

ENTREPRENEURIAL ORIENTATION OF KNOWLEDGE-BASED ENTERPRISES IN CENTRAL AND EAST EUROPE¹

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1 INTRODUCTION

There is a widespread recognition that entrepreneurship is not simply an individual matter but also refers to characteristics of entire organizations. In that context, the key features of organisations are their entrepreneurial orientation. Since the pioneering paper by Miller (1983), a sizable literature has grown up that investigates the entrepreneurial activity of the firm and employs measures of the degree to which a firm can be classified as entrepreneurial (Covin and Slevin, 1989; Lumpkin and Dess, 1996; Zahra, 1996; Shane and Venkataraman, 2000; Shane, 2003; Wiklund and Shepherd, 2003, Salaran & Maritz, 2009). Entrepreneurial orientation (EO) is seen as consisting of a number of different dimensions. Miller and Friesen (1982, 1983), Miller (1983) and Covin and Slevin (1989) have defined entrepreneurially oriented organisations as those that are innovative, proactive (pioneering) and risk taking. More precisely, according to Miller (1983:771) “an entrepreneurial firm is one that engages in product-market innovation, undertakes somewhat risky ventures, and is first to come up with ‘proactive’ innovations”. For Covin and Slevin (1989:77) “entrepreneurial firms are those in which the top managers have entrepreneurial top management styles, as evidenced by the firms’ strategic decisions and operating management philosophy”.

This chapter explores the factors influencing entrepreneurial orientations of firms but it adds an important new dimension – the role of networks in entrepreneurial orientation (EO). This may seem quite logical in the context of volume that adopts systemic perspective on entrepreneurship. Indeed, external networks may influence entrepreneurial orientation. They may differ across different sectors depending on their networking, learning, and competitive strategies (March 1991, Shane and Venkataraman 2000, Lumpkin and Dess 2001, Shane 2003), especially as these relate to technological, market and institutional opportunities (Radošević, 2007; Radošević and Yoruk, 2013). Equally, EO are shaped by external factors like knowledge infrastructure, FDI linkages and business environment.

The research is based on in-depth survey of 60 knowledge-intensive entrepreneurial (KIE) firms in four Central and East European countries⁴ (CEEC). The issue of EO to the best of our knowledge has not been explored in the context of this region. CEE is largely middle-income region, which has undergone tremendous institutional transformation as well as integration into the world and EU economy with widely differing outcomes (World Bank, 2005; EBRD, 2013, IMF, 2013; Pisani-Ferry et al, 2010). The issue of entrepreneurship and within it primarily the role of individuals has been relatively widely explored (for example, see Smallbone and Welter, 2001; Estrin, Meyer and Bytchkova, 2005; Estrin and Mickiewicz, 2010). However, the KIE in CEE has not been to the best of our knowledge explored (for exception see Radošević, Savic, and Woodward, 2010).

The last 25 years in this region represent a historically unique period for exploring is there anything unique or specific about EO of CEE firms. In view of the large-scale systemic change, which is usually labelled as ‘transition’ (EBRD, 2013), it is quite interesting to explore whether external networks have facilitated or hindered EO of firms. KIE is embedded in systems composed of heterogeneous actors and networks of various types, and is shaped by institutions (regulatory systems). In that respect, our inquiry takes a broader perspective and goes beyond a focus on innovativeness, proactiveness, risk taking, autonomy and aggressiveness which characterise current approaches. We also take into account the role of networks as an important new element of EO. We explore this issue in the context of the region where external networks of firms have undergone deep transformation and thus the role of networks is quite pertinent issue. More specifically, we explore EO of KIEs, which are usually perceived as the key promoters of technology upgrading and structural change (Coad and Reid, 2012). In the context of the CEE, networking strategy has been described as one of firms’ major strategies (Peng, 2000) both as a reflection of opportunities or as a survival strategy i.e. a response to fundamental uncertainties of the institutional context (Stark, 1996). In Radošević, Yoruk and Woodward (2011) we showed that EO is inherently different in different sub-populations of firms depending on their sources of knowledge.

⁴ Croatia, Czech Republic, Hungary and Poland.

In the next section we present the extended theoretical background on entrepreneurial orientation (EO). Section three describes the sample of firms studied as well as the data and methodology, while section four presents the results. Section five concludes.

2 THE CONCEPTS

2.1 Firm Level Entrepreneurial Strategies Based on Dimensions of Entrepreneurial Orientation

In this chapter we follow Miller (1983) who was the first that perceived entrepreneurial activity in the firm as the activity that arises from the effective complementary and simultaneous entrepreneurial innovativeness, proactiveness and risk-taking. Following Miller (1983), Covin and Slevin, (1989, 1991) and Lumpkin and Dess, (1996, 2001) developed the notion of *entrepreneurial orientation* defining it as strategy-making processes and styles of firms that engage in entrepreneurial activities. The concept was well-received in the entrepreneurship literature. Further studies comprise Zahra (1993) and Zahra and Covin (1995: 44) who used the concept of corporate entrepreneurship and suggested that ‘it provides a potential means for revitalizing established companies through risk taking, innovation, and proactive competitive behaviours’. Ireland, Covin, and Kuratko (2009: 21) define corporate entrepreneurship strategy as “a vision-directed, organization-wide reliance on entrepreneurial behaviour that purposefully and continuously rejuvenates the organization and shapes the scope of its operations through the recognition and exploitation of entrepreneurial opportunity”. Morris, Kuratko, and Covin (2008) contend that a firm is employing an *entrepreneurial strategy* when the actions taken in a large firm to form competitive advantages and to exploit them through a strategy are grounded in entrepreneurial actions. Therefore, dimensions of EO, to the extent that they are undertaken in a firm, determine its *entrepreneurial strategy*. Further, when establishing direction and priorities for the product, service, and process innovation efforts of the firm, the company is formulating its entrepreneurial strategy. In this chapter, we primarily refer to EO though we recognise that developed dimensions of EO may implicitly or explicitly lead to entrepreneurial strategy.

Lumpkin and Dess (2001) added two other dimensions to the original dimensions of EO - innovativeness, proactiveness and risk taking proposed by Miller (1983): autonomy and competitive aggressiveness. For Covin and Slevin (1989) and Lumpkin and Dess (2001: 431), these five dimensions capture:

- *innovativeness* refers to willingness to support creativity and experimentation in introducing new products/services, and novelty, technological leadership and R&D in developing new products and processes;
- *proactiveness* is an opportunity-seeking, forward-looking perspective involving introducing new products or services ahead of the competition and acting in anticipation of future demand to create change and shape the environment and it captures the tendency of a firm to lead rather than follow, to be the first to introduce new products, processes and/or services;⁵
- *risk-taking* embraces a firm’s predilection for risk, its perception of risk as necessary for success in the competitive environment in which it finds itself, and its tendency to act boldly and aggressively under conditions of uncertainty, as well as tendency to take actions such as venturing into unknown new markets, committing a large portion of resources to ventures with uncertain outcomes, and/or borrowing heavily;⁶

⁵ This suggests that timing of innovation is important and thus companies that are pioneers are considered as more entrepreneurial than followers.

⁶ There are different proxies regarding this aspect. These could be differentiated as risk based on a) diversification (i.e. entry into new area), b) specific sectoral risks (i.e. high technology activities being more risky than low technology activities) although this is only for technology risk, and c) size of investments or size of loans.

- *autonomy* is defined as independent action by an individual or team aimed at bringing forth a business concept or vision and carrying it through to completion; contrary to autonomy, dependence of entrepreneur would prevent him to exercise any of the other features of EO; and
- *competitive aggressiveness* reflects the intensity of firm's efforts to outperform industry rivals, characterized by a combative posture and a forceful response to competitor's actions. It differs from proactiveness in the sense that proactiveness is about creating opportunities (i.e. getting to a place where the competition hasn't been yet), but competitive aggressiveness is about defending them (i.e. keeping the competition out of place, or eliminating them if they arrive).

