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## Article

# SME open innovation implicating factors in different innovation phases

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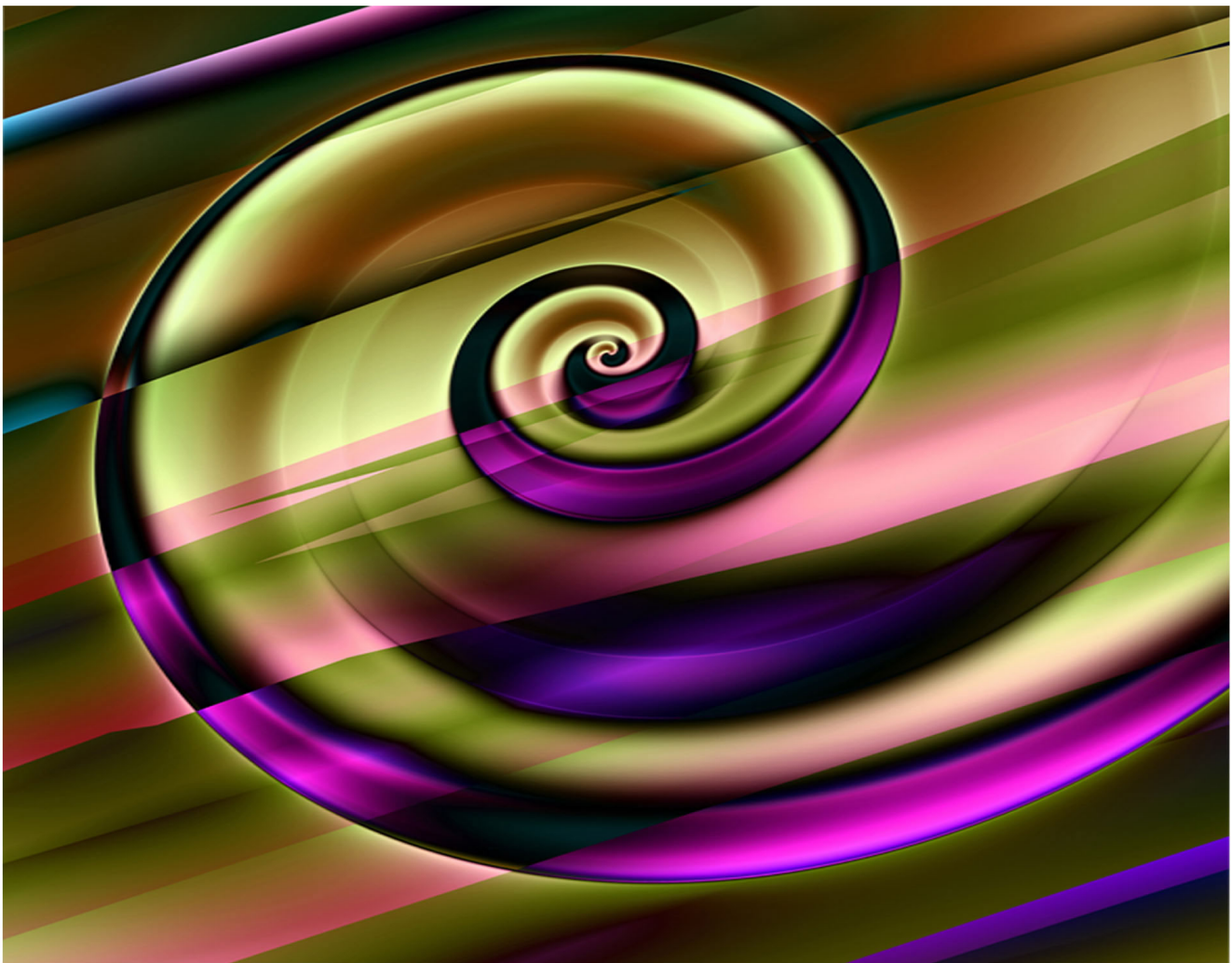
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## **SME Open Innovation implicating factors in different innovation phases**

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**Abstract:** The present study focuses on the open innovation impact factors on different phases of open innovation to create qualitative basis for quantitative research within SME-s. Study has been provided in three countries with different economies and cultures that were comparable by pair: Sweden and United Kingdom as representatives of innovation-driven economy and Estonia and Sweden as representatives Northern European culture. The main factors like connection of the innovation processes with market innovation manager's personal capabilities and public sector innovation policy were identified by majority of experts in all three countries. Experts did not have common view about importance of the intellectual property commercialization capability for open innovation.

