Available online at www.sciencedirect.com
ScienceDirect
Technovation 29 (2009) 438–450
technovation
www.elsevier.com/locate/technovation

The antecedents of SME innovativeness in an emerging transition economy

Sonja Radas*, Ljiljana Božić

The Institute of Economics, Trg J.F. Kennedy 7, 10000 Zagreb, Croatia

Abstract

Understanding forces that contribute to the success of small and medium enterprises (SMEs) is very important, as these enterprises are vital for both developed and developing economies. Since innovativeness is among the most important means through which such businesses contribute to economic growth, numerous research studies were conducted to determine which factors positively impact SME's innovative efforts. This is an even more important issue for developing economies, where SMEs are often faced with inadequate infrastructure. Since there is a lack of studies on SME innovation in developing economies, often policy in such countries is based on findings from developed countries.

In this paper, we explore factors that drive innovation activities in SMEs in a small emerging transition economy (Croatia), and compare it with findings from developed economies. In addition to factors used in most previous studies, we consider market scope, firm's market orientation and presence of strategic, managerial and marketing changes. We find that most factors that were found to be important in developed economies are important in developing economies as well. In addition to that, market scope was discovered to be a very important factor in both product and process innovation. Implementing corporate changes has positive impact on radical product innovation while implementing new organizational structures has positive effect on incremental innovation. When investigating determinants of product innovation, we distinguish new products of low novelty from new products of high novelty, and show that they need to be supported by different policies. To gain additional insight in innovation efforts, we examine obstacles to innovation. We find that firms that report facing obstacles are not less likely to innovate less, which suggests that innovators are able to work around obstacles without damaging effects to innovation. This study is based on a postal survey of 448 SMEs in Croatia, which was performed in 2004.

Keywords: SME; Innovation; Developing country

1. Introduction

Small and medium enterprises (SMEs in further text) are considered to be the engine of economic growth and employment. One of the primary means through which SMEs are expected to accomplish this task is by developing and commercializing innovations. Innovation may be even more important for SMEs than for large firms: some authors (Fritz, 1989; Sweeney, 1983) deem that SMEs use product innovations as a means to becoming competitive to a higher extent than their large counterparts. In this paper by innovation, we mean a new or significantly improved product (good or service) introduced to the market as well as new or significantly improved process introduced within the enterprise. We investigate both incremental and radical product innovations. Incremental innovation refers to product line extensions or modifications of existing platforms and products, while by radical innovations we mean products that are new to the market as well as for the company.

Because of the importance of the SME sector in creating economic growth, both developed and developing countries are very interested in finding ways to stimulate SMEs in realizing innovations. But in which ways can SMEs be helped to innovate? What is the best way for policy makers to encourage innovation? Many efforts have been made in

*Corresponding author. Tel.: +385 1 236 2238; fax: +385 1 2335 165.
E-mail addresses: sradas@eizg.hr (S. Radas), ljbozic@eizg.hr (L. Božić).

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doi:10.1016/j.technovation.2008.12.002

that direction during the last few decades (Keizer et al., 2002). If we could understand how SMEs innovate and what propels them to innovate, answering these questions would be much easier. Interestingly, despite the strong commitment to supporting SMEs, the actual process by which such firms undertake innovative activity remains unclear (Hoffman et al., 1998). Therefore, the first step in devising the right incentives to support innovation in SMEs is an investigation into which factors impact the innovation efforts of SMEs and in which way (Keizer et al., 2002).

Since SMEs are integrated in the region in which they exist to much larger extent than large firms, the determinants of innovation for SMEs depend on specificities of that region (Kaufmann and Todtling, 2002). For example, Keizer et al. (2002) show that using innovation subsidies, having links with knowledge centers, and the percentage of turnover invested in R&D are the most important factors for innovation in SMEs in Netherlands (more precisely, in the Brabant region), which has direct impact on their policy recommendations. However, basing policy measures on these results may be ineffective for other countries because the same factors may not be as crucial for another region and another economy. For example, Kaufmann and Todtling (2002) in their investigation of SMEs in Upper Austria show that support measures that are not in tune with real situation "on the ground" can be rather ineffective.

Most published research studies, which deal with determining factors significant for SME innovation, come from developed economies. As noted in Hadjimanolis (1999) "The study of innovation, including the obstacles to its successful implementation, while relatively well researched in the industrialized countries is rather neglected in less-developed countries." It is not known to which extent the findings from developed countries can be generalized to developing economies. For example, in the context of technology management, Cetindamar et al. (2009) show the importance of questioning the appropriateness of US-based management theories with regard to their use in developing countries. Yet policy makers in developing countries, faced with the task of crafting regulations to support SME innovation, often draw upon the stock of knowledge from investigation of SMEs in developed economies. So an important issue for policy makers would be to find out to which extent they can rely on these findings. In this paper, we shed some light on this question by investigating factors that significantly impact innovation in SMEs in Croatia, a small developing economy. In investigating these factors, we build upon the existing field of research about innovation determinants in SMEs. Our data come from the Community Innovation Study performed in 2004 and covers period from 2001 to 2003.