In continuation we use this conceptual framework but we extend it by exploring the role of networks in EO. Overall, we aim to explore whether firms in emerging markets like CEE have all the attributes of developed EO and how the specific external constraints or opportunities affect their EO.

2.2 Network Orientation

The importance of networks for entrepreneurship emerges from the interactive nature of knowledge generation and utilisation. For KIEs to innovate the firm needs to access external knowledge through its networks and process that knowledge combining it with internal knowledge. When favourable, networks operate as external scale economies which impact a firm's EO through benefits of close proximity, through backward or forward linkages or joint infrastructure, they improve a firm's rate of growth, reduce risks and improve innovativeness. If developmental or opportunity driven networks surround KIEs they could facilitate their growth through knowledge exchange with other firms. On the other hand, rent-seeking networks can block entry and growth of entrepreneurially oriented firms. It is not obvious in which direction networking affects proactiveness and autonomy as these seem to have ambiguous effects – i.e. they may both increase and decrease these two dimensions of EO.

Malerba (2010) argues that successful entrepreneurs are 'consummate networkers' who thrive in communities. Referring to views of the firm as a 'processor of information', Cohendet and Llerena (2010) see the governance of the firm as consisting primarily in "the coordination of distributed pieces of knowledge and distributed learning processes." Lazonick (2002a, 2002b) in his theory of innovative enterprise explains how transformation of external technological and market conditions is the essence of the innovative firm. For such a process to take place, an enterprise has to pursue organizational integration or a set of incentives to employers and managers to cooperate in contributing their skills and efforts toward the achievement of common goals. Business enterprise is a social structure that is embedded in a broader (typically national) institutional environment. The industrial, organizational, and institutional conditions of which networking is very important do promote or constrain the EO of an enterprise. Network oriented entrepreneurial strategies are especially important in the context of emerging markets where firms are deprived of various local knowledge sources.

Access to external knowledge may come from a number of sources, including cooperation with supply chain partners, but also from cooperation with other kinds of organizations specifically devoted to research, or from various published sources, such as journals and patent disclosures (Shaw, 1994). It has become commonplace to note that the importance of networking for innovation has grown in recent decades due to the distributed nature of the innovation process and the complexity of knowledge. A number of studies have demonstrated a positive link between a firm's R&D intensity and the number and intensity of its strategic relationships (Powell and Grodal, 2005). Eisenhardt and Schoonhoven (1996) point to a link between networking and various dimensions of EO, with evidence from the US semiconductor industry, the more a company's strategy is oriented toward risk-taking, the more alliances it forms. This confirms the view that networking may be a risk reducing strategy in conditions of highly uncertain technological opportunities. How various aspects of networking (both internal and external to the organization) relate to EO has been studied by Walter et al. (2006) and Salaran and Maritz (2009). Stam and Elfring (2008) investigate whether the intensity of networking can lead to higher levels EO.

The relationship between networking characteristics of the firm and its EO is important for catching up economies where coupling of different knowledge sources is one of the key entrepreneurial challenges. Based on Table 1 below, we explore the extent of autonomy, innovativeness, risk-taking, proactiveness, competitive aggressiveness and networking orientation. We refer to network orientation as firm's perception about the importance of taking part in collaborative agreements and awareness regarding advantages of collaborating en route to innovation. Elements of networking are also embedded in autonomy, innovativeness and competitive aggressiveness

dimensions (see table 1 additions in italics). Network orientation, on the other hand, captures the ‘perception’ of the firm with regard to importance of networks.

Table 1. Dimensions of entrepreneurial orientation (based on Covin and Slevin, 1989,1991; Lumpkin and Dess, 1996, 2001) including network orientation *⁷

Autonomy	Innovativeness	Risk-taking	Proactiveness	Competitive aggressiveness	<i>Network orientation</i>
1.Firm origin 2.Factors influencing company formation: a. Market and financial opportunities b. Technical knowledge <i>c. Network experience</i>	1. Basic indicators: a. Number of new products/processes/services introduced into the market during the last three years b. Share of new products/processes/services in total sales during the last three years c. Innovation productivity d. Share of income/payment from/for licensing/royalties during the last three years 2. Sources of knowledge for developing new products: <i>a. Value chain and market networks</i> <i>b. External R&D</i> <i>c. In-house R&D</i>	1. Source of funding to start the company 2. Factors creating obstacles in the entrepreneurial activity of the company: a. Technology, market and labour related factors b. Know-how related factors c. Financial constraints 3.Institutional barriers in setting up and operating company: a. Corruption and informal obstacles b. Regulatory impediments	1.Main strategy of the firm 2.Implementation of strategic activities: a. Technology upgrading b. Management and personnel training 3. Sources of knowledge for exploring new ideas: <i>a. External R&D</i> <i>b. Market networks</i> <i>c. Value chain and in-house R&D</i>	1. Primary competitive advantage of the company 2.Factors creating and sustaining competitive advantage 3.Export performance	<i>1. Participation in collaborative agreements:</i> <i>a. Production capability acquisition</i> <i>b. Technology acquisition/knowledge generation</i> <i>2.Contribution of networking to the activities of the company:</i> <i>a. in market-related areas</i> <i>b. in technology-related areas</i>

Given the absence of this type of research in the context of the CEE we are not able to formulate prior hypotheses and thus this chapter is largely of exploratory nature. Very tentatively we assume that all elements where external factors play a very important role like networking (knowledge infrastructure, value chains) and risk taking (financial system, venture capital) may be constrained i.e. EO may be deficient in these dimensions.

3 DATA AND RESEARCH METHODS

3.1 Selection of Sectors and Firms

We study two sectors, computer and related activities (NACE Rev1.1, K72) and manufacturing of machine tools (NACE Rev 1.1, DK29.4). CEEs have inherited good competencies in mechanical technologies from the socialist period, which explains why we have chosen machine tools. Also, CEE are integrated into global value chains in IT which is quite new sector for these economies and where EO issues may be quite different when compared to old sector as machine tools. Finally, two sectors are capital goods (machine tools) and ‘knowledge capital goods’ sectors (IT) and, despite their limited sizes as specialized supplier sectors, they play very important role in knowledge systems of these economies.

We have selected a sample of firms in both sectors that can be considered KIEs. These are defined as firms that are innovative, have significant knowledge intensity in their activity, and which explore and exploit innovative opportunities. KIE have internal management, business model and organization that enable them to transform knowledge into innovation. KIE operates based on new products and processes (innovations), which are knowledge intensive, and, hence both use and generation of knowledge are essential part of KIE.

⁷ Italics denote elements, which we have added to dimensions of EO developed by cited authors.

The major operational criterion for selection of firms from machine tools and IT is that they are innovative. They should have introduced new products, processes or services onto the market during the last three years. However, in addition to this criterion, a selected firm should meet at least one of the auxiliary criteria below:

1. It is employing highly skilled personnel (MSc, PhDs) in engineering sciences,
2. It is continuously (not intermittently) investing in R&D, or
3. It has registered patents.

The use of these criteria would have made quite difficult use of a random sample. Hence, we have selected the overall portfolio of firms so that they are diverse in several dimensions (success, strategy, etc.). Unlike AEGIS definition of KIEs firms in our sample are both new and old firms, but they are all innovating and knowledge intensive as proxied by our auxiliary criteria. Also, KIEs could be of domestic, foreign or mixed origin. A restriction of sample on new and young firms only would go against the systemic view of entrepreneurship. Last but not least, our strict criteria regarding knowledge intensity of firms would significantly limit the portfolio of potential firms to be selected, especially in small CEE economies.

3.2. Data Collection and the Sample

Data that forms the basis for this chapter have been gathered based on face-to-face structured interviews with managers in 60 firms in Czech Republic, Hungary, Poland and Croatia during April-May 2011. The sample involves 18 Czech, 15 Croatian, 6 Hungarian and 21 Polish firms. Table 2 details the firms by sector. The managers were asked questions related to the formation stage of their companies, market conditions, their networks, research activities and institutional structure.