### **1 Introduction**

According to traditional approach, innovation has been interpreted as process inside a single organisation that is focused on gaining competitive advantage at the marketplace. When trying to understand traditional (closed) innovation that takes place inside one organisation, many innovation studies have focused on large companies with internal R&D laboratories and capabilities to discover, develop and commercialize technologies (Chesbrough, 2003). Participation in formal and informal entrepreneurial networks has been discussed as a factor of successful innovative entrepreneurship since the last decades of the 20th century (Breschi and Malerba, 2005). Increasing mobility of knowledge workers, rapid development of internet based knowledge networks and expansive scope of possible external suppliers have undermined the effectiveness of traditional innovation system (Chesbrough, 2003). Open Innovation (OI) is defined by Chesbrough as „the use of purposive Inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively“ (Chesbrough, 2003). The assumption for open innovation is readiness of the organisations to commercialize not only internal ideas, but also ideas outside the organisation, as well as commercialize their ideas through external channels. At the same time open innovation assumes disclosure of some business information to outsiders in order to have their meaningful contribution.

Most open innovation studies have focused on different natures of innovation and innovation processes that generally take place in large enterprises (Chesborough 2010). There is no qualitative evidence that would demonstrate significant advantage of larger enterprises in

innovation. Smaller enterprises are often more flexible to discover new business opportunities and that could be an advantage for the innovation process management that utilizes radically new ideas. McMullen et al. (2007) explain that an entrepreneurial opportunity can be either an objective construct visible to an entrepreneur or a new innovative construct created by a knowledgeable entrepreneur. However, only few of smaller enterprises have sufficient capacity to manage the whole innovation process by themselves and this encourages them from innovation cooperation with other enterprises (Edwards et al. 2005). Small technology firms have an important role on revitalizing economy but they face infrastructural, marketing, financing and internationalisation challenges in their business development (Pellikka and Virtanen, 2009). Encouragement of SMEs could be a key factor for development of the economy on local, regional and national levels (Jones, O.; Tilley, F., 2003). The main research question is, how to encourage the open innovation for smaller enterprises. What are the key catalysts and barriers of OI for SME in more and less advanced market economies? How business and institutional environment impacts openness and success of innovation?

## **2 Literature review**

### **2.1 General approaches**

The main areas of open innovation analysis cover various perspectives. The studies cover following areas:

- industrial dynamics of open innovation (Christensen, et al 2005);
- open innovation processes in a particular industry sector (Cooke, 2005), (Henkel, 2006) or;
- ways in which to inspire open innovation (Lichtenthaler, 2008).

Open innovation is however not a clear-cut concept. It comes in many forms and shapes which add to the richness of the concept but hinders theory development. Therefore, it is necessary to develop open innovation frameworks. Different sets of open innovation practices can be contrasted by developing matrices distinguishing various forms of open innovation. A first way of doing this is recognizing that open innovation reflects less of a dichotomy (completely open versus completely closed) than a continuum with varying degrees of openness (Dahlander and Gann, 2010).

Similarly to closed innovation, most open innovation research so far has taken place in large companies where the open innovation was first noticed as a research field. Discussions on the open innovation concept in small and medium size enterprises were excluded from mainstream (West, et al, 2006) by stating the following reasons:

- open innovation is more easily studied in larger companies because SMEs have less ability to access external resources and have smaller technological assets to knowledge exchange than larger companies (Narula, 2004);
- SMEs use external means of innovation more than large companies because they consider alliances or network as ways to extend their technological competences (Edwards et al, 2005). Therefore open innovation concept is practice familiar to the SMEs;
- SME networks are limited by subcontracting to large enterprises (Rothwell & Dodgson, 1994) or subcontracting from other SMEs (Rothwell, 1991)

- SMEs consider external sources as routes to marketing and sales channels at the later (commercialisation) stages of innovation, while open innovation normally focuses more on the early stages of innovation, addressing external technology sourcing and networking with technology providers and innovative companies in supply chain (Vanhaverbeke & Cloudt, 2006).

It is important to study to which extent these assumptions of researchers hold in different types business environment and how internal and external factors influence OI capability of SMEs.