Following Keizer et al. (2002), we define a list of variables and then proceed to examine their significance for innovation in Croatian SMEs. We take relevant firm characteristics (as is usual in the literature), but in addition we include some new variables. We include (1) market scope, (2) presence of organizational and strategic changes in the firm and (3) market orientation of the firm. To the authors' knowledge, except for market orientation in Salavou and Lioukas (2003) study of Greek SMEs, the three mentioned variables were not considered in this context before. We include market orientation because it was shown to have strong link with innovation (Kohli and Jaworski, 1990; Deshpandé et al., 1993; Slater and Narver, 1994; Atuahene-Gima, 1996; Langerak et al., 2004). We consider organizational and strategic changes because willingness and ability to transform is important for firms in developing economies which need to improve in order to compete and survive. As Hadjimanolis (1999) points out "While firms in less-developed countries, in the recent past, were operating within a relatively protected environment, they must now face the global forces of competition. The globalization of the markets requires the adaptation of firms in order to survive." We also investigate the effect of market scope, i.e. firm's dominant market on innovation (dominant market can be local, national or international), as this is an important issue for a small economy. Since innovating with incremental innovations is different than innovating with radical innovations in terms of factors (Balachandra and Friar, 1997) and skills (Freel, 2005) required, in this paper we distinguish new products of low novelty (incremental innovations) from new products of high novelty (radical innovations). In this respect, our approach is similar to Amara et al. (2008) who considered both the innovation and novelty of innovation in their study of learning and innovation in SMEs.

By exploring determinants of innovation, we gain knowledge about what propels an enterprise to innovate. This picture is not complete without the investigation of hampering factors that prevent firms from innovating. This is why in this paper, we also examine obstacles to innovation.

2. Theoretical background and literature review

Stimulating innovation in SMEs is a very important matter for an economy; a number of studies were conducted recently with the goal to discover which factors contribute to innovation efforts by SMEs (Keizer et al., 2002). Following Keizer et al. (2002), the factors that have effect on innovation can be divided into internal and external, where internal variables refer to characteristics and policies of SMEs while external variables refer to opportunities that SME can seize from its environment.

2.1. Internal factors bearing impact on innovation

Among the internal factors shown to be the most important determinants of innovative activity are high incidence of qualified scientists and engineers, and strong leadership provided by a highly educated director or founder (Hoffman et al., 1998; Le Blanc et al., 1997), although some

studies do not find that effect (Keizer et al., 2002). Among other internal factors, Docter and Stokman (1988) and Oerlemans et al. (1998) report that existence of technology policy instruments in the firm and planning for the future are internal factors linked to innovation efforts. Larson et al. (1991) and Meer et al. (1996) claim that application of project management structures has bearing on the innovation activities. Strategy is another internal factor that is shown to have impact on innovation in SMEs. In particular, Birchall et al. (1996) and Carrier (1994) mention explicit strategies to increase and stimulate internal creativity and risk taking behavior. Yet another internal variable is investments in R&D (Birchall et al., 1996; Oerlemans et al., 1998). Among other internal factors that were found to be important determinants of success of innovative efforts are the nature of the commercialization and marketing effort, the degree of marketing involvement in product planning and firm competence in the area of technology strategy and technology management (Hoffman et al., 1998).

2.2. External factors bearing impact on innovation

Regarding external factors, Keizer et al. (2002) group them into three sets: collaboration with other firms, linkages with knowledge centers and utilizing financial resources or support regulations. Entrepreneurs consider collaboration with other firms as a very important part of their innovation efforts (Massa and Testa, 2008). In particular, Kaminski et al. (2008) show that collaboration with suppliers can contribute to innovativeness of SMEs. Collaboration with suppliers may also have the goal to overcome size constraints as reported in Lipparini and Sobrero (1994), while collaboration with both suppliers and customers may be performed for the purpose of co-design (Birchall et al., 1996; Meer et al., 1996; Docter and Stokman, 1988; Davenport and Bibby, 1999). Collaboration with customers can be a source of improved technology (Le Blanc et al., 1997). Strategic alliances are also shown to be important influencers of innovative efforts when they are integral part of firm's development plan (Forrest, 1990; Cooke and Willis, 1999).

Linkages with knowledge centers include contributions by professional consultants, university researchers and technology centers (Le Blanc et al., 1997; Hoffman et al., 1998; Oerlemans et al., 1998), as well as contribution by innovation centers and Chambers of Commerce (Oerlemans et al., 1998).

Regarding variables which relate to utilizing financial resources or support regulations, availability of R&D funding was shown to be an important influencer of innovative efforts in SMEs (Le Blanc et al., 1997; Birchall et al., 1996; Hoffman et al., 1998).

2.3. Internal and external factors in extant studies

Most of these studies explore just one or a few of the mentioned variables, except for Keizer et al. (2002) who consider a list of both internal and external variables. Although for most of the described variables, the suggestion is that they have a direct and a positive effect on innovative efforts (Keizer et al., 2002), there is no absolute consensus on that. For example, while Hoffman et al. (1998) report that internal factors have more bearing on innovation than external factors, Keizer et al. (2002) find a limited number of both external and internal variables that have a significant influence on innovation efforts where external factors prevail. Even for a particular factor, different studies may yield different results. For example, regarding the education level of employees and managers, Keizer et al. (2002) find in their study of mechanical and engineering sector SMEs that neither the education of the manager nor the percentage of employees with high education is significant in explaining innovative efforts, which is contrary to prior research (Hoffman et al., 1998; Le Blanc et al., 1997). Contradictory results were also found regarding linkages with sources of knowledge, as reported by Hoffman et al. (1998). Similarly, different views exist on the role of financial funding (Hoffman et al., 1998) and the proportion of turnover spent on R&D (Oerlemans et al., 1998; Birchall et al., 1996).

All these findings point to the fact that it is still unresolved which variables influence innovation efforts in SMEs and in which way. Generalizations are difficult due to the complexity of the system we are observing; namely as the behavior of SMEs differs by industry sectors and geographically, it is hard to infer general rules that would hold across the board. One way to learn more about determinants of innovative efforts in SMEs is to conduct a variety of studies under diverse economic conditions and in different geographical areas.

3. Research model

In this section, we propose the research model which contains determinants of innovation together with the obstacles. Fig. 1 outlines our conceptual model.