Table 2. Number of firms by country and sector.

	<i>Software</i>	<i>Machine Tools</i>
Czech Republic	4	14
Poland	12	9
Hungary	2	4
Croatia	12	3
Total	30	30

The sample consists of 30 software (SW) and 30 machine tools (MT) firms. For both sectors in the sample, more than 60% of the firms are SMEs older than 8 years. Moreover, more than 80% of all firms in the sample are independently located indicating that they are not members of a physical cluster. Only a minority of software firms are located in S&T parks and city clusters, which are formed spontaneously.

3.3. Indicators of entrepreneurial orientation

We use a number of individual indicators as proxies to measure the dimension of EO (cf. Table 1). These comprise a combination of observable measures (both numeric and string) and scale indicators formed by presenting the respondents with statements using a five-level Likert Scale approach ranging from ‘not important’ to ‘very important’. We employ factor analysis to collapse a number of indicators into representable concepts explaining the dimensions of EO. Table 3 below presents a summary of indicators in operationalizing the concepts. Respondents were either directly asked about the answers to particular questions or were presented statements to assess the importance of certain indicators at a 5-level Likert scale approach from ‘not important’ to ‘very important’. For autonomy, selected indicators aim to explain the extent of (in) dependence in an established firm along with the exploration of factors that the owners have identified or possessed when setting up the firm. For innovativeness, indicators explain whether the firm showed substantial effort in innovating or not. Risk-taking indicators assess first the financial aspect when starting up the company; secondly the technological, market and financial factors influencing the entrepreneurial activities in the company, and thirdly the institutional barriers which have significant relevance, particularly in the case of CEECs. The indicators of proactiveness show commitment to innovation, including the use of external sources of knowledge. Competitive aggressiveness indicators show determinants of the competitive advantage of the company and actions to sustain their

competitive advantage including exporting. Finally, we have added dimension of network orientation to EO by using indicators that show the importance of participation in different kinds of networks and the contribution of these networks to the company growth.

Table 3. Indicators for assessing entrepreneurial orientation of enterprises and networking orientation.

	A. Categories that emerged from exploratory factor analysis of all statements in B.	B. Respondents were asked to give answers about A / were presented statements to assess the importance of A (5 level from not important to very important).
Autonomy	1. Firm origin	Independent company, corporate spin-out, partner firm.
	2. Factors influencing company formation: a. Market and financial opportunities b. Technical knowledge c. Network experience	a. Knowledge of the market, Availability of finance and Opportunities in a public procurement initiative. b. Technical/engineering knowledge in the field, Design knowledge, Software knowledge. c. Work experience in the current activity field, Networks built during previous career.
Innovativeness	1. Innovation: types and commercial relevance	Number of new products/processes/services introduced into the market during the last three years, Share of new products /processes/services in total sales during the last three years, Innovation productivity, Share of income/payment from/for licensing/royalties during the last three years.
	2. Sources of knowledge for developing new products a. Value chain and market networks b. External R&D c. In-house R&D	a. Clients, Suppliers, Competitors, Trade fairs, conferences and exhibitions. b. Government or public research institutes, Universities or other higher education institutes, External commercial labs/ R&D firms, Scientific journals and other trade or technical publications including patent disclosures. c. In-house (know-how, R&D unit in your firm).
Risk-taking	1. Source of funding to start the company	Own resources, family member, business angel, etc.
	2. Factors creating obstacles in the entrepreneurial activity of the company a. Technology, market and labour related factors b. Know-how related factors c. Financial constraints	a. Technology risk, Demand or market constraints, Marketing problems (i.e. lack of marketing and management know-how), Difficulty in finding employees with technical skills, Difficulty in keeping employees with technical skills. b. Lack of technological know-how, Difficulty in finding partners for technological collaboration. c. Large sunk investment (Capital stock in which we have invested has limited flexibility), Funding constraints.
	3. Institutional barriers in setting up and operating company a. Corruption and informal obstacles b. Regulatory impediments	a. Poorly enforced copyright and patent protection, High level of corruption, Government officials favour well connected individuals. b. Too complex taxation regulations, High tax rates, Time consuming regulatory requirements for issuing permits and licenses, Insufficient competition law to curb monopolistic practices, Bankruptcy legislation making the cost of failure too great, Unsupportive labour market legislation.
Proactiveness	1. Main strategy of the firm	To produce distinctive products, to target new markets or to produce standardized products.
	2. Implementation of strategic activities a. Technology upgrading b. Management and personnel training	a. Renewal of advanced machinery or other equipment, Large scale update of computer hardware and software, Purchase or licensing of patents from other companies or organizations. b. Preparation of formal business plan, Internal or external training of personnel.
	3. Sources of knowledge for exploring new ideas a. External R&D b. Market networks c. Value chain and in-house R&D	a. Government or public research institutes, Universities or other higher education institutes, External commercial labs/ R&D firms. b. Clients or customers, Competitors, Trade fairs, conferences and exhibitions. c. Suppliers, In-house (know-how, R&D unit in your firm), Scientific journals and other trade or technical publications including patent disclosures.
Competitive aggressiveness	1. Primary competitive advantage of the company:	Product/service novelty, Product/service quality, Product customisation, Cost competitiveness.
	2. Factors creating and sustaining competitive advantage:	R&D activities, Alliances/partnerships, Marketing and promotion to sustain their competitive advantage.
	3. Export performance	Share of exports in total sales of the company during 2009.
	4. Employment strategies a. Employee trend from start to 2010 b. Skilled employee trend	a. Ratio of number of employees at the start of the company to number of employees in 2010 b. Share of skilled labour (at different levels, i.e. BSc, MSc and PhD holders) in total employees.
Networking orient	1. Participation in collaborative agreements: a. Production capability acquisition b. Technology acquisition/knowledge generation	a. Outsourcing, Subcontracting, Technical cooperation agreement, Supply agreement, Value added reseller. b. R&D agreement, Licensing agreement

	2. Contribution of networking to the activities of the company: <ul style="list-style-type: none"> a. in market-related areas b. in technology-related areas 	<ul style="list-style-type: none"> a. Finding clients, Finding suppliers, Gathering information about competitors, Accessing distribution channels, Assistance in obtaining business loans/attracting funds, Advertising and promotion, Managing production and operations, Assistance in arranging taxation or other legal issues, Exploring export opportunities. b. Developing new products, Recruiting skilled labour
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4. RESULTS

This research is of an exploratory nature and where appropriate we employ factor analysis to group individual indicators used within the framework in Table 1.

4.2. Autonomy

The conventional view of entrepreneurship is that it is a 'sheer individual act' be it either individual person or organisation. Hence, the issue of organisational independence of firm and the type of opportunity that lies behind its formation are relevant in understanding autonomy issues.

In our sample of firms 90% of SW firms are independent start-ups, while 60% of MT firms are corporate-spin-outs, indicating that starting a business in the latter necessitates initial nurturing phase under a larger, established firm. This may be expected as MT firms are older with competencies inherited from the socialist period while SW firms are new ventures which most often have not been part of larger enterprises.

4.2.1. Importance of Factors for Company Formation

A factor analysis applied to the indicators assessing the importance of factors for company formation identified three conceptually meaningful components (i.e., underlying constructs) (Table 4). The entrepreneurial activity as an independent action demands capabilities and opportunities with regard to the market related, networks related and technical functional areas. Component 1 highlighted the market and finance related opportunities and capabilities. Component 2 highlighted the technical capability including design and software knowledge. Component 3 highlighted the network-related experiences especially those that are outcomes of the previous work experience and networks built during the previous career. These three factors highlight the importance of coupling as well as relative independence of markets, technology and networks in the formation of new firms.

Table 4. Factor analysis for 'Importance of factors for the formation of company'.

