Paper to be presented at the DRUID 2011

on

INNOVATION, STRATEGY, and STRUCTURE -
Organizations, Institutions, Systems and Regions
at
Copenhagen Business School, Denmark, June 15-17, 2011

Open innovation practices and implementation barriers: unwillingness to receive and share knowledge

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Abstract

A key organizational barrier related to the implementation of open innovation strategies refers to the *unwillingness* of employees to undertake extra-organizational knowledge transactions. Negative attitudes against the utilization of external knowledge (i.e. the Not-invented-here (NIH) syndrome), as well as against the external commercialization of knowledge assets, for example, via licensing (i.e. the Not-sold-here (NSH) syndrome), may create resistance to these activities and, consequently, a misalignment between the intentions of top management and the attitudes of involved employees (Katz and Allen, 1982; Lichtenthaler et al., 2010). In this paper, we examine the extent to which these attitudes impact the actual adoption of both the inbound and the outbound approaches to open innovation. We posit that these attitudes have a negative influence, since they create unfavourable perceptions of the value of outside competencies and know-how, supporting only internal development and application of ideas and technologies. We test two hypotheses concerning the consequences of the NIH- and NSH-syndromes with cross-sectional survey data from 355 Danish firms. The population consists of firms in the manufacturing industries (NACE codes 10-37) with 5-499 employees. Our findings help explain the extent to which companies are able to benefit from inflows and outflows of knowledge.

Introduction

As the virtues of an 'open approach' to innovation strategy have been praised by the academic community for its potential of making the innovation process less costly, more agile and flexible, more interest in its adoption has grown among practitioners and academics alike (Huston and Sakkab, 2006, Chesbrough and Crowther, 2006, Lichtenthaler and Lichtenthaler, 2009). Even though companies have always adopted open practices to a certain extent (Von Hippel, 1988, Cohen and Levinthal, 1989, Lundvall, 1992, Powell et al., 1996), Chesbrough's (2003) contribution expanded their reach and intensity to a broader range of activities, from the outsourcing of R&D programs to the external commercialization of technologies. As a result, the concept has become "one of the hottest topics in innovation management" of our times (Huizingh, 2011: 2).

However, despite the rich and growing body of research in the field, there is not yet full understanding of how companies manage to actually implement open innovation practices and overcome critical barriers to operation (Huizingh, 2011). A key organizational barrier in this context refers to the *unwillingness* of employees to undertake extra-organizational knowledge transactions (Chesbrough and Crowther, 2006, Lichtenthaler and Ernst, 2006, Huston and Sakkab, 2006, Lucas and Goh, 2009). Negative attitudes against the utilization of external knowledge (i.e. the Not-invented-here (NIH) syndrome), as well as against the external commercialization of knowledge assets, for example, via licensing (i.e. the Not-sold-here (NSH) syndrome), have been identified in the literature as important elements of resistance to these activities (Katz and Allen, 1982, Lichtenthaler et al., 2010). These negative attitudes may create a misalignment between the intentions of top management and the behaviour of involved employees, rendering the implementation less probable. Given the important practical consequences this may imply, the objective of this paper is to empirically examine the consequences of the NIH and NSH syndrome on the employment of the inbound and the outbound open innovation practices.

Consequences of Attitudes to Knowledge: Theory and Hypotheses Development

"Opening up the innovation process starts with a mindset" (Gassman et al., 2010: 214). Put differently, the implementation of open innovation practices is centred on the idea that companies need to value outside competence and know-how if they are to fully exploit purposive inflows and outflows of knowledge. The recent study by van de Vrande et al. (2009) showed that the organizational and cultural issues which arise when companies start to interact and collaborate with external partners was the main barrier to the implementation of open innovation strategies in Dutch SMEs. The experience of Procter and Gamble in their 'connect and develop' program illustrates the importance of aligning strategic goals and workers' feelings. As the executives recall, "[our goal was] to exert steady pressure on the culture, to continue to shift mind-sets away from resistance to 'not invented here'. Early on, employees were anxious that connect and develop might eliminate jobs or that Procter and Gamble would lose capabilities" (Huston and Sakkab, 2006: 66).

We therefore expect that negative attitudes to the inflow of external knowledge (NIH) mean that companies are less likely to use inbound open innovation practices.

H1: The negative attitude to external knowledge acquisition (i.e. NIH syndrome) negatively affects the degree of implementation of inbound open innovation activities.

In a similar manner, the resistance of employees to the commercialisation of knowledge and technologies outside the walls and normal channels of the company (e.g. via the selling of licences or the setting up of ventures) may be a barrier to encompassing outbound innovation. Here employees feel that if the knowledge or technology cannot be exploited in own products or markets, it should not be exploited at all (Lichtenthaler et al 2010). Therefore, we expect that negative attitudes to the external commercialization of knowledge (NSH) means that companies are less likely to use outbound open innovation practices.

H2: The negative attitude to external knowledge exploitation (i.e. NSH syndrome) negatively affects the degree of implementation of outbound open innovation activities.

