

Technological, Marketing and Complementary Competencies Driving Innovative Performance of Slovenian Manufacturing Firms

Tanja Rajkovič, Janez Prašnikar

Faculty of Economics, University of Ljubljana, Kardeljeva ploščad 17, 1000 Ljubljana, Slovenia.
rtanja@gmail.com, janez.prasnikar@ef.uni-lj.si

The paper discusses innovative performance of firms and underlying competencies, namely technological, marketing and complementary. Competencies are regarded as networks of various capabilities and other firm assets and can be used for cross-industry comparisons. The study is based on a survey carried out among 50 established Slovenian manufacturing companies addressing competencies which they employ in their 65 distinct product lines. Three distinct segments of firms are established based on innovative performance indicators. Used are techniques of multivariate statistics, including cluster analysis and analysis of variance. The results imply that the most innovative firms simultaneously develop technological, marketing and complementary competencies. The implications of our findings are valuable to the firms aligning their competencies with their strategy, as well as to policy makers in technology following countries.

Key words: Technological, marketing and complementary competencies; innovative performance; technology leaders and followers; innovation policy.

1 Introduction

In a dynamic environment companies constantly strive for ways to differentiate themselves from their competitors and in so doing aim to benefit from the thus-created competitive advantage. The link between innovation as a source of differentiation and growth on a national level has been extensively researched in the literature from both theoretical and empirical perspectives. The central role of R&D investments confirms a large number of macroeconomic studies (Griffith et al., 2004; Bassanini & Scarpetta, 2001; Guellec & van Pottelsberghe de la Potterie, 2001). In general, innovative companies should be more successful than their non-innovative counterparts (Griffith et al., 2004; Tether, 2002). It is on these theoretical grounds that the Lisbon strategy for promoting economic development in the European Union is also based (Kok, 2004).

The analysis of data from polls on innovation and R&D activities in 2992 Slovenian firms from manufacturing and service sectors in the year 2002 finds that innovative companies constitute only 21% of the total number. There is a positive bias for large companies, companies that are partially owned by foreigners, and for export-oriented companies (Stanovnik & Kos, 2005). Inno-

vation and R&D expenditures have been stagnating for several years now and are lower than in developed European countries. The majority of Slovenian manufacturers (66%) employ medium-low or low technology according to OECD classification. The comparative gap with some European countries (Austria, Finland) is particularly large in classes of companies that use medium-high and medium-low technology. The share of external expenditure accounted for by R&D in innovation expenditure is less than 10%. There is weak cooperation with other companies in the formation of technological knowledge formation and in drawing knowledge from the academic environment (Prašnikar, 2006).

In the last decades competence based view gained considerable attention in the literature on competitive advantage (Prahalad and Hamel, 1990; Hamel and Heene, 1994; Sanchez, 2004; Hafeez et al., 2007). When companies compete in a dynamic environment, the product-centred perspective on strategy might explain a firm's current competitive advantage. However, this perspective does not facilitate a strategy making process that creates competitive advantage in the future (Fowler et al., 2000). A combination of technological and marketing capabilities and competencies can create such competitive advanta-

ge (Chang, 1996; Song et al., 2005). A firm with strong technological competencies is capable of using scientific knowledge to promptly develop products and processes that offer new benefits and create value for customers (McEvily et al., 2004). A firm with strong marketing competencies is able to use its deep understanding of customer needs to foster development of new products and organize marketing activities that provide a unique value to consumers (Day, 1994; Vorhies, 1998). In addition to each of the direct effects discussed above, technological and marketing capabilities operate also in an integrated manner (Fisher and Maltz, 1997; Rothaermel, 2001; Wang et al., 2004; Song et al., 2005).

Based on data from Slovenian manufacturing firms we determine segments of companies based on their innovative performance characteristics and point out the differences in the competitiveness of their technological, marketing and complementary competencies. Distinctions are made between firms in the positions of technology followers and leaders. Technological and market turbulence as key factors in strategy planning for new product development are also analyzed. Implications of the findings are discussed both from the viewpoint of technology follower firms and countries.

2 Competencies and innovative performance

Competencies as such refer to the ability to utilize resources that spread across multiple functions, products and markets in a sustainable and synchronized manner. They differ from company to company, yet represent a broader, more general perspective on strategy and are not strictly industry specific. Their main constituents are capabilities, a portfolio of capabilities, respectively. Capabilities are repeatable patterns of actions in the use of assets to create, produce and/or offer products to a market (Grant, 2001). Only those key capabilities that are relatively unique and common to various business functions, products and business units are likely to form competencies of a company (Sanchez, 2004). These are industry specific and can be identified by using internal and external knowledge of experts (managers) (Hafeez et al., 2007; Prašnikar et al., 2008).

The knowledge represented by these competencies contributes to speed and flexibility of the development process and results in competitive products as captured by innovative performance (Hagedoorn & Cloudt, 2003; Lokshin et al., 2008). As proposed by Swink and Song (2007) there is substantial impact of both marketing and technological capabilities and competencies in each stage of product development which in turn is associated with higher project return on investment. Competencies not only influence product competitive advantage but also project lead times.