3.1. Modeling factors that propel innovation

As the indicator of innovation effort, we use the fact that the firm developed and launched any product innovation or process innovation in 3-year period

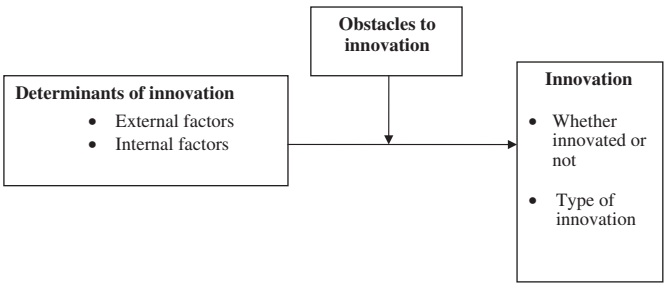

Fig. 1. Conceptual model.

(2001–2003). Three types of product innovation are studied: line extensions, "me-too" products, and radical product innovation. The first two types of innovations are usually referred to as incremental innovations. Line extension refers to minor modification of an existing product, while "me-too" products are imitations of competitors' products that already exist on the market. Both incremental and radical innovations have an important role. Managers design incremental innovations to satisfy a perceived market need with products that can be developed in a relatively short period of time (Ali, 1994). The introduction of incremental innovation is critical for the long time survival of firms (Banbury and Mitchell, 1995). On the other hand, radical innovation is a major innovation, the product totally new to the market as well as to the company. It could be based on new technology or on satisfying a latent market need by disrupting incumbent markets (Iyer et al., 2006). In this paper, each of the five types of innovation (product, process, line extension, "me-too" and radical) is represented by a dummy variable, where 1 denotes that such innovation was introduced in the time period 2001–2003, and 0 denotes otherwise.

Next we focus on defining factors that impact innovation. Following the work of Keizer et al. (2002), we classify our independent variables as external and internal. All variables refer to the period from 2001 to 2003.

3.1.1. External factors

Following Keizer et al. (2002), Birchall et al. (1996) and Meer et al. (1996), as external factors we consider innovation subsidies by municipality, innovation subsidies by the government and collaboration with other firms or institutions (Table 1). Within collaboration, we single out cooperation with universities or research institutes. Regarding the industry–science collaboration, it is not clear what we can expect to find. Some studies show that industry–university links in transition countries are quite weak (Koschatzky, 2002; Radas, 2004; Radas and Vehovec, 2006); it is even more worrisome that although firms may be satisfied with the quality of the collaboration, they may not rate its commercial results highly (Radas, 2004). This situation, which is in all likelihood caused by weaknesses of both parties, can potentially have negative effects on innovation.

A new external factor that we add to this analysis, one which has not been investigated in this setting before, is market scope (Table 1). By market scope, we mean the most important market for the company (local, national or international). For small countries in particular, the market where the firm operates is important for the way business is conducted. For example, firms that are present only in small local markets can be more complacent and less motivated to innovate than the firms that are active on wider (international) markets. Firms that go international encounter stronger competitors and therefore have to innovate in order to gain and keep their position. Actually, survival on a more competitive market requires a steady stream of innovations. Additional push to innovate comes from the fact that more competitive markets often offer higher incentives for innovation (Sorescu et al., 2003). For a small developing country, the further from the headquarters the company goes, the harder it becomes to compete because among other things the firm has to solve increasingly complex supply chain, logistic and marketing issues while contending with incumbent companies. In the model, we introduce two dummy variables; one indicates firm's presence on national market and the other indicates its presence on international markets (Table 1).

3.1.2. Internal factors

We investigate two types of internal factors. The first group of factors is related to firm characteristics like firm age, share of highly educated employees, and share of full-time equivalent employees engaged in intramural R&D (Table 2). We did not consider firm ownership because almost all the firms in our sample are privately owned. The second group of factors speaks about implementation of changes in strategy, marketing, management and organizational structure (Table 3) and about market orientation (Table 4). In the remainder of this section, we explain our choice of factors and discuss their possible effect on innovation efforts.

3.1.2.1. Firm characteristics. *Firm age*: Although there is no result concerning age of SMEs and innovation, there is some evidence (Hausman, 2005) that younger small firms (up to 10 employees) are more innovative than older small firms. Namely, small businesses become less innovative

Table 1
External factors: definition of variables.

External factors	Factor definition
Innovation subsidies from a municipality	1 if the firm received innovation subsidies from a municipality, 0 otherwise
Innovation subsidies from the government	1 if the firm received innovation subsidies from the government, 0 otherwise
Collaboration with other firms or organizations	1 if the firm had any cooperation agreement on innovation activities with other enterprises, 0 otherwise
Links with universities or research institutes	1 if the firm had any cooperation agreement on innovation activities with universities and research institutes, 0 otherwise
National market	1 if the dominant market is national, 0 otherwise
International market	1 if the dominant market is international, 0 otherwise

Table 2
Internal factors: firm characteristics.

Internal factors	Factor definition
Firm age	1 if the firms was founded after 1990, 0 otherwise
Proportion of highly educated employees in the firm	Number of employees with university degree divided by total number of employees—we compute this ratio for 2001 and 2003 and then take the average number
Proportion of full time equivalent employees engaged in intramural R&D	Number of FTE employees employed in the R&D divided by total number of employees—we compute this ratio for 2001 and 2003 and then take the average number

Table 3
Internal factors: strategy, management and marketing changes.

