Aktivnosti istraživanja i razvoja (I&R) kao faktor rasta malih i srednjih poduzeća u stranom vlasništvu u odabranim zemljama srednje i istočne Europe

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Research and development activity as a growth factor of foreign owned SMEs in selected Central and Eastern European countries[*]

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Abstract

This paper aims to explore the role of R&D activity as a factor of growth of foreign owned SMEs in selected Central Eastern European countries (Croatia, former East Germany, Poland and Romania). The paper is based on the micro-level approach, i.e. it focuses on the characteristics of foreign owned SMEs in the selected countries where the population of foreign owned SMEs in each country is divided into two groups. The first group consists of the firms that have achieved high growth, and the control group consists of the remaining firms. **Our empirical analysis is based on the postal survey of foreign investment enterprises in manufacturing in the selected countries. All the surveys took place during the year 2006 and April and May 2007.** *The results show that foreign owned high growth SMEs in the analyzed countries demonstrate a tendency for R&D cooperation primarily with other firms (suppliers and customers), whereas low growth show inclination toward R&D cooperation with other unit of MNE and in case of former East Germany, this finding is statistically confirmed using chi-square tests. In the context of R&D activities as a knowledge source for high growth SMEs R&D activities and innovation activities, it is stressed the importance of R&D cooperation with local suppliers and customers is relatively more important in comparison to existing knowledge of MNE and R&D cooperation with scientific organization.*

Key words: *SME, R&D activities, Central and Eastern European countries*

JEL classification: *F23, 014, O31, O32*

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1. Introduction

This paper aims to explore the role of R&D activity as a factor of growth of foreign owned SMEs in selected Central Eastern European countries (Croatia, former East Germany, Poland and Romania). This is done by utilising the results of the surveys of knowledge transfer and R&D and innovation activities in manufacturing enterprises that have received foreign direct investments (FDI). The population of foreign owned small and medium enterprises (SME) in each country is divided into two groups, the differences between which are subsequently analysed. The first group consists of the firms that have achieved high growth, and the control group consists of the remaining firms. R&D activities in enterprises are measured by annual expenditures on R&D, the existence of R&D collaboration with external partners (suppliers, customers). Moreover, the relevance of R&D activities of other firms as source of knowledge for the R&D and innovation activities of both groups of SMEs is analysed.

Business undertakings with a significant growth potential are relatively rare – even in sectors that display above-average levels of competitiveness. When analysing high growth SMEs, existing research often tends to emphasise factors such as innovativeness and export-orientation. Due to the fact that there is mutual interdependence between R&D and innovation activities (cf. Cohen and Levinthal, 1989), so it is expected that in some extent various types of R&D activities and R&D activities as a knowledge source explain growth of SMEs of foreign investments enterprises (FIE) in the selected countries. The effects of foreign direct investments differ among host countries i.e. precisely depend on various group of factors such as type of investor (e.g. multinational enterprises, small and medium enterprises and financial investors), country of foreign direct investments origin (mostly developed countries) as well as characteristics of host country of foreign direct investments (inward stock of FDI, trade openness, quality of institution and the level of education), (cf. Fortanier, 2007: 69). Moreover, the integration of European and global markets as well as the accession process of post-communist countries into the European Union has been both a challenge and an opportunity for SMEs in Central and Eastern European Countries, where the entry of foreign investments has been frequently accompanied by knowledge transfer (i.e. primarily from foreign investments enterprises to local subsidiaries). Here, the existing knowledge within the multinational enterprise (MNE) (dominantly part of FIE) commonly present source of a competitive advantage for the local subsidiaries which are in majority small and medium sized enterprises. However, R&D co-operations involving local subsidiaries dominantly include national partners (e.g. Jaklič, Rojec Damijan, 2006). So, it is expected that the influence of R&D activities on firm performance within FIE differ among countries and in majority depend on types of R&D activities undertaken by these enterprises.

The paper is organised as follows. Firstly, a brief literature review is provided, outlining research efforts with respect to R&D activities in the context of firm

performance. The next section is a methodological remark, followed by the analysis of importance of R&D activities as a growth factor in selected countries, wherein the importance of various types of R&D activities such as own R&D investments and R&D collaboration are analysed as well as the importance of various R&D activities (i.e. own R&D investments and R&D cooperation) and existing technology of MNE as a knowledge source for SMEs growth. Some concluding remarks are presented in the last section.

2. Literature review

The importance of innovation activities on firm performance has become widely acknowledged (Crepon, Duguet, Mairesse, 1998; Mahemba, 2003; Grifith et al., 2006,), as well as the positive relationship between innovation and exports performance (Nguyen, 2007). R&D activities have been recognized as a crucial factor of innovation activity and/or innovation capacity (Cohen and Levinthal, 1989). In this context, R&D activities improve firm performance (e.g. total revenue increase), but additionally, R&D activities present knowledge source for other knowledge related activities R&D activities and innovation activities.

R&D activities can be conducted in house or out of house (in cooperation with other firms or specialised institutions). The primary issue relating to R&D cooperation is the choice between internal and external R&D activities, i.e. between the options of R&D stimulation and purchase (Veugelers, 1997; Veugelers and Cassiman, 1999). The choice between these options depends on the available technological knowledge, expected outputs, as well as on the accompanying risks and costs of R&D and innovation activities. High risks and costs and the lack of available knowledge induce firms to seek external partners. Hereby the key issue is the creation of an optimal mix of external knowledge resulting from market opportunities and knowledge within firm resulting from business decisions which evolve in the future.