Technological competencies incorporate practical and theoretical know-how, as well as the methods, experience and equipment necessary for developing new

products (Wang et al., 2004). They encompass a portfolio of technological capabilities concerning the capacity of the company to utilize scientific and technical knowledge for research and development of products and processes, which leads toward greater innovativeness and performance (McEvily et al., 2004). According to Swink and Song (2007) technological competencies influence all four stages of the new product development process. At the first stage of business/market analysis technological competencies help address the technical feasibility of products in question. Technical development stage incorporates product and process engineering studies and continues with establishing product designs and specifications, prototyping the product and approving final designs. In all of these tasks technological competencies have a central position. During the third stage of product testing technological competencies are of secondary importance, still, they influence the design of consumer tests and interpretation of the results. At the last stage of product commercialization they are key for production plans and production ramp-up.

Companies with well developed marketing competencies are well aware of customer needs and are capable of value creation on all elements of a product or service that are relevant to the customers (Day, 1994). Constituent marketing capabilities are therefore an interwoven system based on knowledge and skills that allow the company to generate customer value and also facilitate timely and effective response to the marketing challenges (Vorhies, 1998; Vorhies and Harker, 2000; Song et al., 2005). At the business/market analysis stage marketing competencies provide an evaluation of market impacts of product feature options (Kahurana and Rosenthal, 1997) as the aim is to understand the competitive positioning of the future product. During the technical development stage marketing competencies facilitate product feature decisions. Marketing usually takes a leading role in product testing which encompasses selection of key customers and sites, testing of markets and result analysis. Marketing plans, product promotion and distribution are tasks that require marketing competencies for product launch at the product commercialization stage (Paul and Peter, 1994; Swink and Song, 2007).

Complementary competencies reflect the degree of fit between the two groups. They should be treated as a distinct network of capabilities and a failure to value them properly can lead to a deficient identification of key capabilities. The role of complementary competencies according to Wang et al. (2004) is to: 1) integrate different technological specialties; 2) combine different functional specialties; 3) exploit synergies across business units; 4) combine in-house resources with external capabilities required and 5) integrate the dynamic competence building process for superior performance. To align the new product features (technological aspect) with potential customers' needs (marketing aspect) is the role of complementary competencies at the first stage of new product development. They are also employed in the assessment of the needed investment and accompanying risks (Swink

and Song, 2007). Similar complementarity of technological and marketing knowledge is also key during the second stage of technical development. At the same time it proves to be positively related to translating testing results into product and process design modifications (Song et al., 1998) during the product testing. Integration of both streams of competencies contributes to better coordination of production planning and demand management activities during product commercialization.

Firms' new product portfolios balance between new products based on incremental innovation and fundamental innovation (Ali et al., 1993; Schewe, 1996). Development of new generation products based on radical innovations and development of products shaping new industry trends draws from substantially different and novel technologies. In the case of incremental modifications of products "market pull" provides the information on customers' preferences, while "technology push" prevails with completely new technologies that address customers' latent needs (Tidd and Bodley, 2002). Since consumers buy products for the benefits they gain from them, "technology push" still has to observe customer needs. Therefore, customer and market analysis are crucial also for technologically more novel innovations (Bacon et al., 1994).

Innovation and corresponding competencies demonstrate some specific characteristics when a distinction is made between firms that are technology leaders and those that are technology followers. Forbes and Wield (2000) state that basic research and applicative research enable technologically advanced companies – technology leaders – to create new knowledge and to promote new technologies. The followers, on the other hand, develop indigenous technology learning capacity or in other words the abilities to use existing technological solutions in a more efficient manner. It is therefore characteristic that technologically advanced companies introduce new products, which are new for the market, by using new technologies and by transforming existing technological solutions into new ideas. Being a technology leader demands substantial investments that are risky due to their large likelihood of failure. The followers tend to rely more on incremental than on radical innovation based on basic and applicative research as well as on industrial design that provides these firms with an opportunity to supply market niches and achieve high value added.

How managers perceive the environment will also reflect in their actions and innovative strategy they choose to pursue Greenly and Oktemgil (1997). It is important that firms recognize environmental changes and adapt accordingly (Leonard-Barton, 1992). Technological and market turbulence are those two moderating effects that influence new product development strategy planning (Calantone et al., 2003). Technological turbulence refers to the perception whether a firm is able to accurately predict and thoroughly understand specific aspect of the technological environment. Technological and complementary competencies are key for addressing changes and achieving superior performance in environments with high technological turbulence (Wang et al., 2004). Market

turbulence, on the other hand, reflects rapidly changing buyer preferences, wide-ranging needs and wants, competition intensity and constant emphasis on offering new products (Hult et al., 2004). Firms operating in high market turbulence therefore tend to constantly produce innovations in order to respond to the changes in demand and strong competition. They need to develop superior marketing competencies together with strong complementary competencies.