Internal factors	Factor definition
Factors related to strategic and managerial changes	
Implementation of new or significantly changed corporate strategies	1 if such a change was implemented in 2001–2003, 0 otherwise
Implementation of new, advanced management strategies	1 if such a strategy was implemented in 2001–2003, 0 otherwise
Implementation of new or significantly changed organizational structures	1 if such a structure was implemented in 2001–2003, 0 otherwise
Factors related to changes in marketing	
Significant changes in firm's marketing concepts or strategies	1 if such a change was implemented in 2001–2003, 0 otherwise
Significant changes in esthetic appearance or design	1 if such a change was implemented in 2001–2003, 0 otherwise

over time as they become less aware of environmental changes or innovative solutions (Hausman and Fotentot, 1999). This question is even more interesting in our context, because transition countries have changed from centrally planned to market economy. In our study, the dividing point for old and new firms is 1990, which is accepted as the beginning of transition period. Old firms are more entrenched and experienced, but they also may be organized in an old fashioned way, lacking in entrepreneurial spirit and necessary skills. Thus, we may expect that they will be less innovative. However, since the period covered in our study was 2001–2003, which comes 11 years after beginning of transition, it is possible that all the differences between the old and new firms had disappeared.

Proportion of highly educated employees: As we discussed in the previous section, one of the internal factors shown to be among the most important determinants of innovative activity for SMEs is a high incidence of highly qualified employees (Hoffman et al., 1998). These highly qualified employees represent the knowledge base of the company, which is a source of ideas for new product and process development. In support of that claim, Mohnen and Röller (2005) show that human capital is one of the crucial factors in innovative activities, and that absence of necessary skills is a serious impediment to innovation. Modern literature emphasizes importance of knowledgeable employees in *all* business functions, not just in R&D (Leiponen, 2005), as innovation in modern firms requires technical, marketing and integrative competencies (Iansiti, 1995; Kogut and Zander, 1992). This is in particular case in smaller firms where functional boundaries are sometimes blurred. Keizer et al. (2002) also consider the proportion of *all* highly educated employees. Literature shows that highly educated employees positively affect firm's innovative capability, so we also expect to find that for a transition economy the proportion of highly qualified employees in SMEs has positive influence on innovative capability.

Proportion of full-time equivalent employees engaged in intramural R&D: Although for innovation in SMEs, it is important to have highly educated employees across all business functions (Leiponen, 2005), it is possible that R&D is the strongest driver of innovation. To investigate that issue, we consider proportion of FTE employees in R&D. We expect that indeed the stronger the R&D function is, the more innovative the firm would be.

3.1.2.2. Strategy, management and market orientation. In order to understand innovation at a yet deeper level, we need to get into issues of strategy, management and marketing.

Strategic and managerial changes: Well-defined corporate strategy, sound management practices and organizational structures are shown to be important enablers of innovation in developed countries (Birchall et al., 1996), while their absence can seriously undermine innovation (Kaufmann and Todtling, 2002; Freel, 2000). SMEs in developing countries, in particular transition ones, started with very low levels of corporate, managerial and organizational expertise. In order to remain competitive, they needed to adopt significant changes in all three areas. We posit that these changes, which involve adoption of new skills and practices, are certain to have significant positive effect on innovation.

We define three variables, one for each area. Since corporate strategy is recognized as an internal factor that is shown to have impact on innovation in SMEs

Table 4
Internal factors: marketing orientation.

Market orientation index: components[a]

Customer orientation index

1. We constantly monitor the level of orientation to serving customers' needs
2. Our business objectives are driven primarily by customer satisfaction
3. Our strategy for competitive advantage is based on understanding of customer needs
4. Our business strategies are driven by our beliefs about how we can create greater value for customers
5. We measure customer satisfaction systematically and frequently
6. We give close attention to after sales service

Competitor orientation index

1. We rapidly respond to competitive actions that threaten us
2. Our salespeople regularly share information within our organization concerning competitors' strategies
3. Top management regularly discusses competitors' strengths and strategies
4. We target customers where we have an opportunity for competitive advantage

Inter-functional coordination index

1. All of our business functions (marketing/sales, manufacturing, R&D, etc.) are integrated in serving the needs of our target markets
2. All of our business functions ad departments are responsive to each other's needs and requests
3. Or top managers from every function regularly visit our current and prospective customers
4. We freely communicate information about our successful and unsuccessful customer experiences across all business functions
5. Our managers understand how everyone in the business can contribute to creating customer value

[a]For each of the items, firms indicated their agreement with the following statements on the scale from 1 (completely disagree) to 5 (completely agree).

(Hadjimanolis, 1999), we include variable ***implementation of new or significantly changed corporate strategy*** (Table 3). We consider management's strategies because as pointed out in Freel (2000) innovation, being a complex and inclusive process, requires an eclectic base of managerial competency, and managerial deficiencies can present a serious obstacle for innovation. This is why we define variable ***implementation of new advanced management strategies*** (Table 3). Finally, in order to optimally make use of human capital and other resources available to the firm, the firm has to have a suitable organizational structure. In extant research, it was shown that continuous adapting of the organizational structure is one of the basic functions of innovation management (Tomala and Sénechal, 2004). Leonard-Barton (1988) also found that innovation is closely connected with organizational change. To assess the impact of organizational change, we define the variable ***implementation of new or significantly changed organizational structures*** (Table 3).

Changes in marketing: To investigate the dynamic aspect of marketing function, we use two indicator variables (Table 3). First we measure whether ***significant changes in marketing concepts or strategy*** were implemented. Second, we investigate possible ***significant changes in esthetic appearance or design of products***. As with strategic and managerial change, in transition countries these changes signal adoption of new knowledge and skills, which is expected to positively impact innovation.