	Market and financial opportunities	Technical knowledge	Network experience
Knowledge of the market	0.791	-0.146	-0.100
Availability of finance	0.688	0.026	0.323
Opportunities from a public procurement initiative	0.718	0.328	-0.004
Technical/engineering knowledge in the field	-0.112	0.465	0.528
Design knowledge	0.019	0.734	0.164
Software knowledge	0.111	0.839	-0.121
Work experience in the field	-0.040	-0.022	0.865
Networks built during the previous career	0.354	0.028	0.609

Note: KMO measure of sampling adequacy=0.61; Bartlett's test of sphericity significant at 0.002 level; Cumulative % of variance explained is 61.38%.

Descriptive results show that these are KIEs where technological skills play role but also that these capabilities have to be coupled with knowledge of the market. The firms in the sample are mainly self-funded even in MT sector where firm necessitates more capital-intensive investment than in SW sector. As expected, technical/engineering knowledge in the field of activity are rated as highly important by more than 90% of the companies which confirms that firms in the sample are indeed KIEs. Work experience in the activity field is rated as highly important for company formation by almost 90% of the firms. More than 85% of the firms' value networks built in employees' previous careers as very important and moderately important.

Table 5. Important factors for formation of company (% of firms expressing the factors as ‘important’ and ‘very important’)(N_{SW}=30, N_{MT}=30)

	SW	MT	All firms
1. Market and financial opportunities			
Knowledge of the market	53.3 ³	60 ¹	56.7 ⁴
Availability of finance	16.7 ³	30 ¹	23.3 ⁴
Opportunities from a public procurement initiative	6.7 ²	3.3 ¹	5 ³
2. Technical knowledge			
Technical/engineering knowledge in the field	86.7 ¹	93.3	90 ¹
Design knowledge	63.3	53.3 ²	58.3 ²
Software knowledge	90 ¹	36.7 ²	63.3 ³
3. Network experience			
Work experience in the field	80	100	90
Networks built during the previous career	43.3 ³	50 ¹	46.7 ⁴

¹1 missing value, ²2 missing values, ³3 missing values, ⁴4 missing values.

Table 6. Major features of autonomy dimension of entrepreneurial orientation in machine tool and software sectors in CEE.

EO dimension	Dimension category		Results	Synthesis
Autonomy : Independent action by an individual or team aimed at bringing forth a business concept or vision and carrying it through to completion.	Firm origin		90% of SW firms are independent start-ups, 60% of MT firms are corporate-spin-outs	Autonomous or corporate driven entrepreneurship exploiting existing knowledge based on previous experience and recognising market opportunities.
	Factors influencing company formation	Market and financial opportunities	Knowledge of the market is very important for 57% of firms, availability of finance for financial 23%	
		Tech knowledge	Technical knowledge is very important for 90% of firms, software knowledge 63%, design knowledge 58%.	
		Network experience	Work experience in the activity field is highly important for almost 90% of the firms. 47% of the firms value networks built in the previous career as very important.	

4.3. Innovativeness

4.3.1. Innovation: types and commercial relevance

We investigated the number of new products/processes/services introduced by the firms onto the market during the 2007-2009 period, their share in total sales and innovation productivity calculated as the number of new products/processes/services per employee in the firm. Innovation productivity of the firms in the sample ranges between 0 and 7.2, with an outlier firm with the score 24.4 innovations per firm. The majority of the firms, in both sectors, characterize themselves as producing distinctive products and identify customers as the most important source of knowledge for developing new products. These indicate that the sample is formed of specialized suppliers. Thus, when they were asked about innovations, we made sure that innovation is defined as a radically new or significantly improved product compared to other bespoke products produced by the firms. Hence, similar bespoke products are not counted as separate innovations.

Table 7 shows that by absolute numbers, 50% of the firms have introduced more than 10 innovations onto the market during the last three years. There are no differences between the two sectors with regard to absolute

number of innovations. In addition, half of the firms have more than 50% of sales based on new products during the last three years. The sales as proxy are quite unreliable as innovations may not have an immediate success or may have an immediate success but this may not last. Therefore, innovation productivity (number of innovations per employee) may be a better proxy, particularly because it is also an input indicator.

Table 7. Innovations, share of innovations in total sales and innovation productivity (%)

	SW	MT	All firms
1. New products/processes/services introduced onto the market during the last 3 years	N=30	N=30	N=60
More than 10	50	46.7	48.3
Between 5 and 10	16.7	23.3	20
Less than 5	33.3	30	31.7
Total	100	100	100
2. Share of new products/processes/services in total sales during the last 3 years (%)	N=28	N=30	N=58
Equal to or more than 50%	53.3	43.3	48.3
Between 10% and 50%	26.7	46.7	36.7
Equal to or less than 10%	13.3	10	11.7
Total	93.3	100	96.7
3. Innovation productivity (innovations per employee)	N=29	N=30	N=59
Equal to or more than 2	16.7	6.7	11.7
Between 0.5 and 2	23.3	3.3	13.3
Between 0.1 and 0.5 or equal to 0.5	33.3	30	31.7
Equal to or less than 0.1	23.3	60	41.7
	96.7	100	98.3

¹1 missing value, ²2 missing values, ³3 missing values, ⁴4 missing values.

Almost 40% of the firms in the sample pay for licenses while 20% receive payments for their licences. However, there are major differences between the two sectors. Vast majority of MT firms neither pay for formalized knowledge nor sell it indicating that untraded know-how is more important in the sector. In contrast, half of the SW firms pay between 1-49% of their revenues for other organizations' licenses as a way to acquire knowledge and innovate. Moreover, 70% of SW firms have an income from the sale of their own licenses, which indicates they are able to innovate independently.

Table 8. Licensing income and payment as percentage of total revenues (%).

	SW	MT	All firms
1. Share of payment for licensing	N=28	N=15	N=43
Between 1 and 49%	50	3.3	26.7
0	43.3	46.7	45
Total	93.3	50	71.7
2. Share of income from licensing	N=29	N=27	N=56
100%	16.7	3.3	8.3
Between 50% and 99%	20	-	10
Between 1 and 49%	33.3	-	18.3
0	26.7	86.7	56.7
Total	96.7	90	93.3

4.3.2. Importance of sources of knowledge for developing new products and processes

The results of factor analysis (table 9) suggest that there are three major sources of knowledge in developing new products/processes: value chain and market networks or external R&D networks or in-house R&D. In that respect, component 1 highlighted the networks with clients, suppliers, competitors and fairs and exhibitions. Component 2

highlighted the external R&D organisations as the major source of knowledge. Component 3 highlighted the in-house know how which in some cases is formalised R&D.

Table 9. Factor analysis for importance of sources of knowledge for developing new products/processes.

	Innovativeness via value chain & market networks	Innovativeness via external R&D	Innovativeness via in-house R&D
Clients	0.758	0.089	0.052
Suppliers	0.476	-0.237	-0.557
Competitors	0.782	0.052	-0.037
Trade, fairs, conferences and exhibitions	0.789	0.203	0.014
Government or public research institutes	0.044	0.860	-0.017
Universities or other higher education institutes	0.003	0.773	-0.071
External commercial labs/R&D firms	0.278	0.338	-0.281
Scientific journals/trade/technical publications including patent disclosures	0.210	0.768	0.100
In-house know-how (R&D unit in your firm)	0.198	-0.096	0.828

Note: KMO measure of sampling adequacy=0.62; Bartlett's test of sphericity significant at 0.000 level; Cumulative % of variance explained is 60.55%, all firms (N=60).

A ninety percent of firms rate their clients as very and moderately important source of knowledge for developing new products (Table 10). Only half of them consider suppliers as significant sources for product development. At most 10% of firms in both sectors assess knowledge sources such as universities, government research institutes and private R&D labs as significant for developing new products. This result is similar to results from innovation surveys and it confirms that these sources are not important direct source of new knowledge in the CEE. Internal know-how is the most important source of knowledge for developing new products/processes in both sectors (Table 10).