A successful new product development process and thus good innovative performance further contribute to financial success of the product and consequently to overall business success of a firm via two paths (Brown and Eisenhardt, 1995). A productive process lowers costs and enables lower and more competitive prices. A faster process further ensures strategic flexibility and shorter lead times. Product effectiveness, on the other hand, is demonstrated through product characteristics, among them low-cost, unique benefits and fit with firm competencies. Products with these characteristics are also more appealing to the consumers (Zirger and Maidique, 1990). Empirical studies provide evidence that both radical and incremental innovations contribute to firm's survival, growth and profitability (Varadarajan, 2008).

On the basis of the conceptual framework on the influence of technological, marketing and complementary competencies on the innovative performance, we apply the operational model as shown in Figure 1.

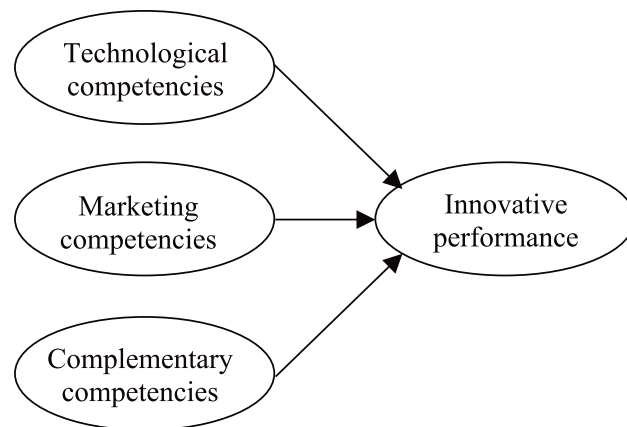


Figure 1: Operational model on the influence of technological, marketing and complementary competencies on innovative performance

3 Methodology

3.1 Sample and data collection

The study is based on a cross-industry survey carried out among medium sized and large Slovenian manufacturing firms. The population targeted in the survey was obtained from the databases of legal entities registered in each of the respective countries. Included were firms that have not been registered later than by the years 2002 and have been operating through the whole period 2002-2006 with products under code D (manufactured products) without

codes that refer to product related industrial services. For problems arising from product finishing industries such as production of clothing items, several further product codes were excluded (luggage, handbags and the like; saddlery and harness, footwear; printed matter and recorded media). This is to avoid the confusions stemming from aligning the design function in these companies with the definition of the traditional R&D function and related activities in manufacturing firms. The target population thus consisted of 382. The study is carried out on valid responses received by 50 firms. 20% of the firms in the sample are in majority foreign ownership.

Respondents were management level employees in charge of company R&D. The questionnaire was initially tested in 12 firms. Its main segments referred to firm competencies and innovative performance. As especially big firms try to take advantage of synergies and economies of scale and scope, many diversify into different businesses. The firms were thus asked to provide data for individual product lines where applicable, yielding a sample of 65 product lines.

3.2 Variables

Variables to simulate the proposed theoretical concepts were selected on the basis of economic, organization and management literature. In devising indicators of competencies we predominantly relied on surveys used in related studies (Chang, 1996; Wang et al., 2004; Song et al., 2005). The selected indicators of the concepts included in the model, enable a multi-industry analysis of the manufacturing sector.

Research shows that technological competencies usually encompass three categories: 1) how advanced research and development is; 2) number of available technological capabilities inside the firm or through strategic partnerships, and 3) how good the company is at predicting technological trends (Eisenhardt and Martin 2007; Wang et al., 2004).

Marketing competencies capture marketing research as well as other marketing activities (Paul and Peter, 1994). To include marketing research and forecast competencies, the indicator "obtaining information about changes of customer preferences and needs" was applied. The competitors' patterns of activities are illustrated with "acquisition of real time information about competitors", customer relationship management with "establishing and managing long-term customer relations" and supplier relations using an indicator "establishing and managing long-term relations with suppliers". Selected indicators to some degree reflect Porter's competitive forces.

Complementary competencies represent the congruence between technological and marketing competencies. The internal environment is measured with "good transfer of technological and marketing knowledge among business units". Indicator "the intensity, quality

and extent of research and development knowledge transfer in co-operation with strategic partners" evaluates dynamic perspective and competence acquisition through strategic partnerships. The efficiency of economic utilization of technological and marketing resources engaged in the product development is evaluated through "cost efficiency of product development". Organizational focus is measured with indicator "how clearly are defined the activities of the business units in the corporate strategy of the firm".

The general extent of innovative performance was measured by "number of modified, improved and new products" representing new product variety or level of innovation (Kim et al., 2005). Technical performance was added and included by variable "quality of products". A number of studies in the operations management literature, namely, confirm the relations between product development and product innovation and quality, whereby high levels of innovation are associated with high levels of product quality (Clark and Fujimoto, 1991; Koufteros and Marcoulides, 2006; Prajogo et al., 2008). While product innovation as such refers to competence responsible for introducing new products and features, product quality or technical performance stands for respective competence of a firm to produce products that would satisfy customer needs for quality and performance (Hall et al., 1999).