## 2.2 Internal and external factors, having impact to OI

Dahlander and Gann (2010) use the dimensions of inbound versus outbound open innovation and pecuniary versus non-pecuniary interactions. The four cells in the matrix are labelled as acquiring, sourcing, selling and revealing as shown on Figure1 below. This model may be a good starting point for empirical research to better understand the activities comprising each of the four strategies and their effectiveness for different organizations and indifferent contexts

inbound innovation	ACQUIRING	pecuniary	SELLING
	SOURCING	non-pecuniary	REVEALING
			outbound innovation

**Figure1 Dimensional matrix of different innovation interactions**

Detailed comparison of these four interaction types is summarized in Table 1:

**Table 1 Open Innovation types**

	<b>Acquiring</b>	<b>Selling</b>	<b>Sourcing</b>	<b>Revealing</b>
<b>Focus</b>	Acquiring inventions and input to the innovative process through informal and formal relationships (e.g. Chesbrough and Crowther, 2006; Christensen et al., 2005)	Out-licensing or selling products in the market place (e.g. Lichtenthaler and Ernst, 2009; Chesbrough and Rosenbloom, 2002)	Sourcing external ideas and knowledge from suppliers, customers, competitors, consultants, universities, public research organizations, etc. (e.g. Fey and Birkinshaw, 2005; Lakhani et al., 2006; Laursen and Salter, 2006a)	Revealing internal resources to the external environment (e.g. Allen, 1983; Henkel, 2006; Nuvolari, 2004; von Hippel and von Krogh, 2003)

	<b>Acquiring</b>	<b>Selling</b>	<b>Sourcing</b>	<b>Revealing</b>
<b>Advantages driving openness</b>	Gaining access to resources and knowledge of partners (Powell et al., 1996)	Commercialize products that are 'on the shelf'	Access to a wide array of ideas and knowledge (Laursen and Salter, 2006a)	Marshal resources and support (Henkel, 2006)
	Leveraging complementarities with partners (Dyer and Singh, 1998)	Outside partners may be better equipped to commercialize inventions to the mutual interests of both organizations (Chesbrough and Rosenbloom, 2002)	Discovering radical new solutions to solving problems (Lakhani et al., 2006)	Gaining legitimacy from external environment (Nuvolari, 2004)
				Foster incremental and cumulative innovation (Murray and O'Mahony, 2007; Scotchmer, 1991)
<b>Dis-advantages driving closeness</b>	Difficult to maintain a large number of ties with different partners (Ahuja, 2000)	Over-commitment to own product and technologies make it difficult to out-license (Lichtenthaler and Ernst, 2007)	Many sources create an attention problem (Laursen and Salter, 2006a)	Difficult to capture the benefits that accrue
	Risk of outsourcing critical dimension of the firm's		Difficult to choose and combine between too many alternatives (Sapienza et al., 2004)	Internal resources can leak to competitors (Laursen and Salter, 2006b)

**Table 2 Comparison of four innovation types (Dahlander and Gann,2010)**

Catalysts and barriers of open innovation for SMEs can be different when acquiring selling, sourcing or revealing innovations depending on their business model, organizational culture available resources and networks. Earlier research that compared innovation management challenges in Estonia and in the United Kingdom (Elenurm, 2010) gave evidence that Estonian enterprises consider leveraging suppliers for ideas less important for their innovative effort than UK enterprises. The first Global Entrepreneurship Monitor study in Estonia in 2012 revealed that if early-stage entrepreneurs aim to sell their innovative products to foreign markets, they more

often receive business development advice from external sources and less often from their family compared to other entrepreneurs (Arro et al. 2013).

The innovation barriers could be classified as external or internal barriers. External can be further subdivided into supply, demand and environment related. Supply barriers include difficulties in obtaining technological information, raw materials, and finance. Demand barriers are associated with customer needs, their perception of the risk of innovation, and domestic or foreign market limitations. Environmental ones include various government regulations, antitrust measures, and policy actions. Internal barriers can be further subdivided into resource related, e.g. lack of internal funds, technical expertise or management time, culture and systems related, e.g. out-of date accountancy systems (Rush and Bessant, 1992), and human nature related, e.g. attitude of top manager to risk or employee resistance to innovation.

### **External factors**

Keizer et al. (2002) divide external factors into three groups:

- collaboration with other organisations;
- linkages with knowledge centres and
- utilizing financial resources or support regulations.