The importance of R&D cooperation has risen steadily parallel with complexity, risk and cost of innovation activities. In terms of organizational modes, R&D cooperation varies from wholly-owned subsidiaries with full internalization of transactions, across various types of equity and non-equity agreements (which include team collaboration) to interpersonal collaboration (Lundin, Frinking and Wagner, 2005). The organizational modes of innovation cooperation are vital because of the different impacts they produce on participating firms' innovation activities. Weak ties serve more as bridges to rapid exchange of novel information, while strong ties are useful for both social control and the exchange of tacit knowledge (Powell and Grodal, 2005: 69). Teece (1980) argues that organizational practices affect performance and can explain sustained performance differences within industries - due to slow diffusion of best practices and difficulties in imitating complex organizational capabilities.

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The research into R&D activities in Central and Eastern European Countries (CEEC) in the context of EU convergence has shown that differences exist[4], where advanced countries (e.g. the Czech Republic, Hungary, Baltic countries) are catching up with the EU average unlike other countries (e.g. Slovakia, Poland) which are trailing behind the EU average (JRC-IPTS 2007: 7). It seems that the differences can be explained primarily by the presence of foreign direct investments, labor costs and characteristics of domestic markets factors (such as qualified labor force, strong national markets for R&D products), where these factors provide a fertile ground for increase of R&D investments in these countries (see more JRC-IPTS 2007). Similarly, Aralica, Račić, Redžepagić (2009) found that foreign owned SMEs in Croatia rely on R&D activities of foreign investors to improve their performance (measured by increase of total revenues and/or increase of employees) where own R&D investment within the SMEs cannot explain firm performance.

The literature examines various types of cooperation. R&D cooperation with suppliers through process innovation is aimed at cost reduction (e.g. Hagerdon, 1993), while the cooperation with rivals is motivated by the need to share R&D costs (Miotti and Sachwald, 2003). R&D cooperation with customers is a source of new ideas for innovations and/or reduces the risk associated with market introduction of the innovations (Von Hippel, 1988), and ensures market expansion when products are novel and complex or when they require adaptations in use by the customer (Tether, 2002). Cooperation with universities is aimed towards radical product innovation, with the goal at entering a new market or market segment (Monjon and Waelbroeck, 2003). Moreover, complementarities between various types of R&D cooperation have been observed. Complementarities were found for joint cooperation strategies with competitors and customers, and with customers and universities where the role of customer cooperation in facilitating commercialization and quicker diffusion of product innovations that may result from competitor and university cooperation (Belderbos, Carree and Lokshin, 2005). There are only few papers which deal with problematic of determinants of successful R&D cooperation in small business. Okamuro (2005) demonstrate that cooperative R&D by Japanese SMEs has a positive and significant impact on profitability, productivity growth and patenting. Moreover, Okamuro (2007) found that in generally organizational and contractual features of the cooperative project affect the success of the project where Japanese SMEs are involved.

The determinants of R&D activities and R&D cooperation are linked to characteristics of firms and industries. Fritsch and Lukas (2001), Vonortas (1997) find that propensity to co-operate increases with firm size. Kleinknecht and Van Reijnen (1992) found

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[4] The differences are observed in terms of R&D Intensity (i.e. the ratios of industry R&D performed to gross national product), Gross Expenditure on Research and Development (GERD) and Business Expenditure on Research and Development (BERD)

the relationship between the size (number of employees) and cooperation only in the relationship between private firm and public research institutions. Several empirical studies hardly find any significant relation between R&D intensity and co-operation. Kleinknecht and Van Reijnen (1992) identify an important role for R&D intensity only for co-operation between private firms and public research institutions, whereas Fritsch and Lukas (2001) obtain ambiguous positive results regarding the relationship between R&D intensity and the probability of co-operation. These results can be explained by characteristics of technologies employed (Negassi, 2004: 270), but the choice between in house R&D and R&D cooperation can also be linked to innovation costs and risks.

Innovation activities tend to be enhanced when a company is a part of a MNE. This is not only due to product mix and process standardisation; many studies show that parent companies have a positive influence on local subsidiaries and their innovation activities through knowledge transfer (e.g. Blomström and Sjöholm, 1999; Girma, Greenaway, and Wakelin, 2001; Damijan et al., 2003). A major challenge for MNEs is to find an organisational system capable of transferring know-how across units and locations, allowing locally generated know-how to be used throughout the multinational organisation (Sanna-Randaccio and Veugelers, 2003). Ivarsson and Jonsson (2003) found two basic motives for foreign R&D units. These were local market adaptation of technology originally developed by the parent corporations in the home country, and access to technological expertise and exploitation of local comparative advantage.

The theories explaining innovation co-operation include the perspectives of transaction costs perspective (which focus on cost reduction), organizational capabilities and technology-based view of the firm (focusing on enhancing the value of firm), lack of internal business resources, and game theory (emphasising strategic considerations in competitive relationships) - cf. Jaklič, Rojec and Damijan (2006). The primary motivation for a customer-supplier network is likely to be cost-economising, whereas strategic agreements aimed at long-term profit optimizing enhance the value of firm's assets (Narula, 2003). There are also several strategic reasons that explain the popularity of cooperative agreements. First, the increase of competition due to liberalisation processes (Buckley and Casson, 1998), which increases the risks and costs of innovation activities. The increasing number of alliances is motivated by reasons stemming from growing development costs and acquiring the resources and skills necessary to sell a new product and/or service (Narula, 2003). Second, declining transaction costs associated with contractual or quasi-internalised relationships in addition to falling profits margins has led to a disintegration of certain firms in particular industries. Furthermore, growing technological convergence between sectors has also played an important role where cross-fertilisation of technological areas has meant that firms need to access an increasing range of competencies (cf. Granstard, Pavitt and Pattel, 1997). In this case alliances initially revolving around

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R&D may be a precursor to mergers and acquisitions (Hagerdoorn and Sadowski, 1999).

Empirical evidence about R&D cooperation and its influence on firm performance has been growing in the recent years, with quite similar results appearing in different national contexts.

In USA Vonortas (1997) found that R&D cooperation has negative impact on profitability. Becker and Dietz (2004) found that cooperative R&D increases both R&D input and output (i.e number of new product). In the Dutch economy, Belderbos, Carree and Lokshin (2005) found overall positive impact of R&D cooperation on labour productivity growth, but different types of cooperation had different influences on labour productivity. Supplier and competitor cooperation enhance labour productivity growth, while competitor cooperation and collaboration with universities and research institutes positively affect growth in innovative sales per employee. In a study of foreign affiliates in Sweden, Ivasson and Jonsson (2003) found that collaboration with customers has positive results on local market adaptation as well as on export activities. Researching Italian firms, Medda, Piga and Siegel (2003) obtained somewhat different results. They argue that only collaboration with other firms significantly influences productivity, whereas cooperation in R&D with universities does not lead to productivity enhancements. The latter findings seem to be linked to the prevalence of radical innovation aimed at opening new markets and/or creation of new products.

3. Methodology remarks

This section analyses the influence of R&D activities on SME growth in the selected countries - Poland, Romania, Croatia and former East Germany[5]. Our empirical analysis is based on the postal survey of foreign investment enterprises in the manufacturing sectors of the selected countries. All the surveys except Croatia (in Croatia the survey took place in April and May 2007) took place during the year 2006. In all the selected countries the surveys were done by a questionnaire. In Croatia the survey was completed by a poll taker who subsequently contacted every single firm from the population. The questionnaires are almost unique for each country[6],

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[5] Country selection is a result of participation in the U-KNOW project, partially financed by the European Commission (EC) Framework Programme 6 (contract nr CIT5-028519), including countries from different parts of Central and Eastern Europe.

[6] Differences between the selected countries exist in the questions *R&D carried out in collaboration with local suppliers as source of knowledge* (table 10) and *R&D carried out in collaboration with customers as source of knowledge* (table 11), i.e. in the Croatian questionnaire these two questions do not exist whereas they do exist in the remaining questionnaires.

consists of three parts: basic information about the firm, the relationship between the foreign investor(s) and the firm, and R&D and innovation activities.

Our methodology tries to depict the influence of various R&D activities on small and medium enterprise growth in the selected countries. For the purpose of the research, R&D activities are measured by annual expenditures on R&D, the existence of R&D collaboration with external partners (suppliers, customers and other unit of multinational companies), where the partners are divided between domestic and foreign. Moreover, the relevance of R&D collaboration with other firms (suppliers and customers), and local scientific organisation as well as its own R&D activities, the existing technology of its MNE as a source of knowledge for the R&D activities of both groups of SMEs are analysed.

The analyzed population consists of foreign owned SMEs in the selected countries. In the table below we observe that the importance of the SMEs differs among these countries. On average, foreign owned SME in Croatia and former East Germany within a population of foreign owned firms have a favorable position (i.e. higher share of employees in the total number of employees and a higher share of sales in total sales) in comparison to their counterparts in Poland and Romania.

Table 1: Comparative analysis of foreign owned SMEs in the selected countries

- in percent (%)

Share / Countries	former E Germany	Poland	Romania	Croatia
Share of foreign owned SMEs in total number of foreign owned enterprises	87.1	70.0	30.0	82.8
Share of foreign owned SME employees in total employee number within foreign owned enterprises	50.4	26.5	8.5	44.3
Share of foreign owned SME sales in total sales of foreign owned enterprises	55.8	28.1	16.6	52.2

Source: Authors′ calculation

For the purpose of the analysis, the SME population (in the selected countries) is divided into two groups. The first group consists of firms that have achieved high growth, and remaining firms comprise the control group. The statistical significance of the difference between high growth SMEs and low growth SMEs is tested using the chi-square test for the each selected country. High growth enterprises are defined as ones that achieve continuing, significant and often outstandingly rapid increase of total revenues and/or number of employees as well as the other indicators of growth like total assets and profits (cf. McMahon et al., 1993). For the purpose of

the analysis, high growth enterprises are defined by simultaneous fulfillment of two criteria. The first one is above-average real sales growth in the period from 2002 to 2005; expect for Croatia where the observed period is from 2003 to 2006. Hereby real sales growth is defined as nominal sales growth subtracted by cumulative producer price index for each selected country (see table 2). For the each selected country we subtracted nominal sales growth[7] (i.e. values from the questionnaires) by PPI cumulative and we got average annual enterprise growth in the observed periods (3.3%), which was the same for each country. The second criterion is the increase in the number of employees in 2005 in comparison to 2002[8], expect for Croatia where the observed period is from 2003 to 2006[9].