The indicator "time needed to develop an improved product" was applied to determine effectiveness of improving existing products (incremental innovation) (Dumaine, 1989). Time refers to the development project lead time and not to the array of products developed as with general indicator number of changed products. Similarly, the effectiveness of new product development referring to radical innovation is measured by "time needed to develop a completely new product".¹ The role of innovativeness of the firm in the industry was represented by indicator "firm's substantial contribution to world trends in the industry". With this indicator we assume for the market pioneers with innovations their competitors find worth imitating. Additionally, the variable of the extent of imitation and innovation was used to represent the innovative strategy firms tend to pursue in new product development.

The success of innovations mirrored in the price premium the firm is able to attain for its new products on the market was assessed by the indicator value added which in accounting sense represents the difference between revenues and costs of goods/services sold (Treacy and Wiersma, 1993). Respondents ranked this indicator the same way as competencies. While cost efficiency of the firm stands for the efficiency the company tries to increase by exploiting all of the resources at its disposal (Ravald and Grönroos, 1996) it was included as a self assessment indicator of the overall cost efficiency of the firm.

The interviewees evaluated their competencies on a five-point scale relative to their main competitors and thus estimated the competitiveness of their individual

¹ Indicators correspond to the strategic factors applied by the Strategic Planning Institute in the PIMS database (Chang, 1996)

competencies within the industry (Song et al., 2005). The scale has five values: 1 - considerably worse than the main competitors, 2 - worse than the main competitors, 3 - same as main competitors, 4 - better than the main competitors, 5 - considerably better than the main competitors. This scale was used also for the variables of new product development characteristics, with the exception of innovation strategy (imitation versus innovation), for added value of products and overall cost efficiency of the firm. Variable depicting to what extent the firms are pursuing the strategy of imitation versus innovation was captured by a five-point scale with the following ranks: 1 - only imitation, 2 - predominantly imitation, 3 - balanced, 4 - predominantly innovation, 5 - only innovation. The time frame for data gathering (data for competencies, innovations and R&D activities) is a three-year period from 2004 to 2006.²

Four different indicators were applied to each category of the environmental turbulences (Calantone et al., 2003; Wang et al., 2004; Song et al., 2005). In the case of technological turbulence were measured speed of change in technology, opportunities arising due to new technologies, ability to predict technological change and extent of technological change in the industry. Question regarding market turbulence referred to market uncertainty, predictability of changes in demand, predictability of competitors' activities and competition intensity.³

3.3 Segmentation

In order to organize observed cases into these relatively homogenous groups, we applied techniques of cluster analysis or data segmentation. While objects within the same group - cluster - share similarities, they tend to be different compared to objects within other clusters. Comparisons of clusters not only provide an insight into such differences but thereby also provide an understanding of their own characteristics. To identify clusters we used a two step methodology (Ferligoj, 1989, p. 88) which applies first the hierarchical method followed by the non-hierarchical method in order to improve the classification if necessary.⁴ Firms' product lines were classified into clusters based on the two variables of innovative performance ("number of changed, improved and new products" and "product quality"). This way an insight can be obtained into the competencies firms develop in order to pursue their innovative strategy.

We identified three distinct segments which we compared among each other looking for statistically significant differences between them.⁵ In Table 1 pluses (+ in

the table) below the average values of segment variables denote whether the differences between segments are statistically significant. If they are not, segments are given the same number of pluses. If differences are established, segments are given varying numbers of pluses, the one with the most being that with the highest mean value. Turning to the variable "number of changed, improved and new products", we can conclude that there are no statistically significant differences observed between the first and second segments (both denoted by one plus [+]). However, there are differences between the first two segments, on one hand, and the third segment, which is ascribed two pluses [++], on the other.

The following three segments were identified (Table 1):

- technology followers with weak competencies,
- technology followers with strong competencies and
- technology leaders.

Based on indicators of innovative performance, it can be observed that the first segment - technology followers with weak competencies - introduced the smallest number of new products as well as those of the poorest quality relative to their main competitors (both indicator scores are below the level of main competitors, value 3). Conversely, it is the third segment - technology leaders - that surpasses main competitors according to both indicators (values above 4 - better than main competitors). While the second segment is lagging behind in terms of the number of innovations, it appears to compensate for the lack of new product variety to some extent with the high quality of those new products it does produce. Further implication that we are dealing with technology followers in the case of the first two segments is provided by their predominant strategy being that of imitation (values below 3 - balanced innovation), which is technologically less demanding.

There is a distinct gap between the first and the third segment when analyzing all three groups of competencies, the first having weaker competencies than main competitors and the third more highly developed ones. The only exception to this general rule is found in connection with the acquisition of information on competitors among marketing competencies.

When addressing technological competencies separately, technology leaders surpass both segments of followers with regards to all three competencies. The one technological competence that sets apart both segments of technology followers is "number of available quality technological capabilities" at which technology followers reach the level of their main competitors. This competence is also that in terms of which technology leaders did

² This is in compliance with OECD classification innovation activity methodology (OECD, 1997).

³ Indicators of environmental turbulence were evaluated on a five-point Likert scale with values 1 - strongly disagree, 2 - disagree, 3 - neither agree nor disagree, 4 - agree, 5 - strongly agree.

⁴ We used Ward's hierarchical clustering method with squared Euclidian distance and MacQueen's K-means non-hierarchical method. One iteration was performed with the minimum distance between initial centres being 0.751. Thus, hierarchical clustering had already produced a good solution.

⁵ Segments were compared using ANOVA and »post-hoc Duncan test« (equal variances assumed), $p < 0,05$ (see Table 1).

Table 1: Product lines segments described by innovative performance, competencies and NPD characteristics

Variables	Segments		
	Technology followers - weak	Technology followers - strong	Technology leaders
No. of product lines	25	19	21
No. of different companies	21	16	20
Innovative performance			
Number of modified, improved and completely new products in period 2004-2006	2.84 +	2.89 +	4.24 ++
Quality of products	2.96 +	4.21 ++	4.24 ++
Technological competencies			
Advancement of R&D	2.84 +	3.16 +	3.86 ++
Number of quality technological capabilities inside the firm or through strategic partnerships	2.72 +	3.32 ++	4.10 +++
Prediction of technological trends	2.68 +	3.00 +	3.95 ++
Marketing competencies			
Obtaining information about changes of customer preferences and needs	2.92 +	3.26 +	3.95 ++
Acquisition of real time information about competitors	3.00 +	3.16 +	3.29 +
Establishing and managing long-term customer relations	3.32 +	3.79 ++	4.10 ++
Establishing and managing long-term relations with suppliers	2.92 +	3.58 ++	3.67 ++
Complementary competencies			
Good transfer of technological and marketing knowledge among business units	2.80 +	3.32 ++	3.52 ++
The intensity, quality and extent of R&D knowledge transfer in co-operation with strategic partners	2.48 +	3.00 +	3.57 ++
Cost efficiency of product development	2.84 +	3.37 ++	3.52 ++
Clearly defined activities of business units in the corporate strategy of our firm	2.88 +	3.58 ++	3.62 ++
New product development			
Time needed to develop an improved product	2.76 +	3.21 ++	3.76 +++
Time needed to develop a new generation product	2.48 +	2.63 +	3.71 ++
Contribution of the firm to industry trends	2.44 +	2.47 +	3.24 ++
Imitation VS innovation strategy	2.32 +	2.74 +	3.33 ++
Other			
Added value of products	2.42 +	3.05 ++	3.64 +++
Overall cost efficiency of the firm	2.54 +	3.26 ++	3.68 +++

Note: For each variable a segment is described by a mean value (except numbers of product lines and firms counted from the sample). Pluses denote segments with statistically significant differences. Applied was ANOVA, »post-hoc Duncan test«, $p < 0.05$.

best within technological competencies (value 4.10 – better than main competitors).

The marketing competence that sets technology leaders apart from technology followers with strong competencies is “obtaining real time information on customers”. No statistically significant differences can be observed between leaders and followers with strong competencies with respect to relationship building with customers and suppliers. However, it is in terms of these two competencies that the segment of followers with weak competencies lags furthest behind. There are however no differences between the segments in terms of their competence in “acquiring real time information about competitors”, all reaching the level of their main competitors. It appears that access to information on competitors cannot be regarded as a potential source of competitive advantage since this type of information is available to all types of firms. Marketing competencies as a whole appear to be the most competitive group of competencies for the segment of followers with weak competencies reaching values close to 3.

Among complementary competencies, only participation in strategic technological partnerships sets technology leaders apart from followers with strong competencies. This competence is also somewhat closely related to the technological competence “number of available

quality technological capabilities” in which followers with strong competencies also trail the leader. Not only do strategic technologic partnerships have the potential to benefit this availability of quality technological capabilities, but also “advancement of R&D” due to the availability of new knowledge. While both segments have a clear and well defined strategy, a cost efficient R&D and efficient transfer of technological and marketing knowledge, followers with strong competencies share the same level of competitiveness in participation in strategic technological partnership with the weakest segment.

Technology leaders perform very favourably regarding new product development lead times, also making greater contributions to industry trends and relying more on innovation than imitation. The segment of technology followers with strong competencies is also competitive when it comes to lead times in developing improved products, although not to the extent of technology leaders. Unlike technology leaders, both follower segments are expected neither to report favourable lead times in developing completely new products, nor to contribute substantially to trends in the industry. Similarly, followers rely predominantly on imitation.

With respect to environmental effect, namely technological and marketing turbulence, no statistically significant differences were found among the segments (Table

Table 2: Product lines segments described by environmental effects

Variables	Segments		
	Technology followers - weak	Technology followers – strong	Technology Leaders
Technological turbulence			
Rapid change of technology in the industry	2.79	2.90	2.70
High impact of new technologies on business operations and competition bringing about big opportunities	3.38	3.33	4.00
Difficulty of predicting technological changes in the next 2 to 3 years	2.67	2.33	2.60
Smaller technological changes represent technological advances in the industry	3.42	3.52	3.50
Market turbulence			
Extremely high market uncertainty	3.54	3.05	3.40
Almost impossible to predict accurately the rapidly changing tastes and demands of consumers	2.79	2.76	2.56
Unpredictability of activities of major competitors	2.92	3.14	2.95
High intensity of the competition in the industry	4.42	4.48	4.55

Note: For each variable a segment is described by a mean value on a 5-point Likert scale. Applied was ANOVA, »post-hoc Duncan test«, $p < 0,05$. No statistically significant differences were found among the segments.

2). This finding implies that differences between the segments cannot be attributed to the characteristics of their respective industries and markets. In other words, it is not that product lines within one segment belong to the same or similar industry or act on the same market. Technology leaders are not necessarily domain of the high-tech industries alone. Along these lines, using firm-level data, Kirner et al. (2008) showed that the high-, medium- and low-tech sectors are each comprised of a considerable mix of high-, medium- and low-tech firms.

It is interesting to note, that perceptions of firms were on average the lowest regarding rapid changes of technology and difficulty of predicting technological changes in the next 2 to 3 years. However, new technologies appear to bring about significant new opportunities and smaller technological changes are the main driver of technological advances in the industries. From the viewpoint of market turbulence, firm from all segments perceive competition in their respective industries as highly intensive. Still, market uncertainty is not extremely high and firms are able to predict changes in demand and tastes of their consumers as well as predict actions of their competitors. Unlike competencies, environmental effects in the form of technological and market turbulence are not contributing to differences among segments. A study by Schmalensee (1988) similarly implies that competitive advantage takes precedence over external environments when accounting for inter-firm profit differentials between firms.

4 Discussion

In our study we have identified three distinct segments of Slovenian firms (more precisely their product lines) according to their innovative performance. We found that the segments significantly differ in their competencies, while in terms of innovative strategy they are hardly affected by the perceptions of environmental turbulence. The most innovative firms simultaneously develop all three types of competencies. To some extent firms can compensate weaker technological competencies with strong marketing and complementary competencies. Based on innovative performance and other traits of new product development of the firms in the sample we can also conclude that even firms with well established and competitive competencies seem to have developed their own competence centers, but they can be hardly denoted as technology leaders successfully producing radical innovation. They are typically followers that intensively follow technological and marketing trends and build their market position through inventions, often based on independent design, or imitation.

Our results can help firms understand what competencies and capabilities they need to develop in order to pursue an innovation strategy of their choice or to examine their existing competencies and identify possible gaps. Technological firms may pay less attention to marketing and complementary competencies than to technological competencies but it can be a great disadvantage if they are not all systematically being developed along the way.

Within the context of the current economic downturn especially, innovation, competencies and competitive advantage may seem to be less relevant, or not very high on the agenda of firms' management. However, these concepts comprise a firm's core. Jeffrey Immelt, CEO of GE, which is the world's largest industrial firm, summarized his thoughts on innovation in the current unfavourable economic climate in the following way: "Companies and countries that really play offence vis-à-vis technology and innovation are going to come out ahead" (The Economist, 2008). Therefore, innovation and competence building should constantly remain high among the priorities, yet an understanding of these concepts is needed in order to be able to reap maximum benefits.

The question that remains is how should a technology follower country approach its growth strategy, narrow the gap with technology leaders and increase its competitiveness. The Lisbon strategy as an action and development plan for the European Union proposes increasing public and private investments in R&D as well as developing innovative climate and entrepreneurship (Commission of the EC, 2005). By focusing on quantitative goals such as share of R&D expenditure in GDP, there exists a danger that investments will not effectively translate in concrete actions.

Based on our findings we are able to make several conclusions that support strategies proposed by the Agenda. Namely for technology follower countries technological competencies may be costly and time consuming to acquire. Yet marketing and complementary competencies can successfully facilitate the process of catching up via incremental innovation. Firms can thus choose imitation as a strategy for developing technological capabilities and bridging the gap to a certain extent. Furthermore, incentives for firm cooperation in new product development can help firms overcome the limitations imposed by their in-house competencies. Encouraged should be innovations based on good market expertise, meaning they respond to concrete market needs and are positioned with a solid understanding of competitors' strategies. Building relationships with customers and competitors should also be encouraged.

5 Acknowledgement

This research is supported by a grant from the CERGE-EI Foundation under a program of the Global Development Network. All opinions expressed are those of the authors and have not been endorsed by CERGE-EI or the GDN.

6 References

- Bassanini, A. & Scarpetta, S. (2001). The driving forces of economic growth: Panel data evidence for the OECD countries. *OECD Economic Studies*, 33. Retrieved November 18, 2008, from [http:// hal.inria.fr/docs/00/16/83/83/PDF/EconomicStudies_01.pdf](http://hal.inria.fr/docs/00/16/83/83/PDF/EconomicStudies_01.pdf).

