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Survival of the fittest: an evolutionary approach to an export-led model of growth

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ABSTRACT

Developing countries often rely on the export-led model of growth. Exposure to (developed) foreign markets increases learning opportunities for firms, enhances their competences and capabilities, and facilitates potentially more innovation. The actual benefit differs among firms depending on internal firm characteristics (genetic material). Using survey data for Slovenia we show that export orientation, firms' genetic material, competences and capabilities and innovation are related. The paper contributes to the literature in several ways, primarily by extending knowledge on innovation and corporate behaviour in an export-led developing country, using micro level data.

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Introduction

Small open economies often rely on the export-led paradigm of growth (Borgersen & King, 2014). Besides the impact on aggregate demand, the international context of the external stimulus to firm behaviour and innovation became progressively more important (Zhou & Su, 2010). This 'learning by exporting' process is caused by both a threat and opportunity. It is expected to drive productivity and innovation due to larger and more demanding competition and consumers, access to advanced technology, and knowledge (Helpman, Melitz, & Yeaple, 2004; Wagner, 2007), which would otherwise remain inaccessible. Exposure also facilitates learning by exporting and innovation in accordance with the Chesbrough (2004) open innovation model. However, the learning process also depends on corporate motivation and the ability to absorb and use the available information. This ability reflects the entire organisation, its goals, aspirations, management, people, relationships, cooperation, processes, competences and capabilities, etc., which is best described by the Nelson and Winter (1982) term genetic material.

Following the ideas of the open innovation model (Chesbrough, 2004), genetic material (Nelson & Winter, 1982) and trade theory (Helpman et al., 2004), this paper proposes that exposure to (more advanced) external sources of knowledge and ideas made available through exports, impacts the formation of corporate genetic material, which in turn propels

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companies' competitiveness in the global market. The idea is studied on the case of Slovenia, a small open economy, pursuing the export led model of growth (Damijan, Kostevc, & Polanec, 2011; Jaklič, Damijan, Rojec, & Kunčič, 2014).

The paper is structured as follows. First, a review of key concepts is provided in order to theoretically link export-orientation, innovation and genetic material. Second, methodology is presented, followed by an empirical analysis based on clustering and structural equations modelling. The article ends with a discussion and conclusions.

The paper contributes to the literature in several ways. First, the empirical results acknowledge that innovation surveys should focus on the study of a firm's competences and capabilities, its attitudes towards R&D, and the organisation of R&D in the company in order to explain the differing innovation performance. Second, we extend the management literature by linking corporate genetic material and capabilities as well as competences to the target market of the firm. Third, we extend the management (Grant, 1991; Peteraf, 1993; Teece, Pisano, & Shuen, 1997), competitiveness (Pisano & Shih, 2009; Porter, 1985), and innovation management literature with trade and development theory. Following Helpman et al. (2004), we incorporate the idea that the market conditions under which firms operate influence their general behaviour and primarily affect the general development of competences (also competences to innovate). The 'learning-by-exporting' (Javorcik & Spatareanu, 2011; Wagner, 2007) and technological transfer (see Forbes & Wield, 2000 and Jia, Jiang, & Ma, 2015) is limited by internal firm's characteristics. We show that companies operating in more demanding markets actively increase their absorption capacity by changing the characteristics of their genetic material and, thereby, improve competences and capabilities as well as innovative performance. The study is the first detailed empirical study of the linkage between exports, genetic material and innovation at the corporate level in the Western Balkan economies. In addition, the study also broadens knowledge on intangible capital in developing countries, since both innovation and corporate internal characteristics are its constituencies (Corrado, Hulten, & Sichel, 2009; Prašnikar, 2010).

Theoretical background and hypotheses

We build on several strands of literature to derive the hypotheses on the relationships between a firm's innovative activity and its exposure to markets, its competences and its genetic material.

Trade and exposure

Based on theoretical arguments (Baldwin, 1988; Dixit, 1989; and Krugman, 1989), penetration of foreign markets assumed within the export-led hypothesis is, in reