Innovation and internationalization in the world of the small

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Abstract

Internationalisation is an important driving force of innovative activities and *vice versa*, innovation is an important catalyst for internationalisation. This paper provides some empirical evidences on the level of innovation and the extent of internationalization among small and medium-sized enterprises in Hungarian knowledge-intensive industries using a novel e-survey. As regards internationalisation these firms display signs of not only traditional but also contemporary internationalisation. The latter firms are active participants of the borderless research and innovation process.

By the empirical findings the Hungarian innovation environment continues to provide inadequate support and moderate encouragement for smaller firms. The firms’ success on the international stage is hampered more by the problems generated by the Hungarian economic environment than by financial difficulties. This study has some important conclusions for evidence-based innovation and economic policies.

Keywords: innovation, internationalization, small and medium-sized enterprises, Hungary

Journal of Economic Literature (JEL) code: 039; F23
1. Introduction

Internationalization is an important driving force of innovative activities and conversely, innovation is an important catalyst for internationalization. Internationalization has the effect of increasing the international transfer of knowledge and international competition forces enterprises to be innovative, while the availability of new markets urges them to implement their innovations in an effort to increase their profits.

Business, including its open innovation activities, has become more global. These phenomena are pushing small and medium enterprises (SMEs) toward the international arena. Notwithstanding anecdotal evidence on the impact of the internationalization of the innovation process on the competitiveness of SMEs, few research projects have undertaken to study the internationalization of SMEs in a systematic way. However, the discussion on the considerable importance of small business coincided with the emergence of globalization in early 1970s. (Schumacher 1973) The internationalization of SMEs accelerated dramatically in the 1980s. (UNCTAD 1993, Buckley 1989, Hollenstein 2001) It is important to analyse observed changes because the innovative activities of enterprises and the attributes of their internationalization vary depending on their size as well as on the magnitude and distance of the markets targeted by their economic activities.

Although SMEs generally share most of the size-related problems such as lack of innovation capabilities and difficulties in accessing cross-border networks, they are not a homogenous group. Common size-related features are the small number of employees, little resources and weak negotiation power, fragility in the face of economic difficulties, and very limited risk-taking capabilities. Replacement of ageing founding managers and/or the delegation of managerial duties at growing micro- and small firms are also problematics that may lead to the decline of firms, and to them losing innovative and networking capabilities. Flourishing SMEs are characterised by a strong innovation attitude and flexibility.

From the very heterogeneous group of SMEs, this study focuses on innovative activities and internationalization, including the interactions between the two, with reference to SMEs in four knowledge intensive sectors.¹

¹ The ceilings for SMEs according to EU rules the ceilings are as follows: less than 250 employees, maximum €50 m turnover or a €43 m balance sheet.
The main issue of this paper is the relationships between different levels of internationalization and innovation activities, and therefore centres on SMEs carrying out R&D and innovation related activities with the aim of assessing the level of innovation and the extent of internationalization among SMEs in Hungarian knowledge-intensive industries. The reasons for selecting knowledge-intensive sectors are their close link to innovation and presumably a greater interest in internationalization. Presence of non-innovative as well as non-internationalised SMEs helps to better understand the importance of both phenomena.

Innovation means the development of new values through solutions that meet new requirements, unarticulated needs, or old customer and market needs in new, value-adding ways.

An innovation-active firm is one that has had innovation activities during the period under review, including those with on-going and abandoned activities. In other words, firms that have had innovation activities during the period under review, regardless of whether the activity resulted in the implementation of an innovation, are innovation-active. (OECD 2005, para. 215)

Internationalization is defined as simple decision of a firm to go abroad (without considering the type of engagement). The main difference between internationalization and globalization are following: ‘internationalised’ activities are carried out in more than one country and ‘globalized’ processes are interdependent and integrated across space. (by Archibugi and Iammariano 2002 p. 102) Internationalization is a better term for SMEs than globalization.

It was assumed that not only contemporary but traditional internationalization may act as a spur to innovation, especially when the targets are the markets of economies that are at a higher developmental level than the Hungarian economy. This assumption leads to following research questions: Is there a correlation between innovation performance and the extent and type of enterprise internationalization? Are internationalised SMEs more innovative and more competitive than their peers not yet participating in – or apparently avoiding – the internationalization process? What differences can be seen between the internationalization and motivations of innovative versus non-innovative enterprises? In what way are knowledge-intensive SMEs in Hungary affected by the internationalization of research and development (R&D) and innovation processes? To what extent do Hungarian SMEs participate in the internationalization process?

Following the short literature review, we briefly describe the position of the Hungarian economy within Europe in terms of its innovation performance, as well as the survey sample
and research methods. In the context of the two-way relationship between innovation and internationalization, the attributes of innovative activities are summarised first. An overview of innovation activities of firms is crucial as a background to the investigation of the features of their internationalization. This section is followed by a discussion of the characteristics of the internationalization process including the factors and motivations of internationalization among innovative versus non-innovative enterprises. Finally, some conclusions are drawn.

2. State of the art


Dunning (1980) eclectic paradigm of international production or OLI (ownership-, location-, and internationalization advantages) model have merged several isolated theories of international economics in one approach. The motivation for internationalization might be: investments in resource seeking, in market seeking, in efficiency seeking, in strategic seeking and in support. Dunning’s revised OLI paradigm (1997, 2008 with Lundan) included strategic alliances and broad network relationships.

Learning in the internationalization process of firms is described in Uppsala model originally in 1977 (Johanson & Vahlne 1977). This dynamic model emphasises that firms gain their first experiences from the domestic market before they move to foreign markets; launching their foreign operations from culturally and/or geographically close countries and moving gradually to areas that are more distant culturally and geographically. The firms start their foreign operations by using traditional exports begin with ad hoc export orders that are followed by regular exports. Then firms gradually move to using more intensive and demanding operation modes (sales subsidiaries etc.) both at the company and target country level. The clear evidence showing the importance of networks in the internationalization of firms was a great challenge for the 1977 model. Business behaviour has changed a lot since the original internationalization process model was built. (Johanson and Vahlne 2009, p. 1420) Companies sometimes leapfrog over stages in the establishment chain. They start to
internationalise soon after their foundation, in such a manner that the internationalization process moves more rapidly now. Joint ventures and strategic alliances are modes that are used much more commonly in the 2000s than previously. Internationalization through acquisition has also grown enormously.

Andersen (1993) distinguished the innovation-related internationalization model from the Uppsala internationalization model. In the innovation related models, internationalization is considered an innovation of the firm. However, these two approaches are closely related. As the innovation process has opened up, more attention has been devoted to the internationalization of innovation. A number of empirical studies have shown that domestic technological capability is a necessary condition for a successful export performance. (Soete 1987, Amendola et. al. 1994). Archibugi and Iammarino demonstrated “the correlation between the R&D intensity (measured by the ratio R&D to value added) and the degree of internationalization (measured by the ratio exports to value added) for the six most industrialised countries was remarkably higher in 1996 than in 1975, confirming that the link between technological intensity and internationalization has been considerably strengthened over time.” (2002, p. 106)

On the base of accumulated facts, several studies have questioned the stage model since an increasing number of firms are active in international markets shortly after establishment (born global). New business practices and theoretical work shed light on modes of internationalization and encouraged the authors to revisit the original Uppsala model after a few decades. The revised model extends the stages of internationalization from exports through global production networks to global innovation networks. It also emphasises that developing knowledge is fundamental to a firm’s internationalization. Operational learning, market-specific and relationship-specific knowledge are critical, and experiential learning is also a central factor in a firm’s internationalization (Johanson and Vahlne 2009). Access to information is crucial, and they explain that new international ventures (born global, born regionals) may grow very rapidly if their founding entrepreneur already had access to knowledge and relationships prior to the internationalization.² The authors believe the revised Uppsala model that puts the network in the centre is equally applicable to large and small firms.

² Firms that are heavily involved in exporting from the time of their establishment are called ‘born globals’ or ‘global start-ups’. Some authors have proposed calling them ‘born regionals’ as they are active in only a part of the international market at the beginning.
Revised stage model can capture some important characteristics at a bunch of the firms. However its general validity has remained doubtful. The internationalization behaviour of firms can be different from Uppsala model. Various firms have different routes to internationalization. The established firms may exist on different level of internationalization either or not to go through on several stages. It means there is no single model of internationalization that fits to all. A systematic analysis of the importance of stage model and identifying other models require data on a large number of individual firms and longitudinal case studies that can be followed over time.

Last few decades has fundamentally changed the way how firms undertake innovation activities. A little detour in innovation literature highlights the closed innovation paradigm was replaced by the open innovation paradigm since 1960s. (Chesbrough 2003, Gassmann and Enkel 2004) These linkages lead to a ‘network model of innovation’ (Callon 1992), ‘distributed innovation processes’ (Coombs et al., 2003) or ‘open innovation’ (Chesbrough, 2003). The common, central idea behind these various terms is that, in a world of widely distributed knowledge, companies cannot afford to rely entirely on their own research, but should, instead, buy or license processes or inventions from others. (Inzelt 2010) Ebersberger et al. broadly grouped open innovation practices into 4 dimensions: search, external sourcing, commercialisation, and collaboration. This paper accepts this grouping and using 3 latter dimensions in investigation. (Some details on defining and measuring innovation activities, their different types, mode of innovation and their related activities are described in the analytical part of this paper.) The concept of open innovation is closely linked to national and regional innovation systems which emphasise the inter-organisational linkages for knowledge creation and diffusion. (Lundvall, 1992; Nelson 1993) The internationalization widens the access of companies to academic knowledge and research capabilities. Globalization is a great challenge for systems of innovation and open innovation got a global dimension. As national economies have become interdependent, firms in all sizes need access to the innovation systems in other locations. Systems of innovation have important effect on internationalization of knowledge creation and knowledge dissemination. (Archibugi and Michie 1995, 1997, Archibugi and Lundvall 2001).

It is a realistic hypothesis many different characteristics of SMEs’ internationalization goes beyond size differences. First of all in the case of SMEs is more reasonable to investigate internationalization than globalization. „Smaller firm size entails stronger dependence on external resources, but also weaker absorptive capacities. Thus, SMEs may be particularly sensitive to these issues.” Ebersberger and Herstad 2013 p. 627
This literature can provide some knowledge to investigate internationalization of SMEs. However the majority of studies on globalization focused on multinational enterprises, the impact of foreign direct investment (FDI) on home and host countries. Those studies have approached the globalization of R&D and innovation through the lenses of headquarters or foreign subsidiaries of MNCs played role. The internationalization of SMEs’ R&D and innovation activities was taken into account as suppliers or subsidiaries of MNEs.

Literature on internationalization of SMEs and their relations with innovation performances is still scattered. Limited attention has been devoted to internationalization of SMEs and to the relationship of their innovation activities. But these businesses have also become actors of internationalization and have involved in internationalization of R&D and innovation activities. (Few of them are: Ács et. al. 1997, Buckley 1989, Ebersberger and Herstad 2012, Hollenstein 2001, Moen and Servais 2002, Narula 2004, Yu-Ching et. al. 2006).

It may assume the motivations by Dunning’s paradigm are influencing not only MNCs but SMEs too for internationalise their activities. According to empirical study on international activities of Swiss-based SMEs confirms Dunning’s OLI paradigm. (Hollenstein 2001) However the size is matter. Internationally expanding SMEs are facing with specific constraints. According to Swiss experiences the main constraints are high financial risks and insufficient management capacity and to a lesser extent, deficiencies with respect to financial resources and knowledge about foreign location. Location disadvantages of home country (high-wages in Switzerland) encouraged much stronger international activities for SMEs than for larger firms.

Moen and Servais (2002) has analysed parallel exporting SMEs from Norway, Denmark and France and observed that export intensity, distribution, market selection, and global orientation are not influenced by first year of exporting activity.

As Narula (2004) observed SMEs have cognitive limits how much they can use non-internal R&D as they need to maintain a minimum threshold level in-house capacity.

Large firms have more to offer in a partnership, and can easily find alternative sources compared to SMEs. SMEs are more careful about picking partners, because they have limited opportunities to fail and they wish to avoid to loss of technological competence. (pp 159-160).

These empirical studies could identify some specificities of SMEs. Further empirical analysis focusing on SMEs is still important to identify their patterns of internationalization and innovations.
For our research we introduced two categories on internationalization of SMEs to investigate their relationships between innovation and internationalization. These two categories are namely: (1) traditional internationalization (2) contemporary (modern-era) internationalization.

The advantage of this classification is that allows investigate the level of internationalization and its relation with innovation in a given period without knowing their changes over-time. Another argument comes from the observation of Hungarian SMEs development over time. Similar to Moen and Servais (2002 p. 68) analysis most SMEs do not develop into larger firms, which implies that the stage models have limited validity for these firms. Traditional internationalization covers the firms that are involved in export activities from occasional export to regular export with lower or higher intensity. They may export into geographically or psychologically near or more distant markets over years.

Several activities became international much latter than exporting, among them corporate research and development (R&D) activity. Before clarifying the other category of internationalization it has to do.

All internationalization phenomena that historically occurred much latter than exporting activities are called as contemporary or modern-era internationalization. This group of firms includes that have involved in internationalization of R&D and innovation, membership in international networks in last decades of 20 century. Beyond that we included into this group the investments abroad that are not generally new phenomena but they are new in the world of SMEs.

Therefore the watershed is not to move from one grade to another (or leapfrog among grades) for our study. The watershed if firms have other kind of international activities as export. This pragmatic classification helps to investigate the relationship between any kinds of internationalization and innovations in a given period of firms operation. This approach allows identify different patterns in the relationship of internationalization and innovations.

3. The Hungarian innovation performance in international context

In spite of the international economic crisis, there are “promising trends” in the majority of EU member states but economic development is not fast enough.

Comparing the proportion of Hungarian innovative firms to several EU countries of similar size to Hungary, it can be seen that Hungary lags far behind in each size category of
enterprises (see Table 1). Looking at the proportion of innovative firms, the widest gap is observed in the category of small enterprises with the Hungarian figure being 26%.

Table 1 Percentage of innovative firms by size category in selected countries (%), 2010

<table>
<thead>
<tr>
<th>Size category (capita)</th>
<th>Hungary</th>
<th>Austria</th>
<th>Belgium</th>
<th>Denmark</th>
<th>Finland</th>
<th>The Netherlands</th>
<th>Norway</th>
</tr>
</thead>
<tbody>
<tr>
<td>10–49</td>
<td>25.9</td>
<td>51.1</td>
<td>55</td>
<td>50.5</td>
<td>52.8</td>
<td>52.1</td>
<td>39.7</td>
</tr>
<tr>
<td>50–249</td>
<td>45.9</td>
<td>71.2</td>
<td>79.3</td>
<td>64.2</td>
<td>63.4</td>
<td>70.3</td>
<td>55.5</td>
</tr>
<tr>
<td>250–</td>
<td>69.6</td>
<td>87.7</td>
<td>86.9</td>
<td>83</td>
<td>83.3</td>
<td>85</td>
<td>66</td>
</tr>
</tbody>
</table>


The proportion of innovative firms of moderate innovator Hungary is approaching Norway in each size categories. However the proportion of innovative small enterprises is two times as high in innovation follower Belgium, Austria, Denmark and the Netherlands and innovation leader Finland.³

Such large differences cannot be explained by the differences between Hungary and more developed countries in terms of the sector structure of small enterprises. The scattered information there is shows that in Hungary, innovative SMEs are rather rare even in knowledge-intensive industries, which are considered to be innovative economic sectors. The latest analysis carried out by the Hungarian Central Statistical Office (HCSO) in 2009 (CIS-type survey) based on data for 2006-2008 indicates the frequency of innovative businesses varies greatly by firm size and industry. Between 2006 and 2008, 60% of large firms, not quite a third of medium firms and only 16% of small businesses were innovative. The extent of variation by industry is aptly illustrated by the difference between, for instance, drug manufacturing, where 60% of firms were innovative, and clothing manufacturing, where the corresponding figure was just over 7%. In the entire Hungarian economy, on average two thirds of sales revenues came from the sale of goods and services that had not changed relative to the previous period. The corresponding proportion was substantially higher, almost 80%, for organisations employing fewer than 50 people (HCSO, 2010, pp. 1-2).

There are some internationally famous eagles (e.g. iGo, LogMeIn, Prezi, and Colorfront) among Hungarian innovative SMEs. However comparing the innovation related activities and performances of Hungarian SMEs to EU27 average the weak performances may observe. Hungarian indicator is the lowest among EU27 by SMEs introducing product and process

³ Based on their average innovation performance, the EU classified member states into four groups. (23EC, 2011): innovation leaders, innovation followers, moderate innovators, and modest innovators. The leaders show performance well above that of the EU27, while modest innovators are well below that of the EU27.
innovations as % of SMEs. Hungarian position is a bit better by marketing and organisational innovations. Poland, Serbia, Bulgaria and Latvia are behind the country. (Innovation Union Scoreboard 2011 p.91, 92)

4. Main characteristics of the survey sample

The research sample was taken from among SMEs in knowledge-intensive, technology-oriented industries. By the OECD analysis (1986) high tech sectors such as ICT, biotechnology, laser technology, nanotechnology are knowledge intensive sectors. These research oriented industries tend to be ahead of other, less competitive sectors in terms of internationalization.

A further sample selection criteria was that the industries should differ from each other along several important dimensions. The survey sample thus covers four technology-oriented, knowledge-intensive industries where, as shown by international trends, R&D activities play a fundamental role and competition is predominantly international. Knowledge intensive sector does not equate with high-tech manufacturing. It may connect to service sector to so called knowledge-intensive business services. These latter sectors have increasing economic importance and they are usually more internationalized in their R&D and innovation activities than others. (Miozzo and Miles 2002) So the sample selection focused on both, knowledge intensive manufacturing and service sectors.

The four selected sectors are the following: **Biotechnology, Medical precision instruments, Information and communication technology (ICT) services, and Engineering activities.** (Corresponding NACE classes are listed in appendix 1.) The first two of these sectors are technology-oriented industries of the manufacturing sector, while the latter two are knowledge-intensive services with strong technological ties. As shown by international trends, biotechnology and ICT have been characterised by dynamic innovative activities and the appearance of products with a high degree of novelty. The medical precision instruments manufacturing and engineering activities are considered to be traditional but knowledge-intensive and innovative.

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4 Even if assuming sample size and data quality problem the more precise indicator can put Hungary in bit better position but the country will remain in the last third group of EU countries by innovative performance of SMEs.
As there is no ready-made register of firms for the sectors under analysis in Hungary, a register was created for the purposes of this research. The final register included the contact details of 1,110 enterprises. (See more in *appendix table 1*.)

The data for our research was collected through an on-line survey specifically developed for the project. (See some details in *appendix 2*.)

Valid responses were given by 246 firms (22%).\(^5\) Taking into account this definition of the Oslo Manual (OECD 2005, para 152) from 246 SMEs, 190 were innovative and 56 were non-innovative in the period under review, 2006-2008. The inclusion of the non-innovative firms constituting only roughly a fifth of the sample is an important element as these businesses provide information on burdening factors that are prevent them from innovation. Non-innovative firms are potential sources of future innovative firms.

The employed term of *internationalization* covers all cross-border activities of domestic firms. From 246-strong sample 176 firms were somehow internationalized and 170 non-internationalized (no any cross-border activities). The presence of innovative and non-innovative as well as internationalized and non-internationalized firms further helps us to analyse the relationship between innovation and internationalization.

Analysing the data by region, about 60% of respondents are based in Budapest, capital of Hungary. Looking at the age of the firms, there are some young businesses but they do not dominate the sample. A little less than 10% of the firms were founded in recent years, in 2006 or later.

With respect to legal status, the great majority of the enterprises (82%) are limited companies. A striking feature of *ownership structure* is that Hungarian private individuals appear in the highest proportion among the sole or shared owners (for 223 firms, at the time of founding). There are few differences between the ownership structure at the time of founding and the current ownership structure: among the current owners there are no local governments and Hungarian research institutes have also disappeared and the number of universities as owners has decreased.

Around a fifth of the firms are so-called partner enterprises, i.e., they are members of a corporate group held together by shared ownership.

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\(^5\) Detailed findings are available in Hungarian http://www.penzugykutato.hu/en/taxonomy/term/95.
4.1. Growth performance

The sales dynamics of firms are affected by several factors in addition to innovation. (Data are presented in appendix table 2) During the period before the economic crisis, two thirds of businesses were characterised by only moderate changes (sale changed less than 10%).

The literature devotes special attention to fast growing SMEs, often termed as gazelles. Gazelle is a temporary phenomenon. The firm must be an SME at the base year of investigation and has to grow above average growth rates for quite some time. Successful gazelles transform themselves into larger enterprises and leaving the group of SMEs. Slower growing firms remain SMEs for a long period (or exit the market). Both the size of growth rate and choice of indicator (sale vs. employment) for allocation into size classes are debated in the literature. (Overview of definitions is in Henrekson and Johansson 2009) There is no uniformly accepted growth rate threshold in classifying a firm as a gazelle. The OECD proposes a threshold of 20% annual growth of sales revenue, at which a firm can be classed as a gazelle (OECD, 2007). Several authors prefer to define gazelles as firm displaying substantially higher growth than their peers. For the period under analysis, a growth of more than 10% is outstanding in a Hungarian context their dynamic firms relating to their peers.

A dynamic more than 10% growth in sales was achieved by 36% of non-innovative firms and merely 23% of innovative enterprises. Possible explanations for the finding that high growth was achieved by a modest proportion of innovative SMEs in these technology-intensive industries may be that their innovations did not carry a high degree of novelty for the market or that they failed to introduce further innovations that could have helped to use the novelties to their greatest advantage. Another explanation may be that the firms did not have the resources necessary for more substantial growth.

The relatively good dynamics of the non-innovative firms correspond to the findings reported by the EC (2008) indicating that innovation is not a necessary condition of corporate growth as it may be rooted in other factors.

Sales dynamics are often influenced by the age of the firm, the recency of its founding. Grouping the enterprises by their founding date, we find typically less than (+/−) 10% change in sales for all groups. A decrease of more than 10% only occurs among the firms founded before 2000. It seems reasonable to assume that in these cases, lack of innovation and failure to renew the business may have contributed to the decline. An increase of more than 10% is also most likely to occur in this age group but we also find a few enterprises displaying quite
strong dynamics among those founded after 2006. The relatively high percentage of firms over the age of 10 among the moderate number of relatively high-growth firms is in line with Ács and Mueller’s (2008) findings that small businesses displaying gazelle-like growth are not necessarily young. With respect to Hungary, this is confirmed by Békés and Muraközy (2011).

Looking at the motivational power of sales markets, high-growth enterprises occur with higher frequency among firms with sales activities at a distance of more than 100 km. The external market of the highest significance is the EU but it is not the one that is the most likely to encourage growth. European countries outside the EU had a stronger market growth motivating effect among the SMEs under analysis. The Commonwealth of Independent States deserves special mention as a significant growth encouraging market, which, however, has little effect on innovative activity.

5. Innovation activity

The various types of innovation for measurement purposes (product, process, organisational and marketing innovation) may be introduced individually or in some combination in a given period. (OECD 2005) In the latter case, we can expect a synergistic effect. Product and process innovations are technological innovations while marketing and organisational innovations are non-technological innovations.

During the investigated period, between 2006 and 2008, 190 firms introduced some type of innovation, mostly (154 firms) product innovations. Process innovations were introduced by somewhat fewer, 137 firms. Non-technological innovations were implemented by a substantially lower number of firms (organisational: 38, marketing: 31 firms). The distribution of enterprises by type of innovation and the dimension of their introduction see in appendix table 3.

All one-dimensional innovators introduced some kind of technological innovation. None of the firms introduced non-technological innovations on their own. These therefore had the function of supporting the implementation of technological innovations and were only introduced by firms developing more than one type of innovation. Although the proportion of one-dimensional innovators is fairly high (37%), the largest group is that of firms introducing two types of innovation (44%). Almost half of all firms are in this group and the great majority of them report product & process innovation combinations. A much smaller but still non-negligible number of firms combined product or process innovations with new
organisational solutions. Market innovation hardly ever appears among the activities of two-dimensional innovators. Within the modest group of three-dimensional innovators, a fairly large share introduced market innovations. There are 10% of firms in the group of four-dimensional innovators. The scarcity of non-technological innovations can be explained by the lack of adequate skills required for their introduction and a shortage of financial resources. The observed non-technological innovation performance shows substantial deviations from the overall picture presented by the results of the HCSO survey of 2009 (2010). The two patterns are similar in that both suggest that marketing and organisational innovations tend to serve the function of supporting technological innovations. According to the HCSO survey, however, a third of the SMEs introduced non-technological innovations without implementing technological ones (HCSO, 2010, p. 3). As the details of industries in the HCSO survey have not been published, there is no way to establish whether the discrepancy can be explained by differences in industry composition or by some other factor.

5.1. Creativity

A firm is considered to be creative if it directly participates in the development of the innovation either as the sole developer or in collaboration with others. A further measure of creativity is the firm’s R&D activity and the efficiency of this activity. Novelty level of innovation is strongly linked to its creativity. A firm may introduce one or another type of innovation that has been implemented by other firms however it is new to the firm. Any types of innovation may new to the world, new to the market or just new to the firm. (OECD 2005 para 207-210) By the novelty of innovations firms can be developers and adopters of innovation. Arundel and Hollanders (2006) and Bloch and Lopez-Bassols (2009) classified the firms by innovative mode into three categories according to the novelty of their innovation outputs: strategic innovators, technology modifiers, and technology adopters. In this paper two groups are distinguished: 1) creative firms (including strategic innovators and modifiers) 2) adopter firms either in technology or non-technology type innovations. Adoption of innovation is also an important factor that is an indicator for diffusion rather while the others are showing the creativity. Beyond creativity new to market, new to the world indicators are helping to identify market leaders and followers.

A firm may be characterised by both creativity and a propensity to adopt. Typical behaviours may vary as a function of innovation type and the firm’s developmental stage. Table 2 displays innovation developers by type of innovation.
Table 2 Types of innovation by their developers

<table>
<thead>
<tr>
<th>Types of Innovations</th>
<th>Creative firm number</th>
<th>Adoptive firm number</th>
<th>Creative firm %</th>
<th>Adoptive firm %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>By oneself</td>
<td>With others</td>
<td>Done by others</td>
<td>By oneself</td>
</tr>
<tr>
<td>Product</td>
<td>85</td>
<td>65</td>
<td>4</td>
<td>55.2</td>
</tr>
<tr>
<td>Process</td>
<td>50</td>
<td>76</td>
<td>11</td>
<td>36.5</td>
</tr>
<tr>
<td>Organisational</td>
<td>29</td>
<td>3</td>
<td>6</td>
<td>76.3</td>
</tr>
<tr>
<td>Marketing</td>
<td>21</td>
<td>10</td>
<td>–</td>
<td>67.7</td>
</tr>
<tr>
<td>Total</td>
<td>185</td>
<td>154</td>
<td>21</td>
<td>51.4</td>
</tr>
</tbody>
</table>

Source: KKVENT_8.

It can be clearly seen that more than half of the firms develop their product innovations themselves and a further 40% develop them in collaboration with others. Less than 3% of innovation was done by other enterprises or institutions. Process innovations also tend to be developed with the participation of the innovator firm but in this case collaborative development is more frequent than unassisted development. In the case of process innovation the proportion of adopters is higher, 8%. Adoption might be accompanied by some modification of original products or processes were developed by other organisations.

Innovation development is typically accompanied by creative behaviour. The highest frequency of unassisted development is observed for organisational innovations but even this type of innovation is adopted occasionally. Adoption does not occur for marketing innovation, however.

Comparing our data on knowledge-intensive sectors with the overall results of the developer-based analysis of SMEs’ product and process innovations in the HCSO survey, (2010) we can see conspicuous differences between the two.
As shown by the Figure 1, compared to the country average, knowledge-intensive sectors are characterised by a considerably higher percentage of firms showing creativity in process innovation. A second important feature of the figure is that collaborative innovation development – the open innovation model (Chesborough, 2003) – is twice frequent among the firms in the knowledge-intensive industries than the overall Hungarian average, both for product and process innovations. Innovation adopters (done by others) are somewhat less frequent in this group than the Hungarian average for product innovation and four times less frequent for process innovation. These differences suggest that the innovation development behaviour of knowledge-intensive industries deviates from the average behaviour.

The development type of the innovations introduced by the firms is greatly dependent on their previous innovation-related activities. Most of the enterprises (137 out of 190)
performed some kind of R&D activity related to innovation during the previous three years. The next most frequent activity, undertaken by somewhat fewer than half of the firms, was training for employees related to the introduction of the innovations. Almost 40% of the firms acquired machinery and equipment needed for the implementation of the innovations. With some obvious variation across the industries, a relatively high share of all firms (32%) purchased computing hardware. High-tech equipment, however, was only purchased by 20%, which is probably related to the nature of the innovations and the financial position of the enterprises. To be able to implement innovations, businesses may extend their competencies by outsourcing R&D activities. This option was chosen by 37% of the firms. Knowledge created elsewhere may be acquired and made use of not only through outsourcing but also by purchasing existing R&D outcomes (13%), patents and know-how (12%). Almost half of those doing in-house R&D carried out these activities as a service for other firms, i.e., provided the necessary knowledge for the implementation of innovations elsewhere. The high incidence of this service indicates a high level of competence in developing intellectual products.

A firm may decide to protect the results of its R&D or other inventive activities by obtaining intellectual property rights for them. Among the 134 enterprises having intellectual property in the sample and 72 has owning patents. 36% of the innovative firms and 7% of the non-innovative firms have patents. These figures indicate a clear relationship between innovativeness and the probability of patents. Of the 72 firms owning patents, further details are known about 66. (See Table 3)

Table 3 Number of patents produced

<table>
<thead>
<tr>
<th>Creating patents</th>
<th>Number of firms creating patents</th>
<th>Number of patents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Innovative</td>
</tr>
<tr>
<td>By oneself</td>
<td>52</td>
<td>48</td>
</tr>
<tr>
<td>With foreign partner</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>With domestic partner</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>62</td>
</tr>
</tbody>
</table>

Source: KKVENT_8, project databank.

Most of the firms in the sample produced their patents internally and half of these own a single patent. More than half of the 48 firms developing their patents internally also
introduced these innovations without external assistance. Openness is not very strong in this circle.

Looking at the 68 innovative firms having patents, the highest number (60) implemented product innovations during the previous three years, process innovations come next (46 firms). The occurrence in the sample of firms owning patents without innovation performance shows the distance between invention and innovation. An ability to invent is not necessarily coupled with an ability to introduce innovations.⁶

5.2. Selling R&D results vs. chasing R&D support

Of the 246 firms, R&D results were sold by 100, most of which (82 firms) also made profitable use of these results through in-house innovations. The 18 firms that only sold their results to external buyers are creative businesses generating and selling knowledge and playing a major role in open innovation but are not innovators themselves.

A firm’s R&D activities intended for sale may be initiated internally by the firm itself or externally, by some other firm. During the three-year period, the R&D contracts received by the firms constituted 29% of sales revenues on average. For five of the firms, the corresponding figure was more than 80%. Among those buying the firms’ R&D results, Hungarian SME’s are found in the highest proportion (29%) followed by foreign SMEs (23%). Multinational firms are not far behind (19%). Hungarian and foreign large enterprises appear in a somewhat lower proportion (10% each). When the seller is a member of a corporate group, the buyers are hardly ever other members of the same group. That is, in this respect, these firms do not typically follow the open innovation model.

Firms possessing creative skills and specialising in R&D activities for sale are major players in knowledge-based economies. They generate the financial resources for new research and ensure the continuity of research activities by selling the results of their completed projects. The success of some of these firms is evidenced by the finding that the

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⁶ The discrepancy between inventive and innovative capabilities is highlighted by international comparison. As it was mentioned earlier Hungary is among the low performing EU27 by indicators on innovation. However licence and patent revenues from abroad as % of GDP gives a good position for Hungary in the rank of EU27. The country is definitively behind the frontiers Switzerland and Netherlands (2.5%) but her 0.8% is above the majority of countries that are below 0.5%. (Innovation Union Scoreboard 2011. p.98.)
1% of the sample (3 firms) producing patents through exclusively internal development are characterised by a growth of more than 10% in sales.

The remaining firms focusing on R&D activities rarely realise R&D market sales revenues. Some of these firms are in the phase of building up their activities and can be expected to develop significant innovations and generate substantial sales revenues in the future. Some other firms, however, are support-hunters and finance their existence by exploiting R&D tenders or other support funds without producing intellectual or financial results. The presence of this latter group highlights the importance of revising certain elements of the Hungarian research support system.

5.3. **Sources of information for innovation and collaboration partners**

The way how firms are undertaking innovation activities has gone through fundamental changes over the last decades of 20 century. As Narula (2004) summarized the literature: there has been remarkable growth in the use of external networks by firms in all sizes due to products are increasingly multi-technological. So the firms have been a growing need to possess multiple technological competences across borders.

This principle is the starting point of government programmes intended to encourage collaboration and the emergence of professional networks. Research collaboration between the private and the public spheres is expected to enhance the efficiency of the transfer of knowledge generated in the public sphere to the private sphere, which would improve the rate of return to public investment in research and the innovation performance of the economy. It is therefore worth looking at the sources of information firms are likely to use for their innovative activities and at the characteristics of their collaboration partners. (Inzelt 2004)

There are two information sources of major significance to most firms: *internal sources and the buyers*. When asked to rate the importance of individual information sources, a substantial share of the firms considered several of them to be unimportant. This is one of the reasons why there is a clear discrepancy between the average importance of sources calculated for all respondents and the corresponding figures calculated for only those respondents that considered a given source to be to some extent important. The gap between the pairs of values suggests that the accessibility of certain sources of information (such as universities or colleges) is inconsequential to a substantial share of the firms. For several of the firms, these sources do not even reach the periphery of their attention.
Knowledge generating institutions are held to be important by only a few firms but may be very important for those who use them. Interestingly, within these institutions universities are used by substantially more firms as knowledge sources than are colleges or the research institutes of the Hungarian Academy of Sciences (HAS). This difference is probably related to the R&D specialisations of these institutions, to their openness towards the business sector and to the level of knowledge management. (See appendix table 4) Some information sources have low average importance by any counting. This result may mean that SMEs are largely unfamiliar with the uses of information offered by these organisations or it may be the case that these organisations pay little attention to the dissemination of their knowledge in ways that make it relevant to SMEs.

The significance of the ability to disseminate and adopt information is also demonstrated by the results of the HCSO innovation survey (2010) revealing that universities are the fourth most important information sources for large enterprises; occupy the seventh place for medium-sized firms and the eighth place for small firms.

If an organisation is an important source of information for firm innovation, it is likely to be a potential collaboration partner in the development and implementation of innovations. The data on partners in innovation collaboration show that – just as in the case of information sources – buyers occupy the top position. When the buyer is an organisation performing further manufacturing or assembly, the collaboration may lead to a radical innovation while collaboration with an end-user is expected to generate incremental innovations involving step-by-step changes. There are examples for both types in our sample. In the ranking of collaboration partners, the prestigious second place is occupied by universities, which reinforces our previous observation that they are among the major sources of information for those who turn to them. The pattern observed here deviates from the overall picture in that the latter ranks suppliers as the most important collaboration partners of SMEs with buyers and higher education institutions coming next (HCSO, 2010, p. 3). That is, the knowledge-intensive industries responding to their buyers appear to be more active than those focusing on the utilisation of their suppliers’ knowledge.

It is worth having a look at the stages of the innovation process in which the different collaboration partners participate and at the geographical scope of collaboration. The innovation process was divided into nine stages – from the conception of the idea through to international distribution – and displays the number of firms collaborating with different types of partners at each stage. (See data in appendix table 5.) Suppliers as innovation partners are broken down to subgroups in the table because general technology, high technology and high-
tech materials suppliers are attributed unequal importance in the process of innovation implementation.

The partners are sorted into two groups: The first contains those involved in each stage of the innovation process with at least some firm in the sample while the second lists those that at some stage of the process did not collaborate with any of the innovative firms. It is clear that buyers, universities, foreign partners, firms supplying technology and other members of a corporate group participate in every stage of the innovation process.\footnote{Further analysis of buyers would provide a good opportunity to focus on user innovation that is an emerging issue in innovation literature. (Recently discussed by Gault, 2012)} (Appendix table 5) This does not mean that each firm maintains the collaboration at each stage of the innovation.

The role of suppliers increases at the stages of prototype development, testing and piloting.

Similarly to the pattern of collaboration with buyers, foreign partners are also most likely to be involved in testing, the next most important stages – with a substantially lower frequency for foreign partners – are piloting, the evaluation of results and market introduction, and collaboration with foreign partners is also fairly important in international distribution.

The fact that more than twice as many firms collaborate with foreign partners at the testing stage compared to the stage of defining and developing ideas suggests that some of the creative firms developing their innovations in collaboration with others introduced technological innovations that carried novelty for only some markets.

The phases of collaboration with suppliers, other firms in the corporate group and foreign partners correspond to the phases generally characterising the given type of innovation partner.

The pattern of collaboration in terms of the geographical location of partners shows a strong preference for Hungary, and the collaboration partners are more likely to be located within a 100 km radius of the firm’s location. The group of foreign collaboration partners is dominated by EU-based firms but among universities and foreign partner enterprises we find roughly the same number of EU-based and North America based firms.

Looking at the contribution of various support and incentive programmes to the collaboration efforts, we find that Hungarian RDI programmes played a role for 33 firms, EU RDI programmes for 27 firms and the EUREKA programme for 15 firms. It is a positive finding that there are firms participating in these programmes but these participation rates of 8-15% are not too impressive for these knowledge-intensive sectors with a higher than
average percentage of innovative enterprises. The firms involved in collaborations within the framework of European programmes tend to be those that also participate in Hungarian programmes, which indicate that national programmes play an important role as training grounds. The moderate participation rate shows little success in involving SMEs even though they are specifically targeted by several programmes.

The above details of the partnerships involving several players at the various stages of the innovation process are indicative of the functioning of the open innovation model among the enterprises under analysis. (Inzelt 2010) The firms’ collaboration with foreign partners and with firms supplying materials and technology shows that some of the SMEs’ collaboration behaviour follows the internationalization of innovation paradigm. (Internationally open innovation is a more accurate term than globally open innovation as SMEs are typically involved in collaborations with only one or a few countries rather than in a global network.)

5.4. The efficiency of the innovation process

One measure of the efficiency of the innovation process is the degree of novelty of the innovation. Significant economic benefits may be attained if the product, process or marketing strategy is new to Hungary (or to the Balkans) but the novelty effect and the odds of long-term market advantage are likely to be increased if the innovation introduced is also new to European countries beyond the River Leitha. Four degrees of novelty are distinguished here: innovations new to the world, those new to Europe, those new to Hungary and those new to the firm. The inclusion of the category “new to Europe” takes into account the type of market about which the SMEs interacting. For a substantial share of the firms, countries beyond the border of the EU fall outside their horizon. The inclusion of the category of “new to Europe” is also warranted by the assumption that in the globalising world of the present novelties that are new to the market of the extended region containing a given country will preserve their significance for a long time. Our classification is more detailed than the system used in the EU’s innovation surveys (CIS), which only distinguish innovations new to the market and those new to the firm. Table 4 displays the number of firms producing at least one innovation as a function of degree of novelty, type of innovation and type of developer.

Among those introducing technological innovations we find a fair number of firms that introduced major innovations. Non-technological innovations are dominated by innovations new to the firm or new to Hungary. A few of the firms produced marketing innovations new
to Europe. The organisational innovations, however, were only new to Hungary both in the case of innovations largely developed by the firm itself and in the few cases of adoption.

Table 4  
Innovators by degree of novelty of innovation and developer of technology

<table>
<thead>
<tr>
<th>Type of innovation and developers</th>
<th>World novelty</th>
<th>Degree of novelty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>New to Europe</td>
</tr>
<tr>
<td>Product innovation</td>
<td>56</td>
<td>17</td>
</tr>
<tr>
<td>– By oneself</td>
<td>36</td>
<td>11</td>
</tr>
<tr>
<td>– With others</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Process innovation</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td>– By oneself</td>
<td>19</td>
<td>–</td>
</tr>
<tr>
<td>– With others</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td>– Done by others</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td>Organisational innovation</td>
<td>–</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: There was no adaptation based product innovation. 
Source: KKVENT_8, project databank.

With respect to the relationship between innovation development and degree of novelty a notable feature of the data is that the product innovations developed by the firms are more likely to be new to the world or at least to Europe than are the process innovations.

The technological innovations having different degrees of novelty may have been developed by the firms themselves, in collaboration with others or – with the exception of new-to-world novelties – they may have been adopted. Collaboration with others plays an important role in the development of innovations of all degrees of novelty but occurs with the highest frequency for innovations new to Hungary only. Looking at the relationship between degree of novelty and type of innovative activity we can see an interesting pattern. (Data are in appendix table 6.) This relationship will only be analysed here with reference to technological innovations as these constitute the largest group and occur with all four degrees of novelty.

Whichever degree of novelty we look at, the introduction of the innovations is associated with in-house R&D activities. The highest degree of novelty is represented by product and process innovations new to the world. For these innovations, the second most important activity is the outsourcing of R&D activities. The intensity of R&D efforts is therefore a major factor in the development of high-novelty innovations. For innovations with lower degrees of novelty, the second most frequent innovation activity is training in these
knowledge-intensive industries, where the general level of employee skills is relatively high. This fact is likely to have contributed to the recognition of the importance of training. Interestingly, the acquisition of machinery, equipment and software has a prominent place for firms introducing products new to Hungary or to the firm.

The degree of novelty of an innovation is likely to be related to the region in which the firm is based. The firms based in Budapest, a relatively favourable innovation environment within Hungary, show better results than their peers based in other locations.

**Internationalization**

Internationalization – active involvement in foreign markets and efforts to acquire knowledge accessible abroad – plays a crucial role in competitiveness.

Here we distinguish two categories of internationalization: (1) Traditional internationalization and (2) contemporary internationalization. Traditional internationalization is achieved when an enterprise has some contact with external markets, such as, import or export activities, which involves contact with an external economy. This form has existed for thousands of years. When a firm is also involved in activities characteristic of internationalization behaviour in the twentieth century, we have an example of contemporary (modern-era) internationalization. These behaviours include business R&D and innovation, the sale or purchase of patents or know-how to or from abroad, the joint possession of a patent produced in collaboration with a foreign partner, investments abroad and membership in an international network. These two types are of internationalization are distinguished to capture the international engagement of SMEs.

In terms of the above classification of internationalization, from 176 internationalized firms 152 were innovative and 24 non-innovative. Taking into account the 190 innovative firms, 79 display contemporary and 73 show traditional internationalization behaviours while 38 firms are not internationalized. Looking at the 56 non-innovative firms, only one is characterised by contemporary internationalization (it has capital investments abroad), 23 show traditional internationalization behaviour and the majority (32) are not internationalized. (See Table 5)
Table 5  
**Type of internationalization of innovative and non-innovative firms**

<table>
<thead>
<tr>
<th>Type of internationalisation</th>
<th>Innovative (Total)</th>
<th>Non-Innovative (Total)</th>
<th>% of firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internationalised by contemporary</td>
<td>79</td>
<td>1</td>
<td>80</td>
</tr>
<tr>
<td>Internationalized traditionally</td>
<td>73</td>
<td>23</td>
<td>96</td>
</tr>
<tr>
<td>Non-internationalized</td>
<td>38</td>
<td>32</td>
<td>70</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td>56</td>
<td>246</td>
</tr>
</tbody>
</table>

*Source:* KKVENT_8, project databank.

Looking at traditional internationalization, more than half of the firms have export activities (and 42% have import activities). Dividing the group into innovative and non-innovative firms, 60% of the former and only 23% of the latter are involved in exporting. Traditional internationalization is also worth investigating, as it is a reasonable hypothesis that compared to non-innovative firms, innovative enterprises will be more likely to endeavour to establish contacts with and conquer external markets. The latter presumably have a better chance of success. If a firm has established its presence in a foreign market either as an importer or as an exporter, this fact may exert some market pressure and encourage innovative activities. For 31 of the innovative firms, export sales revenues constitute between 71 and 100% of all sales revenues (the corresponding figure is less than 10% for 30 firms). There is a substantial difference between the exports of finished goods versus intermediate ones: Firms exporting parts, high-tech parts or semi-finished goods tend to realise export sales revenue of less than 1% of total sales revenues with only a small number of firms attaining a higher export share. For firms exporting finished goods, the share of export sales is typically over 30% and there are plenty of examples for figures over 70%. Exporters of high-tech finished goods tend to cluster in the two categories at the ends of the scale (under 1% or over 70%) while firms exporting services tend to fall in the under-30% category although some of them appear in the over-70% group.

The high proportion of export sales for knowledge-intensive products indicates that traditional internationalization is not independent of innovation activities although there is no clear cause and effect relationship between export and innovation. The increased export activity of innovative firms relative to non-innovative firms suggests that positive innovation
performance may encourage external market presence and expansion. The relationship may, however, hold in the opposite direction: external market presence may encourage and boost innovative activities. The relationship is stochastic; 76% of traditionally internationalized firms in the sample are innovative. Whatever the direction of the association, it cannot be neglected.

We can shed further light on the relationship between innovation and internationalization by measuring the spatial distance between innovative vs. non-innovative firms and their markets. Looking at the spatial distribution of sales, there is a marked difference between innovative and non-innovative firms in terms of the frequency of those active in external markets. While 55% of innovative enterprises sell to the EU market, only 21% of non-innovative firms do so. The difference is even more striking with respect to other geographical regions. Non-innovative firms are most likely (84%) to sell in markets within a 100 km radius from the firm. (The corresponding figure is only 53% for innovative firms.)

Looking at contemporary internationalization behaviour, foreign investment connections that are based on mutual trust between the firms and are highly dependent on the target country as a market environment are more likely to be maintained by innovative firms. Not quite 10% of the SMEs in the sample made investments abroad. Most of these founded independent subsidiary firms.

Firms introducing innovation new to the world or to Europe occur with higher frequency among those internationalized in the contemporary sense than among that displaying traditional internationalization behaviour. The advantage of the former group further increases if we look at innovations new to Hungary or to the firm. The figures suggest that firms showing contemporary internationalization attain somewhat better innovation performance.

Looking at participation in innovative activities as a part of contemporary internationalization, one important factor is R&D collaboration in connection with innovation development, the success of which can be measured in terms of the number of patents produced jointly with the foreign partner. The great majority of the patent producing firms registered their patents independently but 10 of the firms produced patents jointly with their foreign partners.8

Membership in a corporate group is a special case of networking and may play an important role in the process of internationalization. In our sample, 7 of the 79 contemporary

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8 SMEs specializing in R&D constitute a special group of firms internationalized in a contemporary sense and are often acquired by another firm.
internationalized innovative firms have foreign owners, 5 have both foreign and Hungarian owners and 24 are members of an international network of some kind.

Functional networks involving collaboration between the members represent a higher level of networking. These include sales, supply, R&D and innovation networks. Innovative firms are more likely to participate in R&D than in innovation networks. The 50% gap between the frequencies of R&D versus innovation network membership shows once again that the firms tend to excel as knowledge generators rather than as knowledge utilizers. Although this is not a unique characteristic of Hungarian SMEs, it is a fact worth noting. The difference may signal the success of SMEs specializing in knowledge generation but it could also mean that knowledge generation is a forced choice and the SME sector is excluded from innovation because of a lack of knowledge broker firms in Hungary.

Somewhat more than 10% of the firms are characterised by network model-type internationalization. The remaining firms either follow a sequential model or a model specific to small enterprises specializing in R&D.

5.5. Factors affecting internationalization

Foreign market involvement and international collaboration are influenced by several factors. One of these is sales expectations. Among the objectives related to sales, the growth of sales profits and the increase of sales volume were rated very important on a Likert scale by both innovative and non-innovative firms. Export growth was very important for a relatively high percentage of innovative firms, while only a small proportion of non-innovative firms regarded it as an important goal. The latter were more likely to rate the growth of their share of the Hungarian market as very important.

Another important factor is the firms’ evaluation of their competitiveness in an international context. It is worth comparing their ratings related to their national versus their international competitiveness. The first major difference between the two contexts is the presence versus absence of competitors. About 10% of respondents did not have any competitors in the Hungarian market while 4% did not have any in an international context. The firms considered their products and technologies to be very competitive in comparison with Hungarian competitors’ and fairly competitive in comparison with foreign competitors’. Their organizational solutions and especially their marketing methods were considered to be poor even in a Hungarian context. (See appendix table 7)
The firms’ international competitiveness is greatly dependent on their existing competencies. The significance of the various factors shows only a partial overlap between innovative and non-innovative enterprises.

*Special skills* and the *quality of products/processes* are quite important for both groups. For innovative firms, these two factors share their high degree of importance with regular product development, the technological advantage of products and the firm’s development capacity. The market introduction of innovations is also fairly important for these firms. For non-innovative enterprises, the latter competencies are not very important but they attribute a great deal of significance to the ability to adjust to changes and to the reputation of the firm.

The factors bearing little significance in relation to competitiveness are cheap labour, production organisational advantages, the firm’s own patents and network membership. The set of factors innovative firms consider to be of moderate importance barely changes if the average values are calculated with “irrelevant” response excluded. For non-innovative firms, however, if “irrelevant” responses are excluded, low price becomes an important factor with respect to competitiveness.

The firms’ *external market presence* is motivated by several factors. These motivational factors need to be known by policy makers to be able to encourage enterprises’ participation in foreign markets and their internationalization. Four main categories of motivational factors of internationalization are distinguished here: (1) *competitiveness factors*, (2) *marketing factors*, (3) *environmental, geographical and others related to business processes*, and (4) *factors of knowledge and information enrichment*. The individual factors in these four categories were rated by the firms in terms of their power to motivate the firms’ activities. *Figure 2* displays the motivational power of the factors in the four categories for innovative and non-innovative firms.
Figure 2  Similarities and differences between innovative and non-innovative firms by the factors motivating internationalization

<table>
<thead>
<tr>
<th>Competition factors</th>
<th>Marketing factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve competitiveness</td>
<td>Acquiring information</td>
</tr>
<tr>
<td>Entering new market</td>
<td>To become visible</td>
</tr>
<tr>
<td>Avoiding pushing out from the market</td>
<td>Obtain references</td>
</tr>
<tr>
<td>Expansion abroad because of domestic market pressure</td>
<td></td>
</tr>
<tr>
<td>Following competitors</td>
<td></td>
</tr>
</tbody>
</table>

Environmental, geographic and other factors linked company processes

Factors of widening knowledge and information

Note: Influencing role of the factor: 3 = very strong, 2 = medium, 1 = hardly any, 0 = not relevant

On the whole, the factors related to competitiveness were held to be the most important. Next in the ranking, in a less prestigious position, are factors related to new knowledge, which are followed by environmental, geographical and other factors, and the last position is occupied by marketing factors.

Figure 2 clearly visualizes the similarities and differences between the motivational factors of the internationalization of innovative versus non-innovative firms. The two groups show the highest similarity with respect to marketing factors and the highest deviation in
relation to environmental, geographical and others related to business processes. The only factor with equal motivational power for the two groups is the exploitation of the advantages of EU membership, which is, however, held to be of little importance. Every other factor in this category exerts a much stronger influence on non-innovative firms than on innovative firms. At the time of investigation, Hungarian economic policy and a decrease in transaction costs were held to be the strongest motivational factors. Looking at competition factors, those with a pulling force tend to motivate innovative firms while those putting pressure on businesses tend to motivate non-innovative firms.

Looking at the motivational factors of internationalization related to knowledge and information enrichment, the acquisition of new knowledge is held to be outstandingly important by both groups of firms, as are the ability to keep up with the latest market and development trends and the hiring of high-skilled employees. The next group of factors have somewhat lower significance: the acquisition of new technology, access to modern infrastructure in order to accelerate RDI processes, and expansion of R&D staff capacity. Each of these factors is more important for innovative than for non-innovative firms. The results thus reveal that although the factors related to knowledge and information enrichment are more important for innovative than for non-innovative firms, their significance does not surpass the motivational power of other factors affecting internationalization.

Market size and market attractiveness are attributed special importance by both innovative and non-innovative firms. Although their rating differs between the two groups, existing personal and business connections and foreign invitations are both held to be important motivational factors.

Looking at the factors influencing the choice of countries for foreign market presence, a notable difference between the two groups of firms is that while the internationalization of innovative firms is strongly motivated by government support programmes, allowances and opportunities for contacts with science institutions, these factors have no significance for non-innovative enterprises. The attributes they find important include the proximity of customers, previous expansion and the revival of previous business connections.

It is worth noting that some of the factors that are commonly held to be important are not included in the set of major motivational forces by the firms under analysis. Factors having little effect on the choice of target country include the availability of cheap labour, proximity to the firm’s Hungarian location, proximity to suppliers, agglomeration factors and cluster presence.
With respect to the motivational forces underlying international RDI collaboration and network participation, the development of active business connections and the acquisition of special knowledge and technologies receive the highest rating but are nevertheless of only moderate importance. Interestingly, non-innovative firms – which have not yet joined any networks – consider network participation more important than the acquisition of knowledge and technologies as a driving force of development.

6. Conclusions

This paper has provided important information shedding some light on current processes characterising the innovation performance and internationalization behaviour of SMEs and the relationship between these activities. In Hungary, as well as in other European countries, there were significant changes in the business environment during the investigation period too. Since 2008, economic crises have had a negative impact on the activities of SMEs as well. However, the selected knowledge-intensive Hungarian industries suffered less from the negative effects of the economic downturn. The economic situation did not impair our understanding of the impact of the open innovation system on SMEs, the influence of internationalization on the activities of SMEs, or the adjustment of these Hungarian organisations to the new situation and to the increasingly borderless open innovation system.

The paper has revealed that Hungarian SMEs are adapting to the increasingly globally open innovation system. Some Hungarian SMEs can successfully participate in the borderless R&D and innovation process. Our detailed analysis of internationalization highlights that SMEs display signs of not only traditional, but also contemporary internationalization. Open innovation allows for a variety of collaboration patterns and there are a variety of reasons why partners are important. Innovative SMEs are not only passive supplier-developers contributing to the implementation of larger enterprises’ innovations but can also be active participants in this process. They have varied and extensive connections supporting their innovative activities. This is evidenced by their partnerships, the information sources used for innovative activities and their collaboration with various organisations in relation to the implementation of their innovations. Network model-type internationalization is present in the sample but only a tiny fraction of firms is involved (10%). The reason of the network model-type’s scarcity might be weak networking capabilities or carefulness of SMEs to pick partners, because they have limited opportunities to fail and they wish to avoid a loss of technological
competence as Narula observed a decade ago. (2004) If we take into account collaboration activities, an important finding is that collaboration with others plays a remarkable role in obtaining additional competencies.

The simplified classification of internationalization brought in the light high-growth firms are represented in a somewhat higher proportion among firms showing contemporary internationalization. There is a correlation between innovation performance and the internationalization of firms. The high proportion of export sales for knowledge-intensive products indicates that traditional internationalization is not independent of innovation activities although there is no clear cause and effect relationship between export and innovation. The increased export activity of innovative firms relative to non-innovative firms suggests that positive innovation performance may encourage external market presence and expansion. The relationship may, however, hold in the opposite direction: an external market presence may encourage and boost innovative activities. The relationship is stochastic; 76% of traditionally internationalised firms in the sample are innovative. Whatever the direction of the association, it cannot be neglected. Those firms that are showing contemporary internationalization achieve somewhat better innovation performance.

As regards the localisation issue, there is another interesting contribution to literature on SMEs. The pattern of collaboration in terms of the geographical location of partners shows a strong preference for Hungary, and partners are more likely to be located within a 100 km radius of the firm’s location either in business connections or R&D collaborations. In terms of the spatial distribution of sales there are differences between innovative and non-innovative firms. More than half of innovative enterprises sell to the EU market, while only one fifth of non-innovative firms do so. Among the small group of foreign collaboration partners, such as universities and foreign partner enterprises, we find roughly the same number of firms based in the EU and in North America.

The degree of novelty of an innovation is likely to be related to the region in which the firm is based. The firms based in Budapest, a relatively favourable innovation environment within Hungary, show better results than their peers based in other locations.

The firms by types of internationalizations do not differ substantially in terms of their growth. The absolute majority of innovative firms in the group showing contemporary internationalization mostly follow from the definition of the group. An interesting feature is that firms introducing products or processes new to the world or to Europe occur with a higher frequency among traditionally internationalised firms than in the other group. One explanation for this difference may be that some R&D activities carried out for innovation
were sold prior to the introduction to the market, without any self-innovation. It is also possible, however, that some of the firms in the contemporary internationalization group are involved in R&D activities that support market piloting or testing but do not lead to innovations with a high degree of novelty at the given firm.

The firms’ external market presence and collaboration are motivated by several factors. These motivational factors need to be known by policy makers to be able to encourage enterprises’ participation in foreign markets and their internationalization. With regards to the motivation for internationalization described in the literature (Dunning 1997, Dunning and Lundan 2008, Archibugi and Lundvall 2001), two factors strongly characterise SMEs internationalization and innovation in the sample: market-seeking and learning from abroad. These motivations are important for both innovative and non-innovative firms, even if some of the descriptors of these motivations have a different importance for them. The importance of resource-seeking is low for innovative firms and is of virtually no importance to non-innovative firms.

Focusing on the innovation status of the firms, the data grouped them according to the innovative versus non-innovative dichotomy in Table 6. The data along this dimension of innovation are distinguished by types of internationalization. This table provides some interesting information even if the great majority of internationalised non-innovative enterprises are characterised by traditional internationalization.
Table 6  The main differences between innovative and non-innovative firms by their proportion of internationalization and motivations

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Innovative</th>
<th>Non Innovative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internationalization</td>
<td>80 %</td>
<td>43 %</td>
</tr>
<tr>
<td>• Traditional</td>
<td>38 %</td>
<td>41 %</td>
</tr>
<tr>
<td>• Contemporary</td>
<td>42 %</td>
<td>-</td>
</tr>
<tr>
<td>Proportion of export firms</td>
<td>60 %</td>
<td>23 %</td>
</tr>
<tr>
<td>Investing in foreign markets</td>
<td>Few</td>
<td>Rare bird</td>
</tr>
</tbody>
</table>

Motivation for internationalisation by factors

- Marketing                                         Very similar
- Environmental, geographic and other factors       Weak impact
  Medium-strong impact
- Competitiveness                                    Pulling effect
  Pushing effect
- Broadening knowledge and information                Strong-medium-importance
  Weak-medium-importance
- Membership in international networks               Existence of members
  No members

The presence of novelties to world                   to world

- Non internationalized                               16 %
- Traditionally internationalized                      24 %
- Contemporary internationalized                      29 %

Source: KKVENT_8 project databank.

Looking at the developers of the innovations, the innovation information sources, the collaboration partners and the internationalization of the firms, we find that in terms of innovation mode, technology modifiers occur most frequently in the survey sample. Technology adopters are also represented in the sample, but there are barely any strategic innovators for whom innovation is a core component of their competitive strategy. The scarcity of strategic innovators is only partly explained by their small number even in these knowledge-intensive industries. The other reason is that firms using innovation as a strategic activity may quickly grow out of their SME status or may be acquired by MNCs.

For knowledge-intensive firms, intellectual property may play an important role. The survey results reveal a clear positive relationship between the production of intellectual property and innovation performance. Several firms proved to be successful in producing patents and innovations themselves. The experiences of the firms suggest, however, that patent development and the implementation of technological innovations often rely on
collaboration with others, which plays an important role in obtaining additional competencies and contributes to the success of innovation.

A by-product of this research relates to one of the impacts of R&D supporting schemes. Among the limited participating SMEs on Hungarian programmes and within the framework of European programmes the presence of support-hunters is relatively strong. These firms are focusing on R&D activities but rarely realise R&D market sales revenues. This group of firms finance their existence by exploiting R&D tenders or other support funds without producing intellectual or financial results, and thus lose their direct links to the market.

The survey results reveal that SMEs also display contemporary internationalization behaviour and there is a relationship between their innovative activities and their internationalization behaviour. Although some of the SMEs continue to follow the closed innovation model, a substantial share of the firms are characterised by open innovation. Those subscribing to the closed model tend to internationalise the traditional way, as expected from the nature of the model. Those following the open innovation model and collaborating with other firms and institutions have a better chance of borderless, contemporary internationalization.

**Lessons for public policies**

The information gained from the research is important from the perspective of innovation and economic policymaking. The most important conclusions of the study for evidence-based public policy are as follows:

1. With respect to the introduction of innovations new to the world or to Europe, the firms based in the relatively favourable innovation environment of Budapest showed better performance than their peers based in other regions of the country. The development of the innovation environment presents a challenge for several policies. *The Hungarian environment and innovation system continue to provide inadequate support and only moderate encouragement for SMEs*. The degree of success of the firms on the international stage is hampered more by the problems generated by the Hungarian economic environment (regulations, administration) than by financial difficulties. Reforming the innovation environment is by no means an easy task, but it is absolutely essential for progress. This conclusion of the research concords with Kiss (2009).

2. *R&D* was the most important innovation activity among firms introducing major innovations. In addition to R&D, innovation followers also highlighted the importance of
training, which may be an important message not only for innovation policy but also for education policy. Another kind of training that is also important for SMEs is the type that is directed at upgrading the skills for participating in international relationships. The training issue is still more important in Hungary than for established market economies.

3. One innovation-related activity that is crucial for SMEs is to acquire up-to-date machines and equipment. Their lack is a physical limiting factor on innovation. Future supporting schemes will have to deal with this issue.

4. Another significant finding is that creative firms and those developing their innovations in collaboration with others occur with substantially higher frequency among firms in knowledge-intensive industries than in the Hungarian economy as a whole. It is important that innovation policy should address this issue. In order to improve the competitiveness of the economy and to create an innovative economy, it is at least as important to expand the group of enterprises willing to innovate as it is to improve the efficiency and performance of existing innovators.

5. The presence of support-hunters among knowledge-intensive SMEs highlights the importance of revising certain elements of the Hungarian research support system. Autonomous information sources could help the policy-makers to avoid support-hunters.

6. The bureaucracy and other institutional problems are still deterring some SMEs from innovation activities and internationalization. A better understanding of SMEs can help to build a system that effectively supports international expansion and competitiveness without further distorting the market.

7. The stochastic relationship observed between exporting and innovation cannot be disregarded by policies intending to encourage innovation at SMEs. The equal opportunity of SMEs has to be ensured through customised incentives for both SMEs that are already innovative and for those that are not yet innovative. As regards upgrading the innovative performance of the economy, it is crucial to broaden the circle of innovative firms and to encourage innovative firms to introduce novelties on the international market, if only at the European level.

8. Equal opportunity of SMEs has to be ensured through tailor-made incentives both SMEs that are already innovative and for those that are not yet innovative. As regards upgrading the innovative performance of the economy, it is crucial to broaden the circle of innovative firms and to encourage innovative firms to introduce novelties on the international market, if only at the European level.
Funding
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APPENDIX

Appendix 1 Selected sectors relating to NACE Rev2

<table>
<thead>
<tr>
<th>Selected sectors</th>
<th>Corresponding NACE Rev2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biotechnology</td>
<td>This sector does not exist in NACE classification. Our empirical research covered only a part of this sector, the so called red biotechnology that relates to medical processes. The nearest NACE Rev.2 classes are for example: 72.11-Research and experimental development on biotechnology, 21.1-manufacture of basic pharmaceutical products</td>
</tr>
<tr>
<td>Medical precision instruments manufacturing</td>
<td>26.51 Manufacture of instruments and appliances for measuring, testing and navigation, 26.60 Manufacture of irradiation, electro-medical and electric-therapeutic equipment, 32.50 Manufacture of medical and dental instruments and supplies</td>
</tr>
<tr>
<td>Information and communication technology (ICT) services</td>
<td>Few sub-sectors were selected from this large sector: 26.1 Manufacture of electronic components and boards, 26.2 Manufacture of computers and peripheral equipment, 26.4 Manufacture of consumer electronics, 62.01 Computer programming activities, 62.02 Computer consultancy activities, 62.03 Computer facilities management activities, 62.09 Other information technology and computer service activities</td>
</tr>
<tr>
<td>Engineering activities</td>
<td>71.12 Engineering activities and related technical consultancy, 71.20 Technical testing and analysis</td>
</tr>
</tbody>
</table>

Appendix 2 The e-questionnaire and its design

The e-questionnaire designed to survey the innovative activities and internationalization of SMEs and the relationship between the two processes comprises questions grouped into seven topic categories.

1. General characteristics of the firm
   (The location where the firm is based; the year of founding; legal status; ownership structure; major changes in the past 3 years; sales markets in a geographical sense; the importance of various objectives; membership in corporate group.)

2. The firm’s innovative activities
   (Whether the firm has introduced innovations since 1989, the type of innovations introduced in the past three years; the developers of the innovation; R&D activities and their use; innovation-related activities; innovation-related information sources and the importance of collaboration; type and importance of collaboration with foreign partners.)

3. The firm’s network participation
   (Network membership, starting date of membership, and type of network; frequency of participation; the purpose of membership; the effects of network membership.)

4. The firm’s competitiveness
   (Position in ranking of Hungarian and international competitors; importance of various factors in competitiveness.)

5. The firm’s position in an international context
   (Forms of external market connections; the share of export and import by product category; supplier or subcontractor status; foreign direct investment activity; development, registration and purchase of patents; development of know-how in collaboration with foreign partner; external market sale of know-how and license.)

6. Motivations of internationalization
   (The most important motivational factors of foreign activities and development of connections with foreign partners; support received from Hungary or from an institution in the target country for the purpose of international expansion, finding partners or R&D and innovation activities; motivations for participation in R&D and innovation collaboration or network with partners in foreign ownership; factors impeding foreign market involvement; the major obstacles to international R&D and innovation collaboration.)

7. The basic details of the firm
Notes:

- Wherever terminology or questions used in Hungarian statistical surveys were available, these were used in the various question blocks of the e-questionnaire. This facilitated the completion of the questionnaire since respondents saw questions using terminology familiar to them. A further advantage of the design is that some of the results are directly comparable to macro-level data.

- In line with the objectives of our research, the e-questionnaire includes several questions that have not been included in Hungarian surveys before. Exploiting the advantages of the e-questionnaire method, the majority of the questions were designed as multiple-choice questions, where respondents selected their answers from a pre-defined list of categories or alternatives. This design helped decrease the time needed to complete the questionnaire and also simplified data processing. The e-questionnaire method had the further advantage of allowing respondents to focus on questions that were relevant to them.

- In order to ensure that respondents’ interpretation of the questions developed on the basis of expert knowledge would correspond to the investigators’, the questionnaires were tested through personal interviews in each of the selected industries. The pilot study tested whether the questions were easy to understand, free from ambiguity and relevant to respondents, and response time burden was measured to avoid the time factor lowering completion rate. Following the pilot study the contents of the questionnaire were finalised and the e-questionnaire was designed. The technical implementation of the e-questionnaire (html programming) and its administration were carried out with the help of Crosstabs First Ltd. (This partner is also bound by the ethical guarantees concerning the handling of respondents’ individual data.) The programming process involved repeated testing of the on-line manageability of the e-questionnaire at the various stages of development. It was of paramount importance that
  o respondents should be able to interrupt the completion of the questionnaire and return to it at a later time;
  o only relevant questions should appear (if, for instance, a respondent did not introduce innovations, the question asking for the type of innovations introduced was to remain hidden; or if a respondent did not have any export activity, the questions asking about export details did not appear);
  o If a response was presumably omitted by accident, a warning should appear, but if the question is still not answered, this should not prevent the next question from appearing.
  o The recording and automatic processing of responses were also tested during the development phase. The e-questionnaire was optimised for MS Explorer but other browsers could also be used to complete it. During the data collection period, the e-questionnaire could be accessed at http://crosstabs.hu/kkvent.

- Thanks to the user-friendly design and technical solutions and to the minimal response time burden, there was a high response rate (22%) and the questionnaire was fully completed by most of those who started it. These data suggest that the questions were considered to be relevant even if a few requests to provide details were passed over.
Appendix Tables

Appendix Table 1 Number of firms by source of register for on-line survey

<table>
<thead>
<tr>
<th>Source</th>
<th>Sector</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) HCSO CÉG-KÓD-TÁR (Business register)</td>
<td>All 4</td>
<td>1678</td>
</tr>
<tr>
<td>2) HCSO R&amp;D firm register</td>
<td>All 4</td>
<td>188</td>
</tr>
<tr>
<td>3) National Development Agency - National Development Plan supported SMEs</td>
<td>All 4</td>
<td>88</td>
</tr>
<tr>
<td>4) Biotechnological Association, List of members</td>
<td>Biotechnology</td>
<td>58</td>
</tr>
<tr>
<td>5) Hungarian Pharmaceutical Manufacturers Association</td>
<td>Medical instruments</td>
<td>52</td>
</tr>
<tr>
<td>6) Association of Hungarian Consulting Engineers and Architects</td>
<td>Engineering</td>
<td>102</td>
</tr>
<tr>
<td>7) Association of Informatics Businesses</td>
<td>ICT</td>
<td>104</td>
</tr>
<tr>
<td>8) On-line business databank</td>
<td>All 4</td>
<td>20</td>
</tr>
<tr>
<td>9) Snowball</td>
<td>All 4</td>
<td>117</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>2407</strong></td>
</tr>
</tbody>
</table>

Notes:

1. If the study is focusing on industries and not on various sector it is much easier to use existing registers of Statistical Office. As this study focused on sectors other employed business databanks helped to identify more firms that are belonging to the investigated sectors.

2. HCSO R&D register is a part of the business register. Application of R&D register supported the selection of firms in investigated sectors. Even these efforts our research sample is not a representative statistical sample.

The lists of businesses obtained from the various sources were checked for duplicate entries and all contact details were verified and updated. With the duplicate entries and inaccessible e-mail addresses filtered out, the final register included the contact details of 1,110 enterprises.

Appendix Table 2 Changes of sales (2006-2008)

<table>
<thead>
<tr>
<th>Size of Changes in sales</th>
<th>Number of firms</th>
<th>% of firms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Innovative</td>
<td>Non Innovative</td>
</tr>
<tr>
<td>Sale increased at least 10%</td>
<td>63</td>
<td>43</td>
</tr>
<tr>
<td>Sale changed less than 10%</td>
<td>164</td>
<td>142</td>
</tr>
<tr>
<td>Sale decreased at least 10%</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>246</td>
<td>190</td>
</tr>
</tbody>
</table>

Source: KKVENT_8 project databank.
### Appendix Table 3 Innovative firms by dimension of innovation

<table>
<thead>
<tr>
<th>Types of innovations</th>
<th>All</th>
<th>One</th>
<th>Two</th>
<th>Three</th>
<th>Four</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>156</td>
<td>38</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Process</td>
<td>137</td>
<td>32</td>
<td>+</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Organisational</td>
<td>38</td>
<td>–</td>
<td>–</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Marketing</td>
<td>34</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>All</td>
<td>70</td>
<td>17</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td>70</td>
<td>84</td>
<td>17</td>
<td>19</td>
</tr>
</tbody>
</table>

**Signs:**  
+ = the innovative firms have introduced the given type;  
– = the given type of innovations has not occurred.

**Source:** KKVENT_8, project databank

### Appendix Table 4 Importance of information related to innovation

<table>
<thead>
<tr>
<th>Sources of Information</th>
<th>Total</th>
<th>Very important</th>
<th>Important</th>
<th>Hardly important</th>
<th>Mean* (Max. = 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All respondents</td>
<td>Total except no significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-house</td>
<td>135</td>
<td>98</td>
<td>34</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Costumers</td>
<td>133</td>
<td>79</td>
<td>37</td>
<td>17</td>
<td>2.2</td>
</tr>
<tr>
<td>Competitors or other firms within the sector</td>
<td>121</td>
<td>37</td>
<td>51</td>
<td>33</td>
<td>1.7</td>
</tr>
<tr>
<td>Conferences, fairs and exhibitions</td>
<td>114</td>
<td>39</td>
<td>48</td>
<td>27</td>
<td>1.7</td>
</tr>
<tr>
<td>Suppliers of equipment, materials, services or software</td>
<td>108</td>
<td>35</td>
<td>50</td>
<td>23</td>
<td>1.6</td>
</tr>
<tr>
<td>Standards</td>
<td>105</td>
<td>38</td>
<td>27</td>
<td>40</td>
<td>1.5</td>
</tr>
<tr>
<td>Technological or commercial publications</td>
<td>103</td>
<td>31</td>
<td>40</td>
<td>32</td>
<td>1.4</td>
</tr>
<tr>
<td>Scientific journals</td>
<td>101</td>
<td>36</td>
<td>43</td>
<td>22</td>
<td>1.5</td>
</tr>
<tr>
<td>Universities</td>
<td>90</td>
<td>28</td>
<td>40</td>
<td>22</td>
<td>1.4</td>
</tr>
<tr>
<td>Colleges</td>
<td>39</td>
<td>11</td>
<td>17</td>
<td>11</td>
<td>0.6</td>
</tr>
</tbody>
</table>

**Note:** Very important = 3, Important = 2, Hardly important = 1, Not significant = 0.  
The values of those sources that are unimportant for firms (such as professional or trade organisations; consultants, technological brokers and private R&D institutes; and HAS research institutes) are excluded from the table.  
**Source:** KKVENT_8, project databank.
## Collaboration at different stages of the innovation process by type of partner

<table>
<thead>
<tr>
<th>Partners in innovations</th>
<th>Drafting idea</th>
<th>Elaboration of idea</th>
<th>Prototyping</th>
<th>Testing</th>
<th>Applying in the practice</th>
<th>Controlling application</th>
<th>Evaluation of results</th>
<th>Entering market</th>
<th>International distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customers</strong></td>
<td>106</td>
<td>49</td>
<td>31</td>
<td>26</td>
<td>64</td>
<td>63</td>
<td>45</td>
<td>48</td>
<td>36</td>
</tr>
<tr>
<td><strong>University</strong></td>
<td>76</td>
<td>35</td>
<td>52</td>
<td>34</td>
<td>43</td>
<td>18</td>
<td>22</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td><strong>Foreign partners</strong></td>
<td>64</td>
<td>15</td>
<td>15</td>
<td>21</td>
<td>37</td>
<td>26</td>
<td>23</td>
<td>26</td>
<td>24</td>
</tr>
<tr>
<td><strong>Technology supplier SME</strong></td>
<td>37</td>
<td>10</td>
<td>18</td>
<td>24</td>
<td>22</td>
<td>12</td>
<td>9</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td><strong>Other company in the group</strong></td>
<td>24</td>
<td>12</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>18</td>
<td>10</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td><strong>Public research organisations</strong></td>
<td>28</td>
<td>13</td>
<td>17</td>
<td>13</td>
<td>16</td>
<td>7</td>
<td>7</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td><strong>Competitors or other firms in the sector</strong></td>
<td>21</td>
<td>-</td>
<td>3</td>
<td>9</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>Colleges</strong></td>
<td>20</td>
<td>13</td>
<td>19</td>
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<td>10</td>
<td>7</td>
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<td>4</td>
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</tr>
<tr>
<td><strong>Multinational suppliers of high-tech materials</strong></td>
<td>19</td>
<td>7</td>
<td>6</td>
<td>9</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Multinational suppliers of technology</strong></td>
<td>18</td>
<td>6</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>-</td>
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<tr>
<td><strong>SMEs supplying high-tech materials</strong></td>
<td>12</td>
<td>7</td>
<td>6</td>
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<td>1</td>
<td>2</td>
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*Note:* Only those partners are in the table that were mentioned at least by 10 respondents.

*Source:* KKVENT_8 project databank.
### Appendix Table 6  

**Degree of novelty and innovation activities**

<table>
<thead>
<tr>
<th>Innovation related activities (ranked by using to world novelties and new to Europe)</th>
<th>Degree of novelty</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>World novelty</td>
<td>New to Europe</td>
<td>New to Hungary</td>
<td>New to firm</td>
</tr>
<tr>
<td>In-house R&amp;D</td>
<td>29</td>
<td>21</td>
<td>40</td>
<td>47</td>
</tr>
<tr>
<td>Contracting others for R&amp;D</td>
<td>15</td>
<td>9</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>Train the employees for introducing innovations</td>
<td>9</td>
<td>12</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Performing R&amp;D for contractors</td>
<td>9</td>
<td>9</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Acquiring machines, equipment and software to innovations</td>
<td>6</td>
<td>9</td>
<td>28</td>
<td>22</td>
</tr>
<tr>
<td>Purchasing outside knowledge (patents, know-how and other novelties, )</td>
<td>8</td>
<td>6</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Purchasing R&amp;D findings</td>
<td>6</td>
<td>6</td>
<td>9</td>
<td>6</td>
</tr>
</tbody>
</table>

*Source: KKVENT_8 project databank.*

### Appendix Table 7  

**Competitiveness of innovative firms (self-evaluation)**

(Number of firms)

<table>
<thead>
<tr>
<th>Type of innovations</th>
<th>Domestic competitiveness</th>
<th>International competitiveness</th>
<th>No competitor</th>
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<tbody>
<tr>
<td></td>
<td>Very strong</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Product innovation</td>
<td>69</td>
<td>46</td>
<td>6</td>
</tr>
<tr>
<td>Process innovation</td>
<td>66</td>
<td>56</td>
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<tr>
<td>Organisational innovation</td>
<td>25</td>
<td>77</td>
<td>33</td>
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<tr>
<td>Marketing innovation</td>
<td>24</td>
<td>59</td>
<td>43</td>
</tr>
</tbody>
</table>

*Source: KKVENT_8 project databank.*