Methods

Sample and data collection

The data used for this study is part of a cross-sectional survey of Danish SMEs. The data collection took place as an online survey in the period from August to November 2010. The questionnaire was pre-tested by experts, mostly researchers from universities but also companies participated. Data was collected in Danish, since most respondents had this as their native language.

The population was drawn from a Danish nationwide electronic database (NED) and consists of firms in the manufacturing industries (NACE 10-37) with 5-499 employees (SMEs). This resulted in a population of 3086 firms that were all contacted by phone. The phone call ensured that the firm would be willing to receive the questionnaire and in case of acceptance, we recorded the name and e-mail of the person responsible for innovation, either the R&D or the innovation manager. In the case of small businesses without these job titles/functions, we asked for the business owner. In a few cases, we obtained only the general company email, from which the questionnaire was then distributed. We screened out companies that had not worked with product/process innovation within the past 3 years and respondents with less than 3 years experience in the company. The phone interviews resulted in 1241 usable company e-mails to which the questionnaire was sent in August 2010. Of the 1241 e-mails sent, we received 355 usable responses, resulting in a response rate of 28.6%.

Measures

The not-invented-here (NIH) and the not-sold-here (NSH) syndrome are constructs each based on 4 items measured on a 7-point Likert scale (α = 0.737 and α= 0.771 respectively) (see appendix). They were computed by calculating the arithmetic averages of their respective items so that they could be treated as

observed indicators. The items pertaining to the NSH scale were adopted from Lichtenthaler et al. (2010) with minor adaptations (except for item 8, which was added to enhance the scale in terms of capturing the positive side of attitudes). Since a survey measure for the NIH syndrome was not available in the literature, the NIH items are an attempt to mirror and adapt this scale for the attitude to acquiring external knowledge. The open innovation practices were also developed based on previous literature (Pisano and Verganti, 2008, Chesbrough and Crowther, 2006). Table 1 provides an overview of the activities investigated, as well as the intensity in which they have been used by the companies in our sample. The open innovation practices were measured as binary variables (i.e. 1: used/ 0: not used), which were summed for the calculation of the two constructs of inbound and outbound practices. We thus assume that the higher the number of activities companies employ, the more open they are to the external environment. In addition, we use a number of control variables in the study: company age (ln), company size in terms of number of employees (ln), market dynamism (5 items on a 7-point likert scale, $\alpha = 0.756$) (see appendix) and innovation capability (whether or not the company has introduced new products within the past 3 years (2007-2009)). All constructs were standardized for the regression analysis in order to reduce potential multicollinearity problems.

TABLE 1
The Use of the Open Innovation Practices among Danish SMEs

Construct	Practices	N	%
Inbound open innovation practices	Used the internet to search for new trends or technology	303	86%
	Used information from trade organizations	272	77%
	Participated in innovation related fairs or shows	242	67%
	Purchased R&D work from others	206	58%
	Outsourced R&D (totally or partially)	90	25%
	Purchased licenses, patents or know-how	87	25%
	Worked with lead users	80	23%
Outbound open innovation practices	Supported that employees work with own ideas	195	55%
	Actively participated in other's innovation projects	186	52%
	Supported entrepreneurial activities in the company	93	26%
	Sold patents, licenses or know-how	30	8%
	Made own innovations available to others free of charge	21	6%

Note: Authors'elaboration (N=355)

Results

Table 2 presents descriptive statistics and correlations among study variables. It is worth noting that companies in our sample presented higher levels of NSH tendencies (average: 4.08 on a 7-point scale) than of NIH tendencies (average: 2.84 on a 7-point scale). Besides, the two attitudes to knowledge were found to correlate positively and significantly. The use of outbound practices was found to be less frequent (average:

1.49 out of a total of five), in comparison with inbound ones (average: 3.63 out of a total of seven). In addition, our data reveals that larger firms tend to employ inbound practices to a larger extent, whereas older firms tend to make less use of outbound methods. Our data thus seems to be in line with existing evidence in the literature, which shows that companies perform more inbound than outbound activities and that larger firms adopt more open innovation than smaller ones (Van de Vrande et al., 2009, Huizingh, 2011).

TABLE 2
Descriptive Statistics and Correlations of Study Variables

Variables	Min	Max	Mean	S.d.	1	2	3	4	5	6	7	8
1. Inbound Practices	0.00	7.00	3.63	1.67	1.00							
2. Outbound Practices	0.00	5.00	1.49	1.05	0.32**	1.00						
3. NIH syndrome	1.00	5.75	2.84	0.90	-0.24*	-0.20*	1.00					
4. NSH syndrome	1.00	7.00	4.08	1.18	-0.07	-0.26*	0.20**	1.00				
5. Age	0.00	5.74	3.30	0.96	0.09	-0.13*	0.04	0.08	1.00			
6. Size	0.00	7.82	3.21	1.30	0.34**	0.03	-0.20*	0.10	0.40**	1.00		
7. Market dynamism	1.00	6.60	4.11	0.94	0.06	0.11*	-0.02	-0.24*	0.06	-0.04	1.00	
8. Innovative capacity	0.00	1.00	0.77	0.42	0.25**	0.09	-0.20*	0.04	0.03	0.16**	0.03	1.00

Note: Authors' elaboration

** Significant at the 0.01 level (2-tailed) / *. Significant at the 0.05 level (2-tailed).

Table 3 presents the results of OLS regression analysis, in which it is reported standardized coefficients and their significance. Even though all variables were standardized, we checked the variance inflation factors (VIFs) in each of the regression equations. Since the highest value was 1.27, we could be confident that multicollinearity was not a major problem in our study (Wooldridge, 2009).