Table 2: Producer prices indices (PPI) and nominal sales growth

- in percent (%)

Countries / Year	2003	2004	2005	2006	Cumulative PPI[10]	Nominal sales growth
Poland	2.6	7.0	0.7	-	10.3	20.3
Romania	19.5	19.1	10.5	-	49.1	59.1
former E. Germany	0.6	1.7	2.7	-	5.1	15.1
Croatia	-	3.1	3	2.9	9	19.0

Source: WIIW (2007), EIZ (2007), EIZ (2006)

Normally, annual enterprise growth (3.3%) would place SMEs in the category of capped-growth SMEs (McMahon, 2001). However, due to an unfavourable business environment, they are considered sufficiently propulsive to be considered as high growth SMEs in the selected countries. Our initial results regarding a growth performance differ within the small and medium populations among the selected countries. High growth SMEs more frequently appear in Poland (48.7%) in comparison to other countries. In Romania high growth SMEs take a share of 44.6%, in Croatia 40.4% and high growth SMEs in former East Germany take a share of 20.7%.

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[7] Sales growth equals sales value in the year 2005 divided by sales value in the year 2002 for the each selected country, except Croatia where sales growth equals sales value in the year 2006 divided by 2003.

[8] SMEs that have grown rapidly and exceeded the threshold of 250 employees by 2005 and/or 2006 have not been excluded.

[9] Companies in the selected countries which achieved two criteria first, above average growth of total sales higher than nominal sales growth and second the increase of number of employees are classified in the group of high growth small and medium enterprises in the each selected country.

[10] PPI cumulative index is the sum total value of PPI, calculated between the period 2003-2005, except for Croatia where the PPI cumulative index is the sum total value of PPI, calculated between the period 2004-2006.

4. R&D activities as growth factor in SMEs

As foreign investments enterprises such as multinational corporations, expand into foreign markets, the assumption is that their success is partly determined by their ability to effectively transfer their competitive technologies to their local subsidiaries (mainly small and medium sized enterprises) in order to establish a competitive advantage in the local market (cf. Chung, 2001). This is by no means implying that local markets cannot provide sources of knowledge which can, to an extent, contribute to enterprise growth. In addition, the specific interactions (e.g. suppliers and customers) in the local market merit the investigation of the domestic and international network (where R&D cooperation include local and international partners) and their influence on enterprise growth. Hence, links or networks, where local enterprises such as SMEs are involved become increasingly important for the assessment and analysis of their business activities.

Therefore in this chapter the aim is to analyse the differences between high growth SMEs and others in terms of the various types R&D activities. We are analysing R&D activities as a growth factor in the selected countries, where the importance of various type of R&D activities such as own R&D investments and R&D collaboration are analysed as well as the importance of various R&D activities (i.e. own R&D investments and R&D cooperation) and existing technology of MNE as a knowledge source for SMEs growth.

4.1. The influence of R&D activities on growth of SMEs

Our analysis shows that there are no statistically significant differences between high growth SMEs and low growth SMEs regarding the share of their R&D activities (Table 3)[11]. In terms of the growth profile it seems that low growth SMEs (40.4%) in Croatia show more inclination towards commercialization of their R&D investments, i.e. dominate in category 10.1% - 100% and similar results appear in former East Germany. On the other hand Poland and Romania are countries where SMEs do not show a consistent pattern.

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[11] Former East Germany: chi-square 0.360 (p value 0.828), Poland: chi-square 1.328 (p value 0.424) Romania: chi-square 4.802 (p value is 0.077), Croatia: chi- square 1.322 (p value 0.516)

Table 3: Share of R&D expenditure in total sales, in the selected countries, 2005

- in percent (%)

The stages of the scale / Countries (in percent)	former E Germany		Poland		Romania		Croatia[12]	
	Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth
0	17.3	19.4	63.3	59.4	52.8	72.4	53.9	65.7
0.1-10	65.4	67.7	33.3	40.6	33.3	10.3	5.7	5.7
10.1-100	17.3	12.9	3.3	0.0	13.9	17.2	40.4	28.6
Total	100	100	100	100	100	100	100	100

Source: Authors′ calculation

Table 4 below explores the differences between high growth and low growth SMEs considering R&D cooperation with other domestic units of the MNE network in four countries. In Poland there is significant difference between high growth and low growth SMEs ($p = 0.007$) and the value of chi square test is 16.096. However, low growth SMEs show more inclination towards such cooperation; 16.2% of them consider this cooperation *very important* whereas 41.0% of high growth SMEs consider the cooperation as *not important*. Same results appear in Romania and former East Germany. In Croatia there is ambiguous result regarding this cooperation. In the all remaining countries (except before mentioned Poland) there are no statistical differences between high growth SMEs and low growth SMEs[13].

Table 4: R&D cooperation with other domestic units of the MNE network

- in percent (%)

The scale of important / Countries	former E Germany		Poland		Romania		Croatia	
	Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth
Not important	2.4	17.1	16.2	41.0	34.5	33.3%	47.4	42.1
Little important	22.0	18.4	29.7	10.3	10.3	22.2	5.3	13.2
Important	39.0	25.7	32.4	33.3	13.8	11.1	12.3	7.9
Very important	26.8	24.3	16.2	0.0	6.9	2.8	8.8	5.3
Highly important	2.4	3.3	0.0	2.6	0.0	0.0	3.5	5.3
No answer	7.3	11.2	5.4	12.8	34.5	30.6	22.8	26.3

Source: Authors′ calculation

[12] 2006.