Market orientation: Among internal factors that are shown to have impact on the success of SMEs innovative efforts are marketing effort and the degree of marketing involvement in product planning (Hoffman et al., 1998). We broaden the scope to include several dimensions of market orientation. Simply defined, market orientation is implementation of marketing concept, or the process of generating and disseminating market intelligence for the purpose of creating superior value for the customer (Narver and Slater 1990; Kohli and Jaworski, 1990). Numerous studies have found that the market orientation is positively related to business performance (Narver and Slater, 1990; Slater and Narver, 2000; Cano et al., 2004; Tse et al., 2003; Hooley et al., 2000). Market orientation represents business culture (Narver and Slater, 1990) or business behavior (Kohli and Jaworski, 1990) that leads to superior performance partially because it encourages innovation activities (Langerak et al., 2004). Innovation is important contributor to the business performance. Therefore, positive market orientation–innovativeness relationship is frequently hypothesized and empirically supported in many studies in marketing literature (Kohli and Jaworski, 1990; Deshpandé et al., 1993; Slater and Narver, 1994; Atuahene-Gima, 1996; Langerak et al., 2004). However, evidence about link between market orientation and innovation comes mostly from study of large firms, and this connection is under-researched in SMEs (Salavou and Lioukas, 2003). Therefore in this paper, we include market orientation among possible drivers of innovation in SMEs.

Market orientation is measured by widely accepted Narver and Slater (1990) market orientation scale that covers three behavioral components of market orientation. These are ***Customer orientation, Competitor orientation and Interfunctional coordination*** and they are equally important components of market orientation. Each of these components is an index measured by a set of questions (Table 4). The value of each index is computed as the average value of the items comprising the index. Reliability analysis was performed for each of the indices, and Cronbach α's are 0.84, 0.83 and 0.83, respectively. Average inter-item correlations are 0.48, 0.54 and 0.51, respectively. These numbers indicate a very high level of reliability of these indices. Market orientation index is average of respondents' scores on customer and competitor orientation as well as interfunctional coordination. All three components of market orientation are strongly correlated and therefore converge on a common construct (Narver and Slater,

1990), the ***market orientation index.*** Reliability analysis for this index yields Cronbach α of 0.91 and inter-item correlations of 0.45, which indicates very high degree of reliability.

3.2. Obstacles to innovation

To gain more complete understanding of innovation in SMEs, we inquire about obstacles and hampering factors. SMEs are expected to have more problems with barriers to innovation than large firms due to inadequate resources and expertise. Obstacles to innovation can be classified as external and internal (Piater, 1984). External obstacles include those that are supply related, demand related or environment related. Internal obstacles have to do with difficulties that are related to resources within the firm or human capital. In this study, we look at the mixture of internal and external obstacles, seeking to identify the most important ones (Table 5). In particular, we consider demand for firm's products, financing issues, state support, business environment, organizational issues, and availability of information about markets and technology. We ask firms (1) if they encountered obstacles in their innovation activities, and then (2) we ask them to rate each obstacle. In this paper, we seek to examine if obstacles have any bearing on whether firms innovate. In his study of SMEs in Cyprus, Hadjimanolis (1999) found that obstacles are not correlated to innovation. The explanation he offers for this interesting result is that innovative firms are somehow able to get around obstacles, so that although they recognize barriers to innovation those barriers do not cripple them. To investigate that issue in Croatia, we analyze the relationship between barriers to innovation and the fact that the firm innovated.

Table 5
Variables related to obstacles to innovation.

Variable	Definition
Encountered obstacles	1 if any of the statements below is true about any innovation activity, 0 otherwise • It was seriously delayed • It was prevented from being started • It was burdened with serious problems
Hampering factors	
Financing and expenses	Firms indicated their agreement with the following statements on the scale from 0 (no importance) to 3 (high importance): • Innovation costs are too high • Lack of appropriate source of finance • Insufficient support from the state for innovation activities The three above statements are used to form the index
Internal factors	Firms indicated their agreement with the following statements on the scale from 0 (no importance) to 3 (high importance): • Lack of qualified staff • Lack of information concerning technology • Lack of information concerning market The three above statements are used to form the index

We measure hampering factors by two indexes that are formed each from three statements that require answers on the scale from 0 (indicating no importance) to 3 (high importance). Indexes are named ***financing and expenses***, and ***internal factors*** (Table 5). We performed reliability analysis for each of these indexes. The Cronbach α for the indexes is 0.72 for ***financing and expenses*** (average inter-item correlation is 0.47), 0.82 for ***internal factors*** (average inter-item correlation is 0.6). The two α's together with high inter-item correlations indicate high index reliability for financing and expenses and internal factors. The value of the index is computed as the average value of the items that comprise the index.

4. Research methodology

The data presented in this study were collected as part of Community Innovation Survey conducted on Croatian companies from manufacturing and service sectors during year 2004. The companies were chosen depending on two characteristics: main activity and number of employees. The data were collected by mail survey followed up by two telephone prompts. This particular survey was the first CIS performed in Croatia and it refers to innovation activities over the period from the beginning of 2001 to the end of 2003. We define SME as a firm employing between 10 and 250 people (microfirms are excluded). Both service and manufacturing firms are included. The response rate for the SMEs was 16%. More precisely, the response rate for the service sector was 17.5% while the response rate for the manufacturing sector was 15% (in comparing our sample with the population we find no statistically significant difference in profits and exports; however, since our firms are on average somewhat larger in number of employees care should be taken when generalizing the results of this papers to very small firms.). After examining and cleaning the data, 448 firms were used in this analysis.

In this study, we define a list of possible factors that have bearing on innovation (Tables 1–4). Our goal is to find those factors that have significant impact on innovation in SMEs in a small developing country. The dependent variables in our study are binary (indicating the presence of innovation or not), which calls for logit modeling.

Following the approach in Keizer et al. (2002), we start by examining bivariate relationships between these factors and the dependent variables that describe product and process innovation, and only those factors that are significantly related to dependent variables are retained. The significance is determined on the bases of χ^2 statistics

(this statistics indicates whether the model obtained by addition of that one variable significantly differs from the intercept-only model).