Table 10. Importance of sources of knowledge for developing new products/processes (% of firms expressing the sources of knowledge as 'important' and 'very important')

	SW	MT	All firms
1. Innovativeness via value chain and networks			
Clients	73.3	50	61.7
Suppliers	20	30 ¹	25 ¹
Competitors	23.3	20 ¹	21.7 ¹
Trade, fairs, conferences and exhibitions	26.7	20 ¹	23.3 ¹
2. Innovativeness via external R&D			
Government or public research institutes	6.7 ¹	6.7 ²	6.7 ³
Universities or other higher education institutes	10	6.7 ²	8.3 ²
External commercial labs/R&D firms	13.3	6.7 ²	10 ²
Scientific journals/trade/technical publications including patent disclosures	23.3	10 ¹	16.7 ¹
3. Innovativeness via in-house R&D			
In-house know-how (R&D unit in your firm)	83.3 ¹	63.3 ²	73.3 ³

¹1 missing value, ² 2 missing values, ³3 missing values.

Table 11. Major features of innovativeness dimension of entrepreneurial orientation in machine tool and software sectors in CEE.

EO dimension	Dimension category		Results	Synthesis
<p>Innovativeness: Willingness to support creativity and experimentation in introducing new products/services, and novelty, technological leadership and R&D in developing new products and processes.</p>	Innovation: Types and commercial relevance	Number of new products/processes/services introduced into the market during the last three years	50% of the firms have introduced more than 10 new products/processes/services onto the market during the last three years. No differences between the two sectors. 50% of the firms have more than 50% share of 'innovative sales' during the last three years.	<p>Oriented towards developing new/distinctive products; Customers as the most important source of knowledge > specialized suppliers.</p> <p>Innovation active firms; specialized suppliers dependent on own R&D, and value chains, only 10% on external R&D.</p> <p>SW firms are involved in licence trade; no patentors.</p>
		Share of new products/processes/services in total sales during the last three years	50% of the firms have more than 50% share of 'innovative sales' during the last three years.	
		Innovation productivity (IP)	IP ranges between 0 - 7.2 and differs considerably between sectors. SW has higher IP.	
		Share of income/payment from/for licensing/royalties during the last three years	Almost 40% of the firms pay and almost 20% receive payments for their licences. MT firms are not buying licences. In contrast, 50% of the SW firms pay between 1-49% of their revenues for licenses. Moreover, 70% of SW firms have an income from the sale of their own licenses. Only one firm (SW) has a registered patent.	
	Sources of knowledge for developing new products	Value chain and market networks	90% rate clients as very and moderately important source (60% rate as very important). Trade fairs and exhibitions are important for only 20% of firms in product development.	
		External R&D	Only 10% of firms rely on external R&D (universities, government research institutes and private R&D labs) for product development.	
		In-house R&D	For almost 80% of firms in-house knowledge is very important source of knowledge. This is more so in SW and somewhat less in MT where suppliers and buyers take more part in innovation.	

4.4. Risk-taking orientation

In the context of CEE countries, the market, technological and institutional conditions affects risk-taking including the institutional barriers to setting up a company.

4.4.1. Source of funding to start a company

The main source of funding for company establishment in 90% of cases is the founder(s)' own finances. There are no significant differences with regard to the two sectors in that respect. Venture capital is almost non-existent even in SW sector.

4.4.2. Factors creating obstacles for entrepreneurial activity of the company

The results of factor analysis suggest that entrepreneurial activity is constrained by technology, market and labour factors; by know-how and by financial constraints (table 12). Component 1 highlights the technology risk related to the innovation, limited demand or market constraints, and the difficulty in finding and keeping employees with good technical skills. This indicates a scarcity of skilled employees which is the emerging problem in CEE. Component 2 highlights the lack of intra-firm technical know-how as well as external know-how (difficulty to find partners for technological collaboration). Finance does not seem to be a problem for the formation of firms but much more for firm growth which requires high fixed investments (sunk costs).

Table 12. Factor analysis for 'Factors creating obstacles for the entrepreneurial activity of the company'.

	Technology, market and labour constraints	Know-how constraints	Financial constraints
Technology risk	0.715	0.158	-0.198
Demand or market constraints	0.601	0.239	-0.015
Marketing problems (lack of marketing and management know-how)	-0.495	0.480	-0.186
Difficulty in keeping employees with technical skills	0.843	-0.038	0.051
Difficulty in finding employees with technical skills	0.372	0.386	-0.051
Lack of technological know-how	0.169	0.785	-0.030
Difficulty in finding partners for collaboration	0.069	0.757	0.154
Large sunk investment	-0.217	-0.109	0.768
Funding constraints	0.117	0.147	0.743

Note: KMO measure of sampling adequacy=0.59; Bartlett's test of sphericity significant at 0.002 level; Cumulative % of variance explained is 55.47%, all firms (N=60).

Majority of the firms (60-70%) consider technology risk, demand and market constraints, and difficulties in finding and keeping employees with technical skills as highly or moderately important factors to their entrepreneurial activities (Table 13). For almost 80% of firms, lack of technological know-how and difficulty in finding partners is not a major constraint. Lack of problems in technical collaboration may well be explained by weak demand by firms for this type of cooperation which includes universities, research institutes and commercial labs. For some firms, financial constraints represent one of the major barriers to product innovation. However, large sunk costs or fixed investments do not seem to be an important obstacle. This may be expected given the relatively low development ambition of firms. However, funding constraints in firm growth are very and moderately important by almost 75% of the firms.

Table 13. Factors creating obstacles for the entrepreneurial activity of the company (% of firms expressing the factors as 'important' and 'very important')

	SW	MT	All firms
1. Technology, market and labour constraints			
Technology risk	26.7 ¹	50 ²	38.3 ³
Demand or market constraints	40 ²	60 ¹	50 ³
Marketing problems (lack of marketing and management know-how)	20 ¹	3.3 ²	11.7 ³
Difficulty in keeping employees with technical skills	23.3 ¹	46.7 ¹	35 ²
Difficulty in finding employees with technical skills	20 ¹	50 ¹	35 ²
2. Know-how constraints			
Lack of technological know-how	13.3 ¹	13.3 ²	13.3 ³
Difficulty in finding partners for collaboration	10 ¹	3.3 ²	6.7 ³
3. Financial constraints			
Large sunk investment	26.7 ²	16.7 ²	21.7 ⁴
Funding constraints	43.3	30 ¹	36.7 ¹

¹1 missing value, ²2 missing values, ³3 missing values, ⁴4 missing values.

4.4.3. Institutional barriers to setting up a company

A factor analysis applied to nine statements to assess barriers to setting up their companies reveals that these can be grouped in two (Table 14), indicating differences between formal and informal barriers. Corruption and informal obstacles include poorly enforced patent protection, a high level of corruption and favouring of well-connected individuals by government officials. Regulatory impediments relate to issues with regard to taxation, licenses, competition law, bankruptcy and labour market legislations.

Table 14. Factor analysis for 'institutional barriers for setting up a company'.

	Corruption and Informal Obstacles	Regulatory Impediments
Poorly enforced copyright and patent protection	0.726	0.160
High level of corruption	0.929	0.055
Government officials favour well connected individuals	0.943	-0.097
Too complex taxation regulations	-0.244	0.897
Too high tax rates	-0.061	0.897
Time consuming regulatory requirements for issuing permits and licenses	0.187	0.403
Insufficient competition law to curb monopolistic practices	0.405	0.555
Bankruptcy legislation makes the cost of failure too great	0.507	0.520
Unsupportive labour market legislation	0.482	0.516

Note: KMO measure of sampling adequacy=0.70; Bartlett's test of sphericity significant at 0.000 level; Cumulative % of variance explained is 63.18%.