Entrepreneurs consider collaboration with other firms as a very important part of their innovation efforts (Massa and Testa, 2008). In particular, the work of Kaminski et al. (2008) show that collaboration with suppliers can contribute to the innovativeness of SMEs. Collaboration with suppliers may also have the goal of overcoming size constraints, while collaboration with both suppliers and customers may be performed for the purpose of co-design.

Connections with knowledge centres that include contributions by professional consultants, university researchers and technology centres, have been studied by various research groups (Le Blanc et al., 1997; Hoffman et al., 1998; Oerlemans et al., 1998), as well as contribution by innovation centres and Chambers of Commerce (Oerlemans et al., 1998). Regarding variables which relate to utilizing financial resources or support regulations, availability of R&D funding was shown to be an important influencer of innovative efforts in SMEs (Le Blanc et al., 1997; Hoffman et al., 1998).

### **Internal factors**

#### **Culture**

By Herzog (2011) organizational culture has a strong impact on innovation and innovation success. However, there is little empirical evidence. (Wind and Mahajan (1997), pp. 5 f.). The literature review on organizational culture indicates that corporate culture is a complex and multi-faceted element of an organization. Although many authors state that research on organizational culture is highly important, literature still lacks sufficient empirical studies of organizational culture. By Lin et al. (2002) corporate culture is a critical factor that has impact to innovation openness. They perceive corporate culture as one of the greatest barriers of knowledge transfer. They claim that organizational cultures are the main factors in building up an environment both inside the organisations and between them. As a result, a company has to encourage knowledge sharing in order to enlarge their absorptive capacity. The amount of bureaucracy, managerial

support and the innovative climate are examples of factors which influence the knowledge sharing within a company.

An important part of organizational culture is the way how is organised the innovation culture. Due to general lack of research on innovation culture and the lack of sophisticated methods to measure innovation culture, a clear definition of the term ‘innovation culture’ has not emerged in the literature in the area of technology and innovation management. Nevertheless, drawing on the discussion on corporate culture and its different levels – i.e. shared basic values, norms and practices Herzog (2011) defines innovation culture as follows:

- a) organization-wide shared basic values that support innovation,
- b) organization-wide norms for innovation, and
- c) perceptible innovation-oriented practices (artefacts and behaviours).

The main question when investigating innovation culture can be: which values, norms, and practices are characteristic for such an innovation culture? Whether there are certain values or norms that are more likely to support innovation than others? Is it possible that even organisation is seeking for Open Innovation the values, norms, and practices try to avoid moving forward?

The discussion on open innovation shows that there are already several contributions to this emerging research area. Most of the research has contributed from different perspectives, such as outsourcing of R&D or early supplier and user integration. Although Open Innovation is a holistic approach to innovation, cultural challenges have not been addressed so far. This is surprising because many companies are facing difficulties during the implementation of the Open Innovation concept. Accordingly, there is a great need to fill this white spot of research on Open Innovation culture at the theoretical and empirical level.

By Herzog (2011) the major building blocks of innovation culture are encouragement of risk taking, openness to new ideas, failure tolerance and emphasis on learning and openness to constructive dissenting opinions. Most of the empirical studies on innovation culture implicitly follow the corporate culture paradigm, which views culture as an internal variable of the organization that can be shaped by management to pursue strategic goals.

Open Innovation is based on two main pillars that could be supported or impeded by cultural norms of organisation. The first pillar is the usage of external technologies to advance internal innovation projects. While the second is the commercialisation of the innovation project results using external distribution channels. To characterize the different flow patterns, Gassmann and Enkel (2004) use the terms outside-in (integrating external knowledge, customers and suppliers, “Inbound” by Chesbrough) and inside-out (selling IP and bringing ideas to market by transferring them to the outside environment, “Outbound” by Chesbrough). Gassmann and Enkel (2004) further distinguish a third core process or archetype of Open Innovation - the coupled process. The coupled process combines “the outside-in and inside-out processes by working in alliances with complementary partners in which give and take is crucial for success”. Based on their empirical research, Gassmann and Enkel conclude that although all three processes are necessary to successfully embark on an Open Innovation strategy, companies usually focus on one primary process while more or less integrating elements of the others. However, for the ease



of illustration and discussion, this thesis only distinguishes between inbound and outbound processes.