Those retained factors are then used in five new multivariable logit models. Two models have product and process innovation, respectively, as dependent variable; while the other three models consider three types of new products, namely line extensions, "me-too" products and radical new products. χ^2 statistics and McFadden's R^2 are computed for every model.

In the analysis of obstacles to innovation, we use ANOVA analysis and the Pearson χ^2 test.

5. Results

5.1. Factors that impact innovation

Examining bivariate relationships between independent factors and dependent variables shows that the factors not significantly related to innovation are innovation subsidies, firm age and proportion of full-time equivalent employees engaged in intramural R&D. Although other authors (Keizer et al., 2002) have shown subsidies to be significant drivers of innovation, our data interestingly show no evidence that having received municipality or government subsidy increases the probability that the firm innovates (the proportion of innovators that received subsidies is not significantly different from the proportion of innovators in the other group as evidenced by the Pearson χ^2 of 0.87). There is a possibility that we do not observe the connection because there is a time lag between subsidy and its result. However, this absence of impact on innovation may be caused by the fact that subsidies in Croatia are not sufficiently large to enable a firm to make significant investment in innovation activities.

Subsidies, firm age and proportion of full-time equivalent employees engaged in intramural R&D are omitted from further analysis. The remaining factors are used as independent variables in a logit model with innovation variables as dependent. We fit a logit model for each innovation variable. Table 6 shows the results.

All the models in Table 6 are significantly different from null model. McFadden's R^2 in every model is acceptable for a cross-sectional data model obtained from large-scale surveys of this type.

Out of the external factors, collaboration with other firms or organizations has positive significant impact on process innovation and incremental product innovation, but it has weak negative effect on radical product

Table 6
Relationship between factors and innovation.

Factor	Product innovation	Process innovation	Line extension	Me too product innovation	Radical product innovation
Collaboration with other firms or organizations	0.84	1.55***	1.27**	1.22**	−0.79
	(0.59)	(0.55)	(0.53)	(0.55)	(0.6)
Links with universities or research institutes	1.72	−0.61	0.81	−0.63	2.01***
	(1.19)	(0.73)	(0.71)	(0.71)	(0.74)
National market	0.73***	0.39**	0.63**	0.89***	0.28
	(0.19)	(0.19)	(0.26)	(0.22)	(0.21)
International market	0.66***	0.48***	0.68***	0.54***	0.16
	(0.17)	(0.16)	(0.21)	(0.18)	(0.18)
Proportion of highly educated employees in the firm	1.42	0.62	1.26	0,49	2.5***
	(0.89)	(0.79)	(0.87)	(0.8)	(0.82)
Implementation of new or significantly changed corporate strategies	0.59	0.57	0.06	0.22	0.85*
	(0.46)	(0.42)	(0.50)	(0.45)	(0.47)
Implementation of new, advanced management strategies	0.05	0.40	0.87*	0.27	−0.07
	(0.42)	(0.40)	(0.5)	(0.44)	(0.47)
Implementation of new or significantly changed organizational structures	0.36	0.48	0.24	1.01**	−0.32
	(0.4)	(0.37)	(0.44)	(0.39)	(0.42)
Significant changes in firm's marketing concepts or strategies	−0.09	−0.19	−0.1	−0.36	0.36
	(0.44)	(0.39)	(0.47)	(0.43)	(0.43)
Significant changes in esthetic appearance or design	1.32***	0.55	0.61	0.72*	0.67*
	(0.38)	(0.35)	(0.42)	(0.37)	(0.38)
Marketing orientation	−1.74	−0.12	−0.14	0.09	0.14
	(0.28)	(0.27)	(0.34)	(0.29)	(0.3)
LR $\chi^2(11)$	82.62	52.18	65.65	61.44	39.49
Log-likelihood	−109.05	−121.32	−90.31	−109.6	−105.52
McFadden's R^2	0.27	0.18	0.27	0.22	0.16

Coefficients marked by * are significant to 0.1 level, those marked by ** are significant to 0.05, and those marked by *** are significant to 0.01. Standard errors are shown in parentheses under coefficient value.Due to deletion of missing cases, number of observations $N = 218$.

innovation. This confirms some of the findings from the literature (Birchall et al., 1996). However, having links with academic and research institutions has very strong positive effect on radical product innovation, while the effect on other types of innovation is lacking. Kaufmann and Todtling (2000) report similar effect, which is consequence of the fact that radical innovations need creative ideas and advanced knowledge that usually resides in academia and research community. This is congruent with Massa and Testa (2008) finding that for academics only the radical innovation is considered as innovation, while entrepreneurs tend to define the term more broadly. In general, our results confirm those in the literature concerning external collaboration, in particular the finding from Keizer et al. (2002) about positive effect that links with knowledge centers have on innovation. This finding is especially interesting in transition setting, because it suggest that although the cooperation between industry and academia may be infrequent and burdened with problems, it bears some fruit and therefore should be encouraged by policy.

Another significant external factor is market scope, which has positive significant effect on every kind of innovation except on radical innovations. Presence on national and international market has a strong positive effect on probability to innovate. This finding is in line with the fact that wider markets are more competitive, and survival on more competitive markets requires innovation. The result that market scope is highly significant for all types of innovations except for radically new products makes sense because of a large difference between radical innovations and innovations of lower novelty. Radical innovation, being something completely new to the market, is a much less controllable event than incremental innovation due to much higher level of risk and unpredictability, which is offset by the product's possibility to open up new markets and generate very high profits (Ali, 1994). It is not just the consequences of innovation but also the antecedents that differ. In the study of small firms by Subrahmanya (2005), it is reported that radical innovation depends on internal factors, while incremental innovation depends more on external factors. This is why market competitiveness (reflected in market scope) as an external factor does not have impact on radical innovation while it is a very significant factor in incremental innovation. Additional explanation is that firms that operate on competitive markets need a steady stream of innovations to sustain their position and thus cannot afford to take time and resources away from incremental innovations to invest it in risky radical innovations.