- Calantone, R., Garcia, R. & Dröge, C. (2003). The effects of environmental turbulence on new product development strategy planning. *The Journal of Product Innovation Management*, 20 (2), 90-103. DOI: 10.1111/1540-5885.2002003.
- Chang, T. (1996). Cultivating global experience curve advantage on technology and marketing capabilities. *International Marketing Review*, 13, 22-42. DOI: 10.1108/EUM000000004460.
- Clark, K. B. & Fujimoto, T. (1991). *Product development performance*. Boston: Harvard Business School Press.
- Commission of the EC (2005). *Working together for growth and jobs: A new start for the Lisbon strategy*. Luxembourg: Office for Official Publications of the European Communities. Retrieved September 25, 2008, from <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0024:FIN:EN:PDF>.
- Day, G. S. (1994). The capabilities of market-driven organizations. *Journal of Marketing*, 58 (4), 37-52.
- Dumaine, B. (1989). How managers can succeed through speed. *Fortune*, 13, 54-59.
- Economist, The (2008). A gathering storm? *The Economist*, 2008, November 22-28, 67-68.
- Ferligoj, A. (1989): *Razvrščanje v skupine. Metodološki zvezki*, 4. Ljubljana: Fakulteta za sociologijo, politične vede in novinarstvo.
- Fisher, R.J. & Maltz, E. (1997). Enhancing communication between marketing and engineering: The moderating role of relative. *Journal of Marketing*, 61 (3), 54-70.
- Fowler, S., King, A. W., Marsh, S. J., & Victor, B. (2000). Beyond products: new strategic imperatives for developing competencies in dynamic environments. *Journal of Engineering and Technology Management*, 17, 357-377. DOI: 10.1016/S0923-4748(00)00029-1.
- Grant, R. M. (2001). The resource-based theory of competitive advantage: Implications for strategy formulation. In Zack, M. H. (ed.), *Knowledge and Strategy*. Oxford: Butterworth-Heinemann, 3-24.
- Griffith, R., Redding, S., & Van Reenen, J. (2004). Mapping the two faces of R&D: Productivity growth in a panel of OECD industries. *The Review of Economics and Statistics*, 86 (4), 883-895. DOI: 10.1162/0034653043125194.
- Guellec, D. & van Pottelsbergh de la Potterie, B. (2001). *OECD economic studies*, (33). Retrieved October 12, 2008, from <http://www.oecd.org/dataoecd/26/32/1958639.pdf>.
- Hafeez, K., Malak N. & Zhang, Y. B. (2007). Outsourcing non-core assets and competences of a firm using analytic hierarchy process. *Computers & Operations Research*, 34 (12), 3592-3608. DOI: 10.1016/j.cor.2006.01.004.
- Hagedoorn, J. & Cloudt, M. (2003). Measuring innovative performance: is there an advantage in using multiple indicators? *Research Policy*, 32, 1365-1379. DOI: 10.1016/S0048-7333(02)00137-3.
- Hall, B.H. (1999). Innovation and market value. *NBER Working Paper Series*, w6984. Retrieved November 7, 2008, from <http://www.nber.org/papers/W6984.pdf>.
- Hamel, G. & Heene, A. (eds.) (1994). *Competence-based competition*. Chichester: John Wiley.
- Khurana, A. & Rosenthal, S. R. (1997). Integrating the fuzzy front end of new product development. *MIT Sloan Management Review*, 38 (2), 103-120.
- Kim, J.Y., Wong, V. & Eng, T.Y. (2005). Product variety strategy for improving new product development proficiencies. *Technovation*, 25, 1001-1015. DOI: 10.1016/j.technovation.2004.02.011.
- Kirner, E., Kinkel, S., & Jaeger, A. (2008). Innovation paths and the innovation performance of low-technology firms - An empirical analysis of German industry. *Research Policy*, 38 (3), 447-458. DOI: 10.1016/j.respol.2008.10.011.
- Kok, W. (2004). *Facing the challenge: The Lisbon strategy for growth and employment*. Luxembourg: Office for Official Publications of the European Communities.
- Koufteros, X. & Marcoulides, G.A. (2006). Product development practices and performance: A structural equation modeling-based multi-group analysis. *International Journal of Production Economics*, 103, 286-307. DOI: 10.1016/j.ijpe.2005.08.004.
- Lokshin, B., Van Gils, A. & Bauer, E. (2009). Crafting firm competencies to improve innovative performance. *European Management Journal*, 27 (3), 187-196. DOI: 10.1016/j.emj.2008.08.005.
- McEvily, S. K., Eisenhardt, K. M. & Prescott, J. E. (2004). The global acquisition, leverage, and protection of technological competencies. *Strategic Management Journal*, 25, 713-722. DOI: 10.1002/smj.425.
- OECD. (1997). *Revision of high technology sector and product classification. STI Working Papers 1997/2*. Paris: OECD.
- Paul, J. V. & Peter, J. W. (1994). Core competencies, competitive advantage and market analysis: forging the links. In Hamel, G. & Heene, A. (eds.), *Competence-based Competition* (77-110). New York: Wiley.
- Prahalad, C. K. & Hamel, G. (1990). The core competence of the corporation. *Harvard Business Review*, 68, 79-91.
- Prajogo, D. I., McDermott, P. & Goh, M. (2008). Impact of value chain activities on quality and innovation. *International Journal of Operations & Production Management*, 28 (7), 615-635. DOI: 10.1108/01443570810881785.
- Prašnikar, J. (2006). From Lisbon to "Lisbon". In Prašnikar, J. (ed.), *Competitiveness, social responsibility and economic growth* (2-18). Hauppague: Nova Science.
- Prašnikar, J., Lisjak, M., Rejc Buhovac, A. & Štemberger, M. (2008). Identifying and exploiting the inter relationships between technological and marketing capabilities. *Long Range Planning*, 41 (5), 530-554. DOI: 10.1016/j.lrp.2008.06.005.
- Ravald, A. & Grönroos, C. (1996). The value concept and relationship marketing. *European Journal of Marketing*, 30 (2), 19-30. DOI: 10.1108/03090569610106626.
- Rothaermel, F.T. (2001). Research note: Incumbent's advantage through exploiting complementary assets via interfirm cooperation. *Strategic Management Journal*, 22, 687-699. DOI: 10.1002/smj.180.
- Sanchez, R. (2004). Understanding competence-based management: Identifying and managing five modes of competence. *Journal of Business research*, 57, 518-532. DOI: 10.1016/S0148-2963(02)00318-1.
- Schmalensee, R. (1985). Do markets differ much? *American Economics Review*, 75 (3), 341-351.
- Song, M., Droge C., Hanvanich S. & Catalone R. (2005). Marketing and technology resource complementarity: An analysis of their interaction effect in two environmental contexts. *Strategic Management Journal*, 26, 259-276. DOI: 10.1002/smj.450.
- Stanovnik, P. & Kos, M. (2005). *Technology foresight in Slovenia*. Ljubljana: Institute for Economic Research.
- Swink, M. & Song, M. (2007). Effects of marketing-manufacturing integration on new product development time and competitive advantage. *Journal of Operations Management*, 25, 203-217. DOI: 10.1016/j.jom.2006.03.001.