## 2.3 Syndromes as barriers for OI

### NIH syndrome

Not Invented Here (NIH) is a term used to describe persistent social, corporate or institutional culture that avoids using or buying already existing products, research, standards or knowledge because of their external origins. Various researchers have referred to the NIH syndrome to describe members of an organization that view internal knowledge as superior to knowledge that lies outside of the own organization. The NIH syndrome is rooted in a negative attitude towards external technological knowledge or external innovations. It has also been used to describe the negative effects resulting from an overemphasis on internal technologies, ideas, or knowledge. According to Mehrwald (1999), the “NIH syndrome represents a negatively biased, invalid, generalising and rigid attitude of individuals or groups to externally developed technology, which may lead to an economically detrimental neglect or suboptimal use of external technology”. The use of the term ‘syndrome’ already implies that the existence of the NIH syndrome is an undesirable condition or attitude in the sourcing of external technology. Accordingly, using this term is appropriate only in case a particular attitude differs from an ideal (based on rational economic considerations) attitude. Furthermore, Mehrwald argues that the term ‘syndrome’ also implies that these attitudes and the resulting behaviour pattern do not occur by chance but systematically. Thus, they are repeated in similar ways in comparable situations. We assume that NIH syndrome is more characteristic for developed than for emerging economies but it should be studied in which cultural context it can become a barrier in cross-border open innovation co-operation.

Although the NIH syndrome has been mentioned in several studies, these studies only refer to the theoretical concept of the NIH syndrome. There are only a few works that specifically address and empirically analyse the NIH syndrome, Mehrwald’s PhD thesis being the most detailed and comprehensive work. Regarding the consequences of being “infected” with the NIH syndrome, two major findings can be distinguished:

- (1) the biased, wrong and generalized evaluation of external technology and
- (2) the negative impact on a organisation’s innovation performance, which may finally result in the failure of the implementation of external technologies.

### NSH syndrome

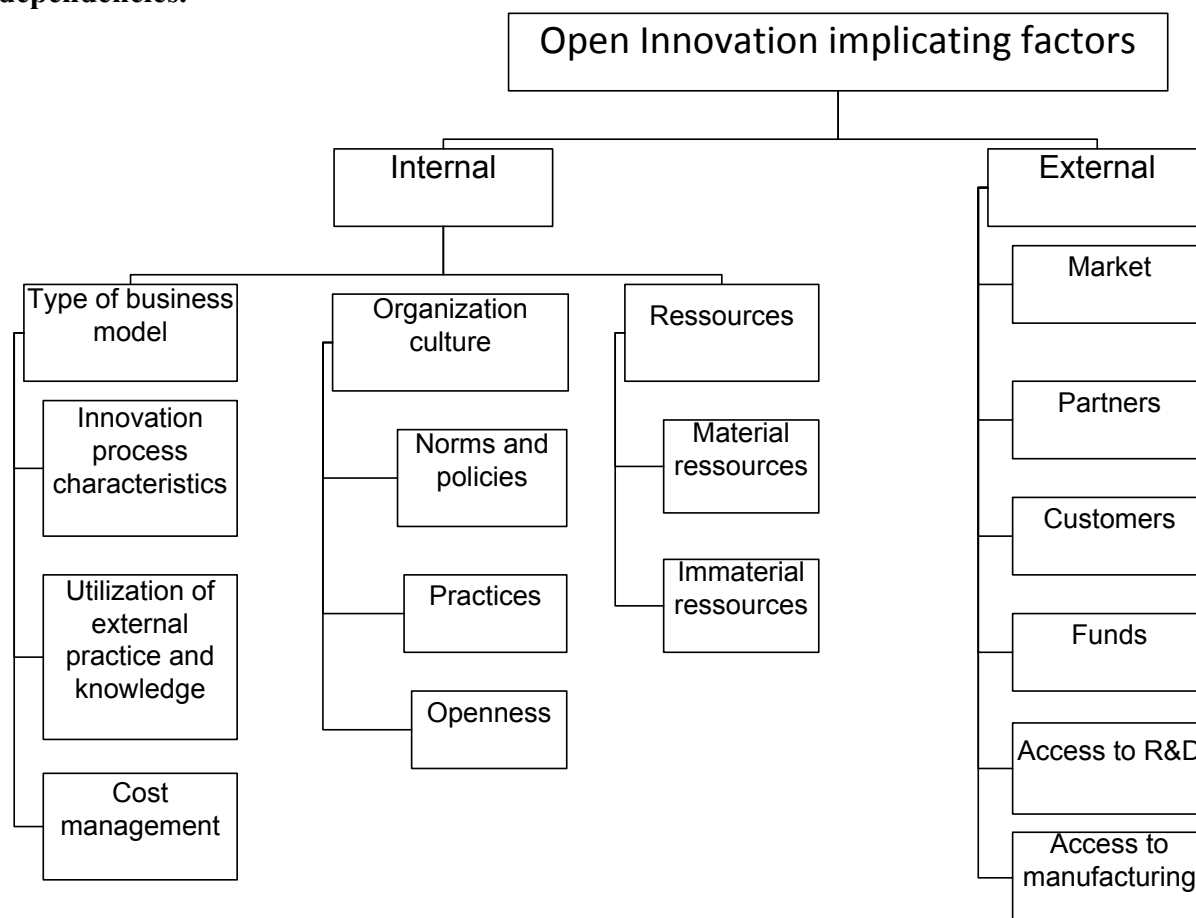
Chesbrough (2003) refers to the expression ‘**not-sold-here (NSH) syndrome**’. The NSH syndrome refers to an attitude to external technology commercialization that is more negative than an ideal attitude which is based on rational economic considerations. It says, if we don’t sell the technology, no one should. Even if technologies are incorporated in a companies’ products or services, it may be worthwhile to use external pathways to market as well. This way, the company may be able to set industry standards based on its own technologies or gain access to external technology, for example via bi-directional technology transfer. Being infected with the NSH syndrome would inhibit the firm or business unit to realize these strategic benefits. Hence, the major consequence of being infected with the NSH syndrome is the suboptimal exploitation of R&D investments (Lichtenthaler 2006).

However, besides the full exploitation of the companies technologies and thereby generating additional sales or setting industry standards, Chesbrough (2003) points at another drawback resulting from an infection with the NSH syndrome. He notes that companies, which are infected with the NSH syndrome, likely frustrate many of their R&D staff, because many of those people's ideas are never introduced to the market. This would discourage R&D staff to further generate ideas and develop new technologies. That implies the existence of the NSH syndrome at the management level. Thus, R&D staff is supposed to have a neutral or even positive attitude towards external technology commercialization.

**Both syndromes could be characterized as internal barriers, originated from innovation leader and organisation culture as described on Figure 2.**

### Assumptions for expert study

The factors, having implication to Open Innovation could act at the same time as catalysts or barriers. The main factors could be summarized as described on Figure 2. We can assume that the factors have different exact meaning and different impact to success of Open Innovation and unfortunately **there is no finding from literature about impact of the exact factors and their dependencies.**



**Figure 2 Factors, implicating to Open Innovation**





## Methodology of expert assessment

To set up further empirical research, an expert opinion questionnaire was produced and provided. The target group consists in total of 10 experienced SME representatives, researchers and business consultants with long track record on Open Innovation networks from Estonia, Sweden and the UK. SME representatives were from innovative small companies (10-49 employees) and microenterprises (start-ups) that had previous experience with commercialisation of new technology. Represented sectors were construction, materials processing and nanotechnology. Business consultants had significant track record in Open Innovation networks with participation of SMEs. The target group was selected to have variety of opinions and find factors that could have common importance to all sectors.

**Table 3 Economy type and perceptions trends in entrepreneurship culture of selected countries**

Country	Economy type (The Global Competitiveness Report)	Entrepreneurship culture type (Xavier, et al, 2013)
Estonia	Transition from efficiency-driven to innovation-driven economy	Nordic culture with high opportunity perceptions and low capabilities perceptions
Sweden	Innovation-driven economy	Nordic culture with high opportunity perceptions and low capabilities perceptions
United Kingdom	Innovation-driven economy	European culture with low opportunity perceptions and high capabilities perceptions

The 5 page questionnaire, based on the findings of literature study, and was constructed and presented to 4 SME experts. It was then adjusted, corrected and re-phrased according to the results of the pilot study. This procedure aimed to increase the content validity of the questionnaire. The results of pilot testing were not incorporated in the expert assessment data.

The questionnaire was divided into four sections. Section A was about evaluation of internal and external factors impact to Open Innovation process. The scale was even from 1 to 10 to avoid neutral marks on centre of odd scale. Factors were presented from literature study and interviewees had freedom to add factors that were important by their opinion but missed from proposed questions

The interviews for the questionnaire completion were face-to-face or by phone conference, since it was predicted (rightly as was later realized) that the response rate with a e-mail or postal questionnaire of such length and complexity would be unacceptably low. The interviewees were owners of companies (6), researchers (2) and business consultants (2). The study included many variables, but in the limited space of this article will focus only the main factors.

In Section B interviewees were asked to indicate five most important factors of OI and combine them with forces that have biggest impact to their reveal evidence. Two supportive forces and two prohibitive forces were asked. In Sections C and D interviewees were asked to rank up to ten supportive and prohibitive forces, listed in Section B.

As the study was qualitative and collected expert opinions from 10 people, no complex qualitative research methods were used in data processing. The results were also studied by target groups and countries.

### Results of expert assessments

The common understanding (view) of the academy, industry and consultants was that OI is more implemented and studied in large enterprises rather than in the SME's. Some differences origin from understanding of open innovation and measurement of innovation success. In general, the studies like Eurobarometer focuses more to innovation expenditures than economic growth, generated by innovation. These differences could have some impact to expert's attitude.

#### Internal factors

The most important factors seem to be (with average score) as described on Table 4:

**Table 4 Open Innovation implication factors**

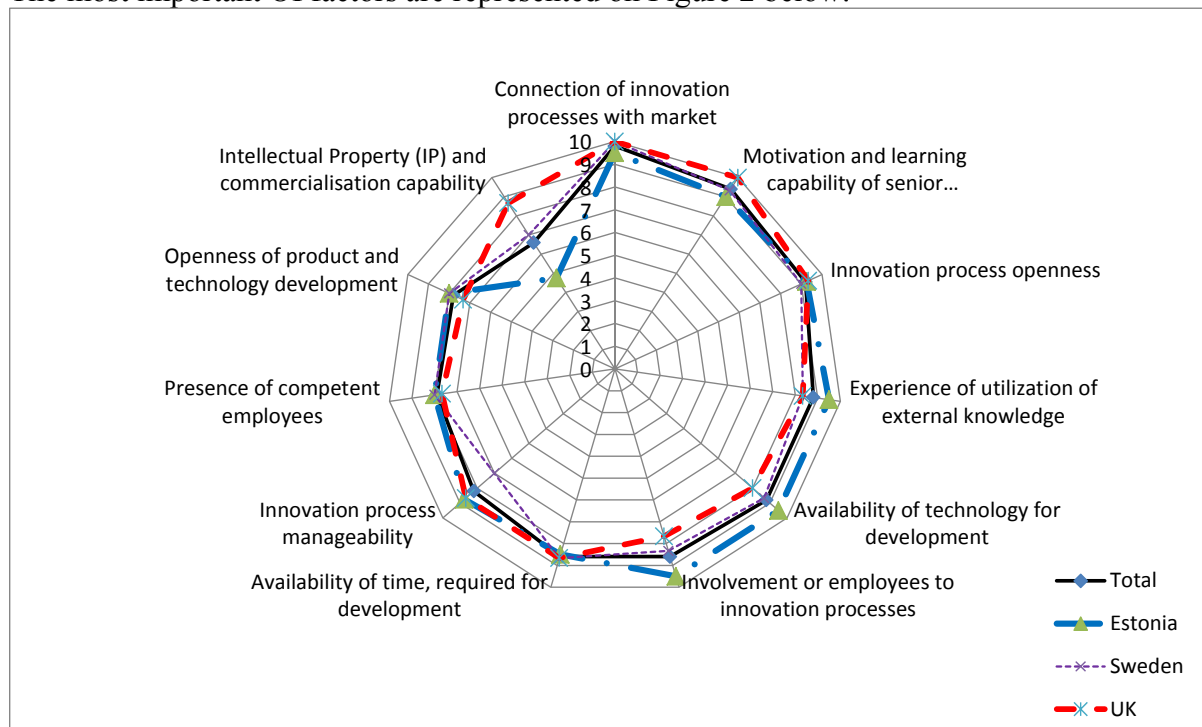
	Average	Standard deviation
<b>Internal factors</b>		
Connection of innovation processes with market	9,8	0,422
Motivation and learning capability of senior management	9,4	0,966
Innovation process openness	9,2	0,632
Experience of utilization of external knowledge	8,8	0,789
Availability of technology for development	8,8	0,789
Involvement or employees to innovation processes	8,6	0,966
Availability of time, required for development	8,6	0,843
Innovation process manageability	8,2	1,317
Presence of competent employees	7,9	1,197
Openness of product and technology development	7,8	1,033
Intellectual Property (IP) and commercialisation capability	6,6	3,134
<b>External factors</b>		
Public Sector innovation policy	9,5	0,707
Cooperation readiness of society	9,2	0,919
Market	9,1	0,876
Partners	9	0,471
Access to external manufacturing resources	8,7	0,949

By average indicators, Intellectual Property (IP) commercialisation capability of IP got only 6.6 points with standard deviation 3,13 that shows high variety of opinions for that factor. That factor has more impact for large enterprises. One important factor that was mentioned by interviewees is learning capability of managers.

Due to the limited number of expert interviews the conclusions between factor differences between Nordic countries and the UK and also between transition and innovation-driven economies could be speculative however, need to be studied more thoroughly in the future. The main difference could be in commercialisation of IP that is evaluated low in a transition economy and high in innovation-driven economies. There is also contradiction between “Experience of utilization of external knowledge” and “Involvement or employees to innovation processes” that is evaluated high in transition economy and lower in innovation-driven economies. In the future research, these questions will need to be clarified to understand, which is more important.

Most interviewees brought out that external factors have less impact to successful OI process than internal factors. However, openness of society and Public Sector innovation policy were marked by transition economy experts as factors with extremely high influence to Open Innovation.

The most important OI factors are represented on Figure 2 below:



**Figure 2 Variety of OI implication factors by economy type**

The most important OI influence factors

The main OI influence factor was proposed to be the innovation leader, manager or entrepreneur, his/her personal properties, commitment, knowledge and attitudes that could be supported or prevented by education, creativity and society's attitude. That was mentioned by all interviewees. Personnel properties like openness and leadership are advantages.

The second important factor was mentioned is access to human capital with appropriate attitudes.

Third important factor that was mentioned is availability and quality of cooperation partners.

Access to financial resources and public sector innovation policy were mentioned as most important external factors that could have significant influence to success of OI process.

Supporting and prohibitive forces

For OI, the same forces could be at the same time supportive or prohibitive. The main forces were mentioned:

1. Leaders attitude and personal properties
2. Education system and its support to cooperation and creativity
3. Availability of cooperation partners
4. Cooperation experience

Leader can inspire the Open Innovation process and drive the innovation through all phases from initiation to market. Leader can also paralyse the knowledge sharing that is necessary for OI. The main personal properties are the same like for each leader and in addition leader will trust the OI network.

Importance of cooperation experience could be reduced by recruiting of partner who has that kind of experience and whom the OI leader can trust.

### **Conclusions and future research**

Most of experts identified personal qualities of the open innovation leader as critical factor for successful open innovation process where the success will be measured by commercialisation of open innovation results.

OI could be divided into six phases:

1. Initiation
2. Motivation and capabilities involvement
3. Idea development
4. OI enablers analysis and development
5. OI environment development (external factors)
6. Monetisation and commercialisation of OI results

Qualities of the open innovation leader that contribute to these phases will be differentiated in our further research. The impact of NIH and NSH syndromes on OI success could be studied.

Challenge could be identification of some OI leader's personal properties that could be different from common leader's properties.

The main attention in OI research in large organizations has been so far turned on phases 4 and 5 (the final phases) although assumption for successful OI that passes the phase 6 is start or phase 1. All interviewees agreed that main factor for successful OI is SME entrepreneur as the leader of OI and his /her attitude and personal properties.

Public sector's innovation policy is focused on innovation clusters, supportive systems and finances that are themes on phases 4 and 5. Business angels start from Phase 3. At the same time, Steve Jobs and Bill Gates, for example, started from Phase 1 without any supportive innovation system and reached phase 6. The challenge is, how to identify the potential innovations on Phase 1, select them on Phase 2 and support through Phases 3-5 to Phase 6. The future research will be focused to find an answer to that question.

Education system can support continuous learning and cooperation or support competition between individuals and individualisation.

Availability of cooperation partners is important but depends from cooperation capabilities of leader and management team. In open world, it is possible to hire cooperation partners crossing the borders of usual business region.

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