Regarding internal factors, data show that the proportion of highly educated staff has a positive effect on radical product innovation, while it has no effect on other types of innovation. This is understandable since radical innovations require substantive creative effort, while introducing products that are similar to those already existing on the market does not require as much original input from firm's own staff (i.e. the work can be completed by less-skilled employees). It is more surprising that proportion of highly educated staff is not a significant predictor in process innovation. This finding can be explained by considering characteristics of the firms in the sample. Namely, a large majority of the sampled firms are in medium and low technology sectors (this is a consequence of the structure of Croatian economy), where process innovation is of relatively low novelty. Being of low novelty, it does not require high employee skills.

Interestingly, proportion of full-time equivalent employees engaged in intramural R&D was not found to have any relationship with innovation. This finding is a reflection of the fact that in modern firms innovation is not confined only to R&D (Leiponen, 2005), in particular in small and medium firms "where R&D activity is being distributed across a number of operational areas, rather than concentrated within a single and discrete R&D function" (Freel, 2005).

Among factors that address strategic and managerial changes, implementation of advanced management strategies is not significantly related to probability of innovation (except for line extensions), which is most likely because SMEs are small enough that informal and more horizontal management styles are still quite effective. Implementation of significantly changed corporate strategies has a positive effect on radical innovation. This is the reflection of the fact that the top management (including CEO) has a very influential position in SMEs; in particular, top echelon is playing an important role in determining strategic orientation of the firm. Salavou and Lioukas (2003) show that strategic choices by top management (for example adopting entrepreneurial orientation) have significant positive impact on radical innovation in SMEs. One way to explain this is that entrepreneurial orientation supports proactive new product development that favors novelty, in contrast to defensive strategies that favor imitation. Being risky and expensive, radical product innovation requires time and involvement of the best and the brightest people in the company. To devote all those resources to radical innovation is a deliberate decision that only top management can make.

Those firms that have implemented new or significantly changed organizational structures have higher probability of me-too innovation, but the positive effect does not extend to other types of innovation. Because me-too innovations are copies of competitors' products, creativity and proactive stance are not all that important in their development. The challenge here is to produce the product at the lowest cost and deliver it to customers in the shortest time, and this is where good organizational structures become essential to ensure that these activities be performed efficiently and on time.

Interestingly, having implemented changes in firm's marketing concepts or strategies has no effect on the probability to innovate. However, firms that had implemented significant changes in esthetic appearance and product design are more likely to product–innovate.

It seems that innovators pay serious attention to all aspects of their product portfolio, not neglecting the "superficial" changes in products like appearance and design.

Although literature has documented a link between market orientation and innovation, our study does not support that. Previous studies (performed mostly on large firms) showed that market orientation has impact on both radical (Christensen and Bower, 1996) and incremental innovation (Sandvik et al., 2000), but it is possible that SMEs are different in that respect. Our result confirms Salavou and Lioukas (2003) who in their study on Greek SMEs did not find connection between market orientation and innovation. We offer the same explanation as Salavou and Lioukas (2003): namely in the presence of other variables market orientation appears to play a lesser role or no role at all.

5.2. Obstacles to innovation

Regarding obstacles, our first goal is to investigate if firms that report obstacles tend to innovate less. Although 40% of firms in our sample report having faced serious problems in innovation activities, interestingly, we do not find that having obstacles prevents firms from innovating.

Data show that there is no difference in process innovation between firms that report obstacles and those that do not ($N = 172$, $\chi^2 = 1.9$, $p = 0.17$). Regarding product innovation, there is a weak relationship showing that far from being *less* innovative, firms that reported obstacles are *more* innovative compared with other firms that did not report obstacles (81.16% of those that reported obstacles innovated compared with 68.93% of those that did not report obstacles—$N = 172$, $\chi^2 = 3.2$ and $p = 0.07$).

It is possible that although obstacles do not prevent firm from innovating, there might be other damaging effects. Namely, obstacles may cause decrease in the number of new introductions and/or their share in income. In order to investigate that issue, we looked into the number of new products and their share in the income. We performed ANOVA and found no significant relationships on either the number of new products or on their share in income, although on average those firms reporting obstacles have introduced smaller number of line extensions and radical new products. All these findings suggest that firms that report obstacles are somehow able to deal with problems and prevent the potential serious negative impact on innovation. This confirms the result from Hadjimanolis (1999), who in the study of SMEs in Cyprus shows that barriers to innovation are not correlated to innovativeness nor economic performance. To quote Hadjimanolis (1999), "The reason may be that innovative firms although facing important barriers tend to find ways to overcome them, while non-innovative firms which do not make serious efforts to innovate tend to underestimate (or not be aware of) the pitfalls/problems associated with innovation…"

Next we focus on hampering factors. Firms that report obstacles quote both ***financing and expense*** and ***internal factors*** as significantly more important (ANOVA results are $N = 95$, $F = 4.46$, $p = 0.04$ for ***financing and expense*** and $N = 98$, $F = 6.7$, $p = 0.01$ for ***internal factors***). Although extant research shows both factors to be challenging for SMEs (Freel, 2000), in our sample ***financing and expense*** is the factor that presents the most problems.