Almost 65% of the firms regard poorly enforced patent protection as insignificant barrier to setting up a company. This is probably due to the fact that firms in the sample do not have any patenting activities during the last three years. Still, 35% of firms consider this issue as moderately or very important. Firms are divided in their opinions about the level of corruption and favouring of individuals in acting as a barrier for starting a company. Some consider these as an important barrier, while for some they are not important. The regulatory barriers to setting up a company – i.e. complex and high taxes, time consuming regulatory requirements for licenses, insufficient competition law, costly bankruptcy legislation and unsupportive labour market legislation, are assessed as not important by more than 60% of the companies. These findings show that legal institutional reforms have been in place in the CEECs, whereas issues with regard to informal barriers need to be tackled. Differences between the two sectors in terms of regulatory impediments are insignificant.

Table 15. Major features of risk taking dimension of entrepreneurial orientation in machine tool and software sectors in CEE.

EO dimension	Dimension category	Results	Synthesis
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<p>Risk-taking is a firm's tendency for risk, its perception of risk as necessary for success in the competitive environment in which it finds itself, and its tendency to act boldly and aggressively under conditions of uncertainty, as well as tendency to take actions such as venturing into unknown new markets, committing a large portion of resources to ventures with uncertain outcomes, and/or borrowing heavily.</p>	Source of funding to start the company		The main source of funding is the founders' own finances (90%). No differences between SW and MT.	<p>Risk taking is constrained by weak demand and markets, technology risks, and skills shortages as well as by regulatory impediments.</p> <p>Corruption is present but unevenly.</p> <p>Financial constraints are not the major obstacles.</p>
	Factors creating obstacles in the entrepreneurial activity of the company	Technology, market and labour related factors	Majority of the firms (60-70%) consider demand and market constraints, technology risk and skills shortages as highly or moderately important factors to their entrepreneurial activities. Lack of marketing and management know-how is not considered to be a major problem.	
		Know-how related factors	Lack of technological know-how and difficulty in finding partners is an issue only for 20% of firms.	
		Financial constraints	Financial constraints are one of the major barriers for more than 20-40% of firms.	
	Institutional barriers in setting up and operating the company	Corruption and informal obstacles	For almost 65% of the firms poorly enforced patent protection is not an important barrier > firms in the sample do not have patenting activities. Still, 35% of firms consider this issue as moderately or very important. Firms are divided about the level of corruption and favouring of individuals as a barrier.	
		Regulatory impediments	The formal barriers for setting up a company – i.e. complex and high taxes, time consuming regulatory requirements for licenses, insufficient competition law, costly bankruptcy legislation and unsupportive labour market legislation, are assessed as not important by more than 60% of the companies.	

4.5. Proactiveness

4.5.1. Core strategy of the company

Almost 90% of the firms state that their core strategy involves production of distinctive products and targeting new markets. This requires proactiveness and the vision in order to grasp market opportunity for a new product or entering a new market by the firm's existing products where these products were not traded before.

4.5.2. Implementation of strategic activities in the firm

A factor analysis applied to five statements about the extent of strategic activities resulted in two components pertaining to technology upgrading and management and personnel training (table 16). These are both knowledge intensive activities as would be expected from KIEs.

Table 16. Factor analysis for 'Implementation of strategic activities in the firm'.

	Technology upgrading	Management and personnel
Renewal of advanced machinery and other equipment	0.474	-0.247
Large scale update of computer hardware and software	0.701	0.277
Purchasing and licensing of patents from other organizations	0.820	-0.033
Preparation of formal business plan	-0.345	0.796
Internal and external training of personnel	0.309	0.808

Note: KMO measure of sampling adequacy=0.48; Bartlett's test of sphericity significant at 0.000 level; Cumulative % of variance explained is 60.58%.

Table 17 shows the frequency with which firms upgrade their existing technologies as a way to stay ahead of competition. These comprise activities such as renewal of advanced machinery, update of computer and software and purchasing patents from other organizations. Frequent implementation of these activities means that firms are proactive and keep up with changes in technology in order to introduce innovations ahead of the competition and acting in anticipation of future demand to create change and shape the environment. On the whole, majority of firms invest in machinery and computer update; but purchase of licensing is limited to at most 30%. Firms also need to continuously improve their management plans and make sure their personnel holds up-to-date knowledge in the field. About 60% of the firms in both sectors implement these activities often (Table 17).

Table 17. Implementation of strategic activities (% of firms expressing the strategic activities as 'important' and 'very important')

	SW	MT	All firms
1. Technology upgrading			
Renewal of advanced machinery and other equipment	30 ³	40	35 ³
Large scale update of computer hardware and software	53.3	26.7	40
Purchasing and licensing of patents from other organizations	30	6.7 ²	18.3 ²
2. Management and personnel training			
Preparation of formal business plan	53.3	56.7 ²	55 ²
Internal and external training of personnel	60	56.7 ²	58.3 ²

² 2 missing values, ³3 missing values.

4.5.3. Importance of sources of knowledge for exploring new ideas

The use of external sources of knowledge for exploring new ideas, not necessarily developing new products in any form, indicates the extent of proactiveness. The respondents were presented with five statements as shown in Table 18. A factor analysis applied on the indicators resulted in three components pertaining to external R&D, value chain relationships and market networks.

Table 18. Importance of sources of knowledge for exploring new ideas

	External R&D	Market networks	Value chain
Government or public research institutes	0.862	-0.149	-0.073
Universities or other higher education institutes	0.760	-0.039	0.220
External commercial labs/R&D firms	0.648	0.201	-0.270
Suppliers	0.050	0.086	0.783
Scientific journals/trade/technical publications including patent disclosure	0.503	0.081	0.609
In-house know-how (R&D unit in your firm)	0.175	0.064	-0.500
Clients	-0.120	0.641	-0.171
Competitors	-0.016	0.880	0.022
Trade, fairs, conferences and exhibitions	0.195	0.769	0.293

Note: KMO measure of sampling adequacy=0.42; Bartlett's test of sphericity significant at 0.000 level; Cumulative % of variance explained is 60.17%.

Table 19 shows that public research institutes, universities and private R&D labs are not major sources for exploring new ideas. This suggests that the R&D system is not involved in firms' upstream activities. This can be due to differences in knowledge profiles of these organizations in the CEECs or due to the absence of 'interface' institutions. Still, for approximately 30% of firms universities are either very or moderately important as sources of new ideas. These results are broadly similar to results from innovation surveys in other countries.

Market networks like links with clients, competitors and trade fairs and exhibitions are rated as important by almost 70% of the firms (Table 19). More than 60% of the firms assess particularly their clients as very important sources of knowledge for exploring new ideas. 80% of the firms confidently state that they rely on their own in-house knowledge for exploring new ideas in order to be proactive. More than 60% of the firms value suppliers and trade journals as important sources of such knowledge. Interviews revealed that specific trade journals are good sources of information for catching up with the recent developments in the field. Suppliers, on the other hand, have contacts with most of the firms in the field; thus they transfer knowledge from one firm to another. In that sense, the information they provide is valuable.

Table 19. Importance of sources of knowledge for exploring new ideas (% of firms expressing the sources of knowledge as 'important' and 'very important')

	SW	MT	All firms
1. External R&D			
Government or public research institutes	3.3	3.3 ²	3.3 ²
Universities or other higher education institutes	13.3	6.7	10
External commercial labs/R&D firms	6.7	6.7	6.7
2. Market networks			
Suppliers	26.7	26.7 ²	26.7 ²
Scientific journals/trade/technical publications including patent disclosures	30	23.3 ¹	26.7 ¹
In-house know-how (R&D unit in your firm)	90	66.7 ²	78.3 ²
3. Value chain			
Clients	63.3	63.3 ¹	63.3 ¹
Competitors	40	33.3	36.7
Trade, fairs, conferences and exhibitions	33.3	36.7	35

¹1 missing value, ²2 missing values, ³3 missing values.

Table 20. Major features of proactiveness dimension of entrepreneurial orientation in machine tool and software sectors in CEE.