[13] Former East Germany: chi-square 7.821 (p value 0.166), Romania: chi-square 2.106 (p value is 0.716), Croatia: chi- square 2.907 (p value is 0.714)

The results produced interesting findings in terms of allocated relevance to foreign cooperation. Generally, data indicates that Polish and Croatian SMEs emphasise this type of cooperation as more important in relation to Romanian and East German counterpart. However, low growth SMEs in Poland and Croatia show more inclination towards R&D cooperation with other foreign units of MNE network. Indicatively, 45.9% of low growth SMEs in Poland used *very important* as their answer and high growth SMEs consider such cooperation as *not important* (20.5%). Similarly, 14.0% of low growth SMEs in Croatia consider such cooperation as *highly important*, whereas 7.9% of high growth SMEs consider the cooperation as *little important*. The majority of former Eastern Germany SMEs, on the other hand, attach little or no importance to this form of cooperation and results regarding the types of SMEs are quite ambiguous. Moreover, there are no statistical differences between high growth SMEs and low growth SMEs in the selected countries[14].

Table 5: R&D cooperation with other foreign units of the MNE-network

- in percent (%)

The scale of important / Countries	former E Germany		Poland		Romania		Croatia	
	Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth
Not important	34.1	25.7	10.8	20.5	27.6	30.6	33.3	31.6
Little important	34.1	32.2	5.4	5.1	6.9	22.2	3.5	7.9
Important	9.8	16.4	29.7	33.3	20.7	11.1	21.1	18.4
Very important	16.6	9.2	45.9	20.5	3.4	5.6	19.3	18.4
Highly important	2.4	2.6	8.1	10.3	6.9	2.8	14.0	10.5
No answer	4.9	13.8	0.0	10.3	34.5	27.8	8.8	13.2

Source: Authors′ calculation

It seems that high growth SMEs in Romania and Croatia show somewhat higher inclination toward R&D cooperation with other domestic firms (table 6) in comparison to low growth SMEs. In Romania 19.4% of high growth SMEs consider such cooperation as *important* and in Croatia high growth SMEs dominates in category *very important* (21.1%). On the other hand almost forty five percent of low growth SMEs population in Romania (44.8%) and Croatia (44.6%) claim such cooperation is *not important*. In former East Germany low growth SMEs show more inclination towards such cooperation, whereas the groups of SMEs in Poland do not show consistent pattern. However there are no statistical differences among the observed groups in the selected countries[15].

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[14] Former East Germany: chi-square 4.931 (p value 0.424), Poland: 8.836 (0.116), Romania: 4.438 (0.488), Croatia: 1.582 (0.903)

[15] Former East Germany: chi-square 7.821 (p value 0.166), Poland: 6.896 (0.228), Romania: 8.555 (0.128), Croatia: 6.820 (0.234).

Table 6: R&D cooperation with other domestic firms

- in percent (%)

The scale of important / Countries	former E Germany		Poland		Romania		Croatia	
	Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth
Not important	2.4	17.1	10.8	25.6	44.8	27.8	44.6	31.6
Little important	22.0	18.4	37.8	23.1	0.0	16.7	5.4	15.8
Important	39.0	25.7	35.1	33.3	13.8	19.4	30.4	21.1
Very important	26.8	24.3	5.4	12.8	3.4	8.3	12.5	21.1
Highly important	2.4	3.3	5.4	0.0	3.4	0.0	0.0	2.6
No answer	7.3	11.2	5.4	5.1	34.5	27.8	7.1	7.9

Source: Authors′ calculation

Despite the fact that the survey results regarding R&D cooperation with other foreign firms show no statistical differences between SME groups[16], there are differences between countries. Namely, SMEs in Poland and Croatia show more inclination to such cooperation in relation to counterpart from former East Germany and Romania. Respectively, high growth SMEs in Poland (20.5%) and Croatia (18.4%) dominate in category *very important*, whereas low growth SMEs in Poland (43.2%) prevail in the category *little important* as well as low growth SMEs in Croatia, dominating in the category *important* (24.6%).

Table 7: R&D cooperation with other foreign firms

- in percent (%)

The scale of important / Countries	former E Germany		Poland		Romania		Croatia	
	Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth
Not important	34.1	25.7	8.1	25.6	34.5	30.6	40.4	36.8
Little important	34.1	32.2	43.2	20.5	0.0	5.6	10.5	15.8
Important	9.8	16.4	32.4	30.8	13.8	22.2	24.6	15.8
Very important	16.6	9.2	10.8	20.5	6.9	8.3	14.0	18.4
Highly important	2.4	2.6	2.7	0.0	6.9	5.6	1.8	5.3
No answer	4.9	13.8	2.7	2.6	37.9	27.8	8.8	7.9

Source: Authors′ calculation

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[16] Former East Germany: chi-square 4.931, (p value 0.424), Poland: 8.723 (0.121), Romania: 2.908 (0.714), Croatia: 2.593, (0.762).

4.2. The knowledge source and its importance for SMEs growth

Another aspect examining SME growth factors is the evaluation of the importance of the technological knowledge sources for firm's R&D and innovation activities. Sources of knowledge can be grouped as internal and external. Internal source includes own firm's knowledge (e.g. R&D investments[17]). External sources of knowledge are the result of active engagement with market actors, (e.g. local and foreign suppliers and customers and specialized institutions such as market agencies and R&D institutes), as results can present knowledge source for firm's R&D and innovation activities. Also, external sources would include the existing technology of the MNE group which is simply applied in local subsidiaries as a part of technology transfer (e.g. acquiring machinery equipment of local subsidiaries from their owner).

The importance of own R&D investments as source of knowledge (Table 8) highlighted differences between countries. On a country level, Polish, Croatian and especially Eastern German SMEs emphasise this knowledge source more in relation to their counterparts in Romania. More precisely, high growth SMEs in Poland show more inclination towards using own R&D investments as a source of knowledge in comparison to low growth, dominates in category *highly important* (7.7%)[18], whereas in East German low growth SMEs consider this knowledge source as more important in comparison to high growth SMEs. However there are no statistically significant differences between SMEs groups in the observed countries[19].

Table 8: R&D carried out internally as a source of knowledge

- in percent (%)

The scale of important / Countries	former E Germany		Poland		Romania		Croatia	
	Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth
Not important	9.5	13.2	13.5	17.9	31.0	19.4	38.6	26.3
Little important	11.9	15.8	21.6	17.9	10.3	5.6	8.8	7.9
Important	21.4	24.3	43.2	20.5	20.7	22.2	12.3	23.7
Very important	31.0	25.0	21.6	25.6	6.9	16.7	26.3	21.1
Highly important	19.0	13.2	0.0	7.7	6.9	11.1	14.0	21.1
No answer	7.1	8.6	0.0	10.3	24.1	25.0	0.0	0.0

Source: Authors′ calculation

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[17] In business practice these investments are closely connected with business functions like product development and/or process engineering.

[18] Similar results appear in Croatia, high growth SMEs appear more frequently in category highly important (21.1%) whereas low growth SMEs dominate in category not important (38.6%).

[19] Former East Germany: chi-square 2.115 (p value 0.833), Poland: 10.243 (0.069), Romania: 2.933 (0.710), Croatia: 3.730 (0.444)

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The relevance of *existing technology of the MNE* groups used in production without subsequent adjustments, (Table 9) is particularly evident in Poland, where 54.1% of low growth and 48.7% of high growth SMEs perceive this as *very important*, unlike the evidence in the remaining countries[20]. Regarding the difference between the observed groups in the selected countries, we observe that in former East Germany high growth SMEs perceive existing technology of the MNE group more important in comparison to low growth SMEs i.e. they dominate in the categories *highly important* (7.9%) and *very important* (13.2%), whereas low growth SMEs dominate in category *little important* (23.8%).

Table 9: Existing technology of the MNE group embodied in products produced as source of knowledge

- in percent (%)

The scale of important / Countries	former E Germany		Poland		Romania		Croatia	
	Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth
Not important	19.0	32.2	2.7	5.1	20.7	13.9	33.9	29.7
Little important	23.8	16.4	10.8	7.7	6.9	2.8	1.8	8.1
Important	19.0	17.1	18.9	20.5	13.8	30.6	16.1	8.1
Very important	9.5	13.2	54.1	48.7	13.8	19.4	21.4	29.7
Highly important	2.4	7.9	13.5	10.3	17.2	5.6	26.8	24.3
No answer	26.2	13.2	0.0	7.7	27.6	27.8	0.0	0.0

Source: Authors′ calculation

However, the results for other countries do not show consistent patterns. Moreover, there are no statistical significant differences between high growth and low growth SMEs regarding perception of existing technology of the MNEs as source of knowledge in the observed countries[21].

As stated above, the external sources of firm's knowledge include the formal and informal cooperation with market actors (such as customers and suppliers) which contribute to the increase of use of the activities related to knowledge (e.g. R&D

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[20] SME group evaluation shows that 30.6% of Romanian high growth SMEs consider technology of the MNEs group as *important*, while 20.7% of low growth SMEs consider that existing technology as *not important* source of knowledge at all. Finally, in Croatia, the results vary as the considerable proportion of both low and high growth SMEs indicate no importance at all of existing technology, but with high share of firms responding in the two highest categories of importance 26.8% low growth stated *highly important* and 29.7% of high growth SMEs stating *very important*.

[21] Former East Germany: chi-square 8.35 (p value 0.138), Poland: 3.629 (0.604), Romania: 5.325 (0.378), Croatia: 3.96 (0.411)

activities and innovation activities) aimed at improving firm's performance (such as total revenues and/or number of employees). In the case of local suppliers, SMEs in Poland can be differentiated from former East Germany and Romania in terms of overall trends, 29.7% of low growth SMEs and 25.6% of high growth SMEs claim such knowledge source as *important*. SME group analysis showed that there is statistically significant difference between groups (0.002)[22] unlike the counterparts in the both countries where substantially higher proportion of SMEs consider this variable as *not important*.