- Tether, B. S. (2002). Who co-operates for innovation, and why - An empirical analysis. *Research Policy*, 31, 947-967. DOI: 10.1016/S0048-7333(01)00172-X.
- Tidd, J. & Bodley, K. (2002). The influence of project novelty on the new product development process. *R&D Management*, 32 (2), 127-138.
- Treacy, M. & Wiersima, F. (1993). Customer intimacy and other value disciplines. *Harvard Business Review*, 71 (1), 84-93.
- Vorhies, D. W. (1998). An investigation of the factors leading to the development of marketing capabilities and organizational effectiveness. *Journal of Strategic Marketing*, 6, 3-23.
- Vorhies, D. W. & Harker, M. (2000). The capabilities and performance advantages of market-driven firms: An empirical investigation. *Australian Journal of Management*, 25 (2), 145-172.
- Wang, Y., Lo, H. P. & Yang, Y. (2004). The constituents of core competencies and firm performance: Evidence from high-technology firms in China. *Journal of Engineering and Technology Management*, 21, 249-280. DOI: 10.1016/j.jengtecman.2004.09.001.

Tanja Rajkovič, B.Sc., is a Ph.D. student at the University of Ljubljana, Faculty of Economics. Her main research interests being innovation and technology management.

Janez Prašnikar, Ph.D. is a full professor of Economics at the Faculty of Economics of the University of Ljubljana (FELU). He is also the director of the Institute of South-east Europe at the Department of Economics, University of Ljubljana, a William Davidson Institute Research Fellow, a Visiting Professor at the Michigan University Business School, a Research Fellow at the Centre for Economic Policy Research in London, and a Director of the International Full Time Master Programme in Business Administration at the FELU. His research includes corporate governance, enterprise restructuring, privatisation and management in transitional economies.

Tehnološke, trženjske in komplementarne kompetence kot dejavniki inovacijske uspešnosti v slovenskih proizvodnih podjetjih

Članek obravnava inovacijsko uspešnost podjetij in njihove ključne kompetence, med njimi tehnološke, trženjske in komplementarne. Kompetence predstavljajo mreže različnih sposobnosti in drugih sredstev podjetja. To omogoča njihove primerjave tudi med panogami. Študija temelji na anketi, v kateri je sodelovalo 50 uveljavljenih slovenskih proizvodnih podjetij. Vzorec predstavlja njihovih 65 različnih proizvodnih linij. Na osnovi kazalcev inovacijske uspešnosti so opredeljeni trije segmenti podjetij. Uporabljena so orodja multivariatne analize, in sicer razvrščanje v skupine in analiza variance. Iz rezultatov je razvidno, da najbolj inovativna podjetja istočasno razvijajo tehnološke, trženjske in komplementarne kompetence. Ugotovitve so pomembne tako za podjetja, ki želijo uskladiti kompetence s svojo strategijo, kakor tudi z vidika ukrepov inovacijske politike v državah tehnoloških sledilkah.

Ključne besede: Tehnološke, trženjske in komplementarne kompetence; inovacijska uspešnost; tehnološki vodje in sledilci; inovacijska politika.