Models 1 and 2 refer to the base models in which only control variables were included. Firm size was found to positively impact the adoption of both inbound and outbound open innovation. Innovative capacity, on the other hand, had a significant impact only on the use of inbound activities. A situation where past innovation output generates benefits in terms of technological competence and reputation may explain this outcome. Furthermore, while firm age was found to have a negative influence on the employment of outbound activities, the level of dynamism in the market was found to have a positive one. Firms embedded in high-velocity and hypercompetitive markets use external forms of exploitation of their technologies to a greater extent, possibly because their capabilities become obsolete at a faster pace and every possible path to market must be used.

Models 3 and 4 include the main effects relative to attitudes. Comparisons with the corresponding base models reveal that the addition of the variables related to attitudes to knowledge significantly improved the models' fit, as R^2 changes were significant for both models ($p<0.05$ for Model 3, $p<0.001$ for Model 4). In other words, the adoption of open innovation practices among companies of our sample is better explained

by accounting for the effects of the NIH and NSH syndromes. In specific, the result of the main effect reported in model 3 ($\hat{\beta}$=-0.138, p>0.05) verifies hypothesis 1, which posited a negative relation between the NIH syndrome and the use of inbound open innovation. Likewise, the result of the main effect in model 4 ($\hat{\beta}$=-0.243, p>0.001) verifies hypothesis 2, which specified a negative relation between the NSH syndrome and the adoption of outbound open innovation. However, the magnitudes of the coefficients reveal that the impact of negative attitudes to external exploitation of knowledge (i.e. NSH syndrome) is the highest. As a final remark, it is worth noting that, except for the variable market dynamism, the other control variables did not lose significance when the main variables were introduced.

TABLE 3
Results from OLS: Consequences of Attitudes to Knowledge on the Adoption of Open Innovation Practices

Variables	Inbound Practices				Outbound Practices			
	Model 1		Model 3		Model 2		Model 4	
Controls								
Age	-0.113		-0.095		-0.234	***	-0.217	**
Size	0.319	***	0.287	***	0.142	*	0.151	*
Market dynamism	0.075		0.070		0.137	*	0.078	
Innovative capacity	0.204	***	0.185	**	0.047		0.06	
Independet variables								
NIH syndrome			-0.138	*				
NSH syndrome							-0.243	***
Model statistics								
F	11.225	***	10.438	***	4.183	**	6.417	***
Adjusted R^2	0.141		0.155		0.54		0.105	
R^2 change			0.17	*			0.55	***

Source: Authors'elaboration
Notes: Standardized coefficients reported (N=355)
Significance: *p<0.05; **p<0.01; ***p<0.001

Conclusions

In this study, we find that the level of protective attitudes to the inflows and outflows of knowledge (the NIH and NSH syndromes) influences negatively the level of open innovation practices. These two syndromes are thus organisational barriers to the implementation of open innovation strategies that should be taken into account by academics when investigating this phenomenon, and by practitioners when deciding on open innovation strategies. This paper thus calls attention to the behavioural and cognitive issues implied in new modes of organizing the innovation processes. Not all employees are necessarily favourable towards the practices of open innovation and may resist their implementation.

Seen from an academic perspective, the paper is an attempt also to focus research on the context of open innovation by studying open innovation practices of SMEs (Huizingh, 2011) and relating open innovation to existing innovation management concepts by studying the NIH and NSH syndromes.

Appendix

TABLE 4
Measures

Construct	Items
Market dynamism (last 3 years)	1. The actions of local and foreign competitors in our major markets were changing quite rapidly. 2. Technological changes in our industry were rapid and unpredictable. 3. The market competitive conditions were highly unpredictable. 4. Customers' product preferences changed quite rapidly. 5. Changes in customers' needs were quite unpredictable.
NIH syndrome	1. Our employees have negative attitudes to applying ideas and technologies from outside. 2. Our employees regard the application of external knowledge as valuable as the application of knowledge generated inside.* 3. Our employees have often received and used knowledge from external sources.* 4. Our employees are focused on deepening existing knowledge and creating new knowledge related to product development.*
NSH syndrome *from Lichtenthaler (2010)*	5. Our employees have negative attitudes to having other companies receiving and using our knowledge and technology. 6. Our employees regard external technology commercialization as an equivalent exploitation mode to the application of technologies in own products and services.* 7. Our employees have often sold/revealed own knowledge and technologies to other companies.* 8. Our employees are positive towards developing new ideas, solutions and technologies for other companies.*

Note: *(reverse coded)

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