 35-54
- Teece, D.J., Pisano, G. & Shuen, A. (1997) Dynamic capabilities and strategic management, *Strategic Management Journal*, Vol. 18 No.7, pp.509-33
- Vesper, K.H. (1990) *New Venture Strategies*, Prentice-Hall, Englewood Cliffs, NJ.
- von Hippel, E. (1988) *The Sources of Innovation*, Oxford University Press, New York
- Williamson, O.E. (1985) *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*, New York: Free Press.
- Zott, C. (2003) Dynamic capabilities and the emergence of intra-industry differential firm performance: insights from a simulation study, *Strategic Management Journal*, Vol. 24, No. 2, pp.97-125.