Table 10: R&D carried out in collaboration with local suppliers as source of knowledge[23]

- in percent (%)

The scale of important / Countries	former E Germany		Poland		Romania	
	Low growth	High growth	Low growth	High growth	Low growth	High growth
Not important	19.4	23.4	10.8	33.3	37.9	22.2
Little important	33.3	21.5	54.1	17.9	3.4	22.2
Important	27.8	19.6	29.7	25.6	17.2	19.4
Very important	11.1	17.8	2.7	7.7	0.0	8.3
Highly important	2.8	4.7	2.7	2.6	13.8	2.8
No answer	5.6	13.1	0.0	12.8	27.6	25.0

Source: Authors′ calculation

It seems that in Poland high growth SMEs shows more inclination towards *R&D collaboration with local suppliers as source of knowledge* in comparison to low growth SMEs, high growth SMEs dominates in category *very important*, whereas more than half of low growth SMEs (54.1%) consider the R&D collaboration with local suppliers as *little important*. In former East Germany it seems that such source of knowledge play stronger role for high growth SMEs in comparison to low growth SMEs; they dominate in category *very important* (17.8%) whereas low growth SMEs are frequently presented in category *little important* (33.3%). Results for Romanian SMEs do not show clear pattern i.e. low growth dominates in category *highly important* (13.8%) whereas high growth dominates in category *very important* (8.3%). However, there are no statistical differences among observed groups for SMEs in Romania, former East Germany and Poland[24].

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[22] The value of chi square test is 17.031.

[23] The indication of the level of collaboration with local suppliers in R&D and innovation (Table 9.) is not available for Croatia, but overall it is evident that little if any importance is given to cooperative agreements with local suppliers in all countries, reflecting low levels of effective R&D communication.

[24] Former East Germany Chi square 4.888 (p value 0.430), Romania; 10.478 (0.063)

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Another important aspect is R&D collaboration with customers as knowledge source R&D, (Table 11), distinguishes former Eastern German SMEs from other countries in the sample. Within the SMEs population in former East Germany, low growth SMEs consider the *R&D collaboration with customers as source of knowledge* more important in comparison to high growth SMEs. They claim that such source as *highly important* (12.1%) whereas more than thirty percent of high growth SMEs consider this source of knowledge as *not important* (35.2%). The analysis shows that there is exhibits statistically significant difference in East German example among the observed SMEs (the value of chi square is 18.209 and p value 0.003), whereas in Romania and Poland there are no statistically significant differences between groups[25]. In Poland, out of the sampled high growth SMEs, 5.1% entered the *highly important* category, with additional 12.8% in the *very important* category. Similar results were obtained in Romania.

Table 11: R&D carried out in collaboration with customers as source of knowledge

- in percent (%)

The scale of important / Countries	former E Germany		Poland		Romania	
	Low growth	High growth	Low growth	High growth	Low growth	High growth
Not important	15.2	35.2	16.2	17.9	34.5	19.4
Little important	33.3	12.0	37.8	25.6	3.4	19.4
Important	27.3	18.5	32.4	28.2	20.7	19.4
Very important	12.1	22.2	10.8	12.8	6.9	11.1
Highly important	12.1	3.7	2.7	5.1	3.4	5.6
No answer	0.0	8.3	0.0	10.3	31.0	25.0

Source: Authors′ calculation

The level of interaction with local scientific institutions (Table 12) could be a good indicator of local academic infrastructure relevance for SMEs growth. The results show that this is definitely an area which requires further improvements. Namely, both groups in all countries predominantly allocate no importance R&D collaboration with local scientific institutions as sources of knowledge. In the all selected countries among the observed groups (low growth SMEs in Poland are exception), dominates SMEs which consider R&D collaboration with local scientific institutions as *not important source of knowledge* at all. We observe that only in Croatia high growth SMEs consider this knowledge source as more important in comparison to low growth

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[25] Former East Germany Chi square 18.209 (p value 0.003), Poland: 5.182 (0.394), Romania; 5.415 (0.367)

SMEs, 17.1% of them perceive such knowledge source as *highly important*, whereas almost half of low growth perceive this knowledge source as *not important* (47.4%). In the all other countries low growth SMEs perceived the knowledge source more important than high growth SMEs. However, there are no statistically significant differences among the observed groups in the all selected countries[26].

Table 12: R&D carried out in collaboration with local scientific institutions as source of knowledge

- in percent (%)

The scale of important / Countries	former E Germany		Poland		Romania		Croatia	
	Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth
Not important	28.6	41.1	29.7	30.8	37.9	47.2	47.4	42.9
Little important	21.4	18.5	21.6	25.6	10.3	16.7	21.1	20.0
Important	28.6	16.6	40.5	23.1	17.2	8.3	10.5	11.4
Very important	9.5	10.6	8.1	7.7	3.4	2.8	17.5	8.6
Highly important	4.8	1.3	0.0	0.0	0.0	0.0	3.5	17.1
No answer	7.1	11.9	0.0	12.8	31.0	25.0	0.0	0.0

Source: Authors′ calculation

Therefore, in terms of knowledge sources, it seems that R&D collaboration with market actors such as customers and suppliers explain growth of SMEs to an extent in former East Germany, Poland and Romania. More precisely, there is statistically significant difference between the observed groups where high growth SMEs in former East Germany emphasise R&D collaboration with customers as opposed to low growth SMEs. Moreover, in Poland and Romania high growth SMEs emphasise more R&D collaboration with local suppliers as source of knowledge in comparison to low growth, but there are no statistical significant differences among the observed groups in these countries.