The fact that financing and innovation cost is rated as the most important hampering factor by all firms confirms findings from other studies that indicate financing as one of the most important issues for SMEs (Hadjimanolis, 1999; Kaufmann and Todtling, 2002; Bertlett and Bukvič, 2006). More detailed investigation of data shows that sources of financing are indeed lacking: most Croatian SMEs financed their innovation activities internally (145 firms), followed by bank credits (48 firms) and supplier credits (31 firms). Other financing instruments are very rare. This finding is in line with other studies that find that SMEs generally show lack of awareness of alternative sources of finance (Freel, 2000). Regardless of problems with financing, data reveal that 85.5% of the firms that reported obstacles managed to secure sources of funding (mostly internal followed by credits from banks and suppliers), which suggests that SMEs in Croatia somehow find a way to work around that problem.

Internal factors encompassing lack of qualified staff and lack of information about technology and markets are also rated as significantly more important by the firms that report obstacles, although in general these issues are not as important as financing and innovation expenses. This confirms findings from extant research, because problems with attracting qualified employees, as well as with having skills and knowledge are well documented in other studies (Freel, 2005; Kaufmann and Todtling, 2002).

6. Conclusion and policy implications

Both developed and developing countries are very interested in finding ways to stimulate SMEs in realizing innovations, due to importance of SME sector in creating growth and employment. Most studies on determinants of innovation are performed in developed countries, and consequently policy makers from developing countries mostly look at those findings when crafting policy measures. However, as few studies in developing economies were performed on this topic, it is not known to which extent it is possible to generalize those findings. It is also known that drivers of SME innovativeness depend on geographic area, which adds another layer of complexity that policy makers have to consider.

Summarizing the main findings of our study, we can say that most factors that are found to be important in studies of SMEs in developed economies are also confirmed to be important in this study, such as having external links with other companies and having links with academic and research institutions. We confirmed findings from

developed economies about the positive impact that proportion of highly educated staff has on product innovation (Freel, 2000; Hoffman et al., 1998), but we did not find that innovation is related to the number of people employed in R&D.

Unlikely developed economies (Keizer et al., 2002), we found that innovation subsides are not linked to innovativeness, which may be the consequence of poor design of those incentives. This together with the fact that a very small number of firms received a subsidy suggests that the existing subsidy schemes are not effective, and that policy makers need to devise better incentives.

In developing countries, in particular in transition countries, SMEs started with very low level of skills and expertise including corporate, management and organizational. We found that implementation of significantly changed corporate strategies raises probability of radical innovation, while implementation of new or significantly changed organizational structures raises probability of me-too innovation. Interestingly, the firms that had implemented significant changes in esthetic appearance and product design are also more likely to introduce product innovations.

We also find market scope to be very important in fostering innovativeness; namely firms operating on wider markets are more likely to innovate. This result is very important for a small open developing economy like Croatia, because it suggests that by encouraging exporting it may be possible to encourage innovation as well.

Regarding factors that hamper innovation, financing and innovation cost is the most important problem, which corresponds to findings from developed economies (Hadjimanolis, 1999; Bertlett and Bukvič, 2006). This factor is followed by lack of qualified employees and information about technology and markets, which is also recognized as a problem in developed economies. Interestingly, we find that firms that report facing obstacles are not less likely to innovate less, which suggests that innovators are able to work around obstacles without damaging effects to innovation. Similar effect is found in Cyprus, another developing economy.

All in all, our findings show that there may be many similarities between developed and developing economies. In other words, if Croatian case is indicative of other developing countries, findings from developed economies may travel across geographic and economic boundaries better than could be expected. However, there may be some particularities that policy makers in developing countries should address. In Croatia, we found that policy should be encouraging SMEs to implement changes involving corporate strategy and organizational structure. This can be done through offering training for SMEs, so that firms can become informed about possible organizational and corporate structures, trends and strategies. Another way to enable changes could be through sponsored consulting programs run with the purpose to help enterprises assess what is right for them and assists them in making necessary changes. Another policy measure (in particular in small economies) should be encouraging SMEs to become exporters. First step would be to determine what possible obstacles to exporting there are and then address those with a set of targeted measures. Incentives that would help firms to access wider markets could also encourage innovation.

Policy should encourage employment of highly qualified people by SMEs. Employing educated people has potential to strengthen ties with academic community, so that would most likely also improve external networks. Policy could encourage inter-company cooperation by aiding in cluster formation—this strategy has shown good results in Slovenia (Bertlett and Bukvič, 2006). That later strategy should be easier to implement than forging ties with academics, as Massa and Testa (2008) find that entrepreneurs prefer collaborating with their peers, other entrepreneurs and/or their social networks.

One thing to consider when devising innovation incentives is that SMEs traditionally face high transaction costs in accessing government programs. This may be particularly difficult for SMEs in transition countries where system is undergoing constant changes. For example, we find that very small percentage of Croatian SMEs received existing subsidies which seem to be non-efficient. Apart from designing effective incentives, policy makers need to think about making the application process easy and enterprise-friendly. In addition, we have shown that radical and incremental innovation have different antecedents, so policy makers can devise different incentive schemes depending on which type of innovation they wish to encourage.

We also find that some of our findings confirm those from Cyprus (Hadjimanolis, 1999) and Greece (Salavou and Lioukas, 2003). Although we have to be careful in drawing conclusions in the absence of other studies on SME innovation drivers from the geographic region of South Eastern Europe, this suggests that SMEs in the same geographic region may share many similarities in their innovation practices.

Future research should involve simultaneous investigation of several developing countries as well as several developed countries using the same survey instrument to address the same set of factors.

Acknowledgments

This paper was presented at the 2005 Technology Transfer Society Conference (special session on R&D and Regional Economic Performance). Authors would like to thank session chair and participants for useful comments. Authors would also like to thank participants of the Opportunity Discovery mini-conference at the Olin School of Business, Washington University in St. Louis for helpful remarks, and to two anonymous reviewers for their valuable suggestions and advice.

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