EO dimension	Dimension category		Results	Synthesis
Proactiveness is an opportunity-seeking, forward-looking perspective involving introducing	Core strategy of the firm		Core strategy of almost 90% of firms involves production of distinctive products and targeting new markets. In MT this is more important strategy than in SW. This can possibly be explained by more distinctive nature of MT products vs stronger service component of SW.	Proactiveness is realized through distinctive products and new markets and based on technology upgrading and training.

new products or services ahead of the competition and acting in anticipation of future demand to create change and shape the environment and it captures the tendency of a firm to lead rather than follow, to be the first to introduce new products, processes and/or services.	Implementation of strategic activities	Technology upgrading	Majority of firms invest often or sometimes in machinery and computer updates; but purchase of licensing is limited to at most 30% of firms. MT is more inclined to renewal of machines, whereas SW is more into upgrading of computer systems.	Main sources of new ideas are own know-how, market networks and value chain partners.
		Management and personnel training	About 60% of the firms in both sectors implement these activities often.	
	Sources of knowledge for exploring new ideas	External R&D	Public research institutes, universities and private R&D labs are marginally involved as sources for exploring new ideas. Still, for around 30% of firms universities are either very important or moderately important source for new ideas.	
		Market networks	Market networks like links with clients, competitors and trade fairs and exhibitions are rated as important by almost 70% of the firms. More than 60% of the firms assess particularly their clients as very important sources of knowledge for exploring new ideas.	
		Value chain and in-house R&D	80% of firms rely on their own in-house knowledge. More than 60% of the firms value the suppliers and trade journals as important sources of knowledge for exploring new ideas.	

4.6. Competitive Aggressiveness

To measure the extent of competitive aggressiveness in firms we asked them to identify their major competitive advantage and what actions do they undertake to create and sustain it. Export performance is also an important measure to assess firm's intensity of effort to outperform its rivals and thus we used it as a proxy. This is a very important proxy in CEE where good local firms are often struggling how to become established exporters.

4.6.1. Primary competitive advantage of the company

A large majority of firms (75-95%) rate all factors of primary competitive advantage (product/service novelty, quality, and customisation) as very important while costs are somewhat less important indicating again that they are specialized suppliers.

4.6.2. Creating and sustaining competitive advantage

Entrepreneurial firms need to be able to sustain the competitive advantage they have. This involves continuous effort into R&D activities, alliances/partnerships and marketing. R&D activities within the firm are very important factor to sustain competitive advantage for 60% of firms (Table 21). This is true for 80% of SW firms and 50% of MT firms. Alliances and partnerships are more important for SW to maintain the competitive advantage, whereas they are less significant for MT with almost 60% of these firms declaring it as not important. This reflects differences in sector characteristics since SW firms are customizers of generic solutions supplied by international software firms via alliances and partnerships, on the other hand MT firms are more independent when focusing on customer-oriented projects. Finally, marketing and promotion are important for 60% of SW firms, but less

significant for MT. Again, SW firms depend more on successful promotion and advertising as they often produce end-user products, while the specialised MT firms do not need to incur such costs as they are in closer links with their clients.

Table 21. Factors creating and sustaining competitive advantage. (% of firms expressing the factors as ‘important’ and ‘very important’)

	SW	MT	All firms
R&D activities	76.7	46.7 ¹	61.7 ¹
Alliances and partnerships	53.3 ¹	36.7	45 ¹
Marketing and promotion	50	13.3 ¹	31.7 ¹

¹ missing value

4.6.3. Export performance

Lastly, we asked firms about the share of exports in their total sales. If this ratio is equal to or more than 95%, we consider the firm as ‘sole exporter’; if equal to or below 5% ‘not exporter’; and as ‘exporter’ for values between 5 and 95. This provides us with a tangible indicator to assess the competitiveness strategy based on an aggressive approach to conduct of export. Within the whole sample 40% of the firms are ‘sole exporters’. Broken down by industry, this corresponds to 60% of SW firms and 20% of MT. Only a minority of the firms aim solely to national markets. In overall, a high share of sole exporters suggest that our sample has picked up ‘better’ or more aggressive firms in both sectors.

Table 23. Major features of competitive aggressiveness dimension of entrepreneurial orientation in machine tool and software sectors in CEE.

EO dimension	Dimension category		Results	Synthesis
Competitive aggressiveness: reflects the intensity of firm’s efforts to outperform industry rivals, characterized by a combative posture and a forceful response to competitor’s actions. It differs from proactiveness in the sense that proactiveness is about creating opportunities, but competitive aggressiveness is about defending them.	Primary competitive advantage of the company		The major factors of competitive advantage of companies are the product/service novelty, product/service quality, product customization and cost competitiveness.	Firms are competing on all competitive factors (novelty, quality, customization and costs) by largely serving both domestic and export markets.
	Factors creating and sustaining competitive advantage		R&D, alliances and promotion activities are important factors in sustaining firms’ competitive advantages. These factors are significantly more important in SW than in MT.	SW firms rely more on R&D and alliances in sustaining these advantages. Employment growth is based on generic expansion.
	Export performance		40% of firms are sole exporters (export 95% or more of sales) of which SW firms 60% and MT 20%. Only a minority of the firms aim solely to national markets.	

4.7. Network Strategies

In addition to Lumpkin and Dess' (2001) dimensions for entrepreneurial strategies, we also wanted to investigate the networking strategies of the firms. From systemic perspective, entrepreneurship is a collective and not only individual level activity and it may influence firm's performance, especially growth. Yet the network component of entrepreneurial strategies is barely touched upon in the entrepreneurship literature.

4.7.1. Importance of participation in collaborative agreements

We investigated the firms' assessment of participation in collaborative agreements such as outsourcing, subcontracting, R&D/technical cooperation/licensing agreements, supply agreement and as value added reseller. In a sense, we aim to find out why firms engage in collaborative activities, if indeed they do? Respondents were presented with seven different types of collaborative agreements and were asked to assess it from 'not important' to 'very important' using a five level Likert Scale approach. A factor analysis resulted in two components that differentiated between production capability acquisition and technology acquisition/generation agreements (Table 24).

Table 24. Network Strategies: Importance of participation in collaborative agreements.

	Production capability acquisition	Technology acquisition for knowledge generation
Outsourcing	0.669	-0.445
Subcontracting	0.711	-0.380
Technical cooperation agreement	0.695	0.146
Supply agreement	0.702	0.097
Value added reseller	0.632	0.340
R&D agreement	-0.111	0.744
Licensing agreement	0.327	0.720

Note: KMO measure of sampling adequacy=0.65; Bartlett's test of sphericity significant at 0.000 level; Cumulative % of variance explained is 57.26%.

Descriptive results indicate that, on the whole, involvement in collaborative agreements to acquire production capabilities is important for at most 40% of the firms. These findings confirm the previous findings that firms are mostly engaged in close relationships with their clients. Similar to the production capability acquisition component of collaborative agreement participation, the importance of R&D agreement and licensing agreement within the technology acquisition component is also rated as significant by only 40% of firms at most. These findings confirm the previous findings, i.e. importance of sources of knowledge for developing new products were mainly pointing to clients and in-house sources of knowledge.

4.7.2. Contribution of networks with other firms/institutions/suppliers to the activities of the company

In what contexts firms' interactions with other organizations facilitate their activities? These may change from finding clients to exploring export opportunities: firm activities can therefore be grouped into market-related and technology-related areas.

75% of firms stated that such networks play an important role for finding clients and gathering information about competitors (Table 25). On the contrary, about 50% of the firms stated that these networks are not important for activities such as finding suppliers, accessing distribution channels, exploring export opportunities and advertising.

We also investigated how important these networks are for technology-related issues, i.e. for recruiting skilled labour as an input to innovation, and developing new products as an output of the innovation process. 55-70 % of firms stated that such networks play an important role for developing new products and recruiting skilled labour (Table 25). However, one must recall clients were stated as the most important source of knowledge for developing new products.

The data presented here show that networks are very important in the entrepreneurial strategies of firms and that there are no significant differences between SW and MT sectors in this respect. Moreover, informal networks seem to be much more important than formal, collaborative agreement-based networks.