5. Conclusion

This research, confirming the link between R&D activities and firm performance analyzed two aspects of R&D activities as factors in SME growth. Firstly, the analysis of *R&D activities in terms of cooperation* with other firms produced interesting findings on a country level as well as on an SME group level. Here, the results showed that SMEs in Poland predominated in terms of cooperation with firms both locally and

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[26] Former East Germany Chi square 6.553 (p value 0.256), Poland: 6.718 (0.152), Romania; 2.056 (0.726), Croatia: ‚5.996 (0.199)

internationally. However, in terms of cooperation with domestic MNE units, SMEs in Poland and former East Germany dominated. Foreign owned SMEs showed greater inclination to cooperate with foreign partners in these two countries in comparison to elsewhere. This result could be explained by low level technological intensity of supplement from the local partners where services and non technological intensive products are dominant in the supply of foreign investment enterprises. In addition, it seems that technology transfer from the MNE is taken as given, as additional improvements and R&D in cooperation with the MNE headquarters is perceived by SMEs as too complicated a process. This argument is further substantiated by results showing that R&D cooperation with other domestic units of the MNE network is relatively stronger in the case of low growth SMEs. On the other hand high growth SMEs show more inclination towards R&D cooperation with firms from domestic market (Romania) and/or foreign markets (Poland and Croatia), however this result are not statistically confirmed. Thus, it seems that R&D cooperation with other firms (domestic and foreign) present stronger opportunity for SMEs growth in comparison to SMEs R&D cooperation with a firm i.e. MNE units.

Secondly, in terms of *knowledge sources* for SME's innovation and R&D activities, the Polish and especially Eastern German SMEs more emphasised the importance of knowledge sources, in relation to Romanian and Croatian counterpart. In Poland SMEs are taking most advantages of knowledge transfers, and emphasise the use of R&D activities overall as source of knowledge while Croatian SMEs show the opposite tendency. While the relevance of existing technology of the MNE groups as knowledge sources used in production is particularly evident in Poland, results for Polish and Eastern German SMEs show that they do not consider local suppliers and scientific institutions as important sources of knowledge. Romanian SMEs on the other hand more actively use R&D cooperation with local suppliers and customers as source of knowledge, which further adds to existing findings on a European level that transition countries cannot be grouped together in terms of similar behavioural and knowledge transfer patterns as other SMEs. Most importantly, high growth SMEs are more likely to rely on internal knowledge as well as collaboration with the market environment, namely customers and local suppliers as source of knowledge. This is a clear indication that local knowledge does indeed play a part in the creation of competencies and more particularly, provides a valuable input in successful R&D. It is evident that the weak links exist with local scientific institutions, which clearly implies that more work is required in bridging the communication gap between the business and academic communities, particularly in the field of developing incremental and radical innovations in local SMEs. In addition, similar conclusions can be drawn from the analysis of the responses concerning R&D cooperation with other firms abroad.

In conclusion, the survey results yielded interesting findings which contribute to research on links between R&D activities and firm performance of MNE and SMEs in the selected countries. The evidence shows that high growth SMEs are an increasingly important segment of foreign investments enterprises. High growth

SMEs use the results of own R&D investments and R&D cooperation with local suppliers and customers as a source of knowledge relatively more in comparison to sourcing MNE knowledge and local scientific institutions in their innovation efforts which confirms the reliance on local knowledge.

Further research would be to enhance these results by taking into account ownership type (i.e. foreign financial investors, MNE group, small and medium sized foreign firms) and their linkage with SMEs growth. Moreover, this methodology could be further improved by forging stronger links between R&D activities and business functions which would provide and identify additional factors which influence SME growth.

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Aktivnosti istraživanja i razvoja (I&R) kao faktor rasta malih i srednjih poduzeća u stranom vlasništvu u odabranim zemljama srednje i istočne Europe

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Sažetak

Ovo istraživanje ima za cilj objasniti ulogu aktivnosti I&R kao faktora rasta malih i srednjih poduzeća u stranom vlasništvu u odabranim zemljama srednje i istočne Europe (Hrvatska, Istočna Njemačka, Poljska i Rumunjska). Istraživanje se zasniva na mikro analizi tj. fokus je na obilježjima malih i srednjih poduzeća u stranom vlasništvu u svakoj od selektiranih zemalja gdje je populacija malih i srednjih poduzeća u stranom vlasništvu podijeljena na dvije skupine. Prva je skupina ona poduzeća koja su postigla visoki rast i druga je kontrolna skupina, poduzeća koja nisu postigla ubrzani rast. Empirijska analiza se zasniva na poštanskoj anketi izravnih stranih ulagača u proizvodnji u selektiranim zemljama. Prikupljanje podataka izvršeno je u 2006. i travnju i svibnju 2007. godini.

Rezultati pokazuju da su mala i strana poduzeća s visokim rastom pokazivala tendenciju za suradnjom u aktivnostima I&R ponajprije s ostalim poduzećima (snabdjevačima i potrošačima), za razliku od ostalih poduzeća koja su pokazivala tendenciju prema suradnji u I&R aktivnostima s ostalim jedinicama multinacionalnih kompanija i to u slučaju bivše Istočne Njemačke, i ovaj je nalaz statistički potvrđen upotrebom hi-kvadrata. U kontekstu aktivnosti I&R kao izvora znanja za inovacijske aktivnosti i aktivnosti I&R malih i srednjih poduzeća s ubrzanim rastom istaknuta je važnost aktivnosti I&R suradnje s lokalnim snabdjevačima i potrošačima. Ta je aktivnost relativno važnija u usporedbi s ostalim izvorima znanja kao što su postojeće znanje multinacionalnih kompanija i suradnje u aktivnostima I&R sa znanstvenim institucijama.

Ključne riječi: *MSP (mala i srednja poduzeća), aktivnosti istraživanja i razvoja (I&R), zemlje srednje i istočne Europe*

JEL klasifikacija: *F23, 014, O31, O32*

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