Table 25. Contribution of networks with other firms/institutions/suppliers in market and technology-related areas (% of firms expressing the factors as 'important' and 'very important')

	SW	MT	All firms
1. Market related areas			
Finding clients	66.7	40	53.3
Finding suppliers	10	23.3	16.7
Gathering information about competitors	36.7	33.3 ¹	35 ¹
Accessing distribution channels	26.7	20 ¹	23.3 ¹
Advertising and promotion	26.7	10 ¹	18.3 ¹
Exploring export opportunities	23.3	16.7 ¹	20 ¹
2. Technology related areas			
Developing new products	40	30 ¹	35 ¹
Recruiting skilled labour	26.7	13.3 ¹	20 ¹

¹ missing value.

Table 26. Major features of network orientation dimension of entrepreneurial orientation in machine tool and software sectors in CEE.

EO dimension	Dimension category		Results	Synthesis
<p>Network orientation</p> <p>Reflects ability to form networks and accessibility to external knowledge through its networks and process that knowledge, combining it with internal knowledge in order to innovate.</p>	Participation in collaborative agreements	Production capability acquisition (outsourcing, subcontracting, supply agreement, technical cooperation and value added reseller)	The involvement in collaborative agreements to acquire production capabilities is very or moderately important at most for 40% of the firms.	<p>Networks are very important in entrepreneurial strategies of firms and there are not significant differences between SW and MT in this respect.</p> <p>Informal networks seem to be much more important than formal collaborative agreements based networks.</p>
		Technology acquisition/knowledge generation (R&D/licensing agreements)	The involvement in collaborative agreements to acquire technology capabilities is very or moderately important at most for 40% of the firms.	
	Contribution of networking to the activities of the company	In market-related areas (finding clients, suppliers, gathering information about competitors, accessing distribution channels, exploring export opportunities and advertising)	Networks are important in finding clients (for 75% of the firms) and gathering information about competitors (for 70%). For 50% of the firms these networks are not important for finding suppliers, accessing distribution channels, exploring export opportunities and advertising.	
		In technology-related areas (for recruiting skilled labour as an input to innovation and developing new products as an output of the innovation process)	Networks play important role for developing new products (for 70% of the firms) and recruiting skilled labour (for 55% of the firms).	

5. CONCLUSIONS

Our main research question is whether firms in emerging markets like CEE have all the attributes of developed EO or whether the specific external constraints and opportunities affect their EO. The picture that emerges from our analysis is sharply different from the dominant 'individual – opportunity nexus' as depicted in GEM-style of research on entrepreneurship. Within this perspective, and in a very simplified interpretation, the individual entrepreneur is conceptualized as a person that has grasped market opportunity and is constrained in its realization by a variety of institutional obstacles. In contrast, our data show *a combination of individual start-ups as well as corporate spin-outs whose establishment and growth are closely interdependent with a variety of networks or network related factors*. Similar to Klepper and Sleeper (2005) and Klepper (2009) CEE firms are spinoffs who have inherited specific knowledge from parent firms. They are either organizational spinoffs (MT) or new start-ups (SW) but whose founders brought accumulated work experience and network capital built during their previous career. This autonomous or corporate driven entrepreneurship is geared towards exploiting existing knowledge based on previous experience and recognising new market opportunities. New KIEs are repositioning themselves in terms of markets or products, but not in terms of technology. In that respect, CEE entrepreneurship is of a cumulative and evolutionary rather than disruptive nature.

In the dominant I-O nexus perspective, the focus is on factors inhibiting firm formation and these are usually sought in a variety of institutional factors. Indeed, the departing rationale for our research was the assumption that there are numerous transition factors that inhibit knowledge intensive entrepreneurship, especially risk taking. On the contrary, *institutional barriers in setting up and operating a company are present but far less than would be expected*. The range of regulatory barriers for setting up and operating a company are assessed as not important by more than 60% of the companies while corruption and discriminatory treatment of companies as barriers are quite divided between companies.

So, institutional barriers still exist but they are weaker than expected and seem to be more firm - rather than sector or country - specific. *The major barriers are related to demand and market constraints, technology risks and skills shortages, i.e. barriers are more developmental than institutional*. Equally, finance is usually portrayed as the major constraint to new firm formation and growth. Our data suggest that this is much less a problem in firm formation but is more present in firm growth. The finance factor is one of the major barriers for growth of 20-40% of firms which again suggests that demand and market constraints, technology risks and skills shortages are much more important factors inhibiting risk-taking.

Innovation is commercially quite relevant for CEE KIEs. Around 50% of the firms have more than 50% share of 'innovative sales' during the last three years which is significantly above the EU average of 9.9% of turnover from new or significantly improved products new to the market in 2008 (calculated based on Eurostat). SW and MT firms are specialized suppliers firms, which largely innovate based on their in-house knowledge (own R&D) and value chains. For only 10% of firms, external R&D is a very important source of innovation for product development. For 90% of firms, clients are a very or moderately important source for product development. All this points to innovativeness which is embodied in a firm's 'know-how' and shared with value chain partners, especially in MT sector. Disembodied knowledge trade is important in SW sector while protection is not embodied in patents but largely in organisational capabilities. This mode of innovativeness of CEE KIEs becomes clearer if we take into account how firms operate pro-actively.

Their proactiveness is realized through distinctive products and new markets which are initially developed or thought through based on their own know-how, market networks and value chain partners. *A collective nature of their innovativeness reflects their interdependence with partners in physical or knowledge value chain*. As specialized suppliers, they are naturally oriented towards clients and suppliers. They maintain their proactiveness through hardware renewal (technology upgrading) and management and personnel training.

CEE KIEs are not new technology based firms that grow based on commercialisation of proprietary technology. Instead, these firms are competing on all competitive factors (novelty, quality, customization and costs) by serving both domestic and export markets. Hence, their innovativeness is much more embodied in their overall entrepreneurship orientation and cannot be reduced to new 'gadget', i.e. artefacts or disembodied knowledge (patents). *The basis of their entrepreneurship is in accumulation of firm-specific know-how and in understanding of clients needs*. In order to sustain these wide competitive advantages, KIEs (especially SW firms) rely on in-house knowledge and alliances.

Networks are very important in entrepreneurial strategies of firms and there are no significant differences between the two sectors in this respect. *Formal collaboration agreements are important in terms of both*

production and technological capabilities for 40% of firms. However, much important are informal networks especially with clients, competitors, in developing new products and in recruiting skilled labour. Our research suggest that indeed networks are quite positively important in establishing company (networks inherited from previous employment), in new product development or innovativeness (value chain partners and market networks), in exploring new ideas or proactiveness (value chain partners and market networks), and partly in sustaining competitive advantages (alliances in SW). Networks are neither hindering nor positive factor in risk-taking. This may suggest that already strong network linkages are confined to incremental and low risk projects. This all suggests that, because of specific features of SW and MT as specialised supplier sectors, networks are their important feature. *But these networks are not improving risk taking ambition and do not generate potential economies of scale and scope through labour pool or joint specialized services.* This may be partly due to the small size of the CEE markets and the lack of inter-country support networks.

Overall, different factors that shape EO in CEE point to the increasing importance of limited demand, small markets, technology risk and skills as inhibiting factors to increased risk taking by entrepreneurs. *The institutional factors that fall within the realm of a structural reforms agenda or transition continue to play role but much less when compared to 'developmental' factors.* The major limiting factors call also for policies which focus on public procurement, stimulation of demand, technology risk funds and for sector specific skills enhancement programs. Policies to increase entrepreneurial orientation in knowledge intensive sectors should be embedded in their specific market context and thus be very much sector or technology specific. This requires in-depth understanding of the major drivers of competition in specific sectors and firm-oriented policies appropriate to open market context.

Finally, our analysis has justified the addition of networking as an additional component of EO. Without it, the very important networking dimension of entrepreneurship would be undermined or overlooked. Of course, our results are limited to two sectors explored and future research should further test key stylized facts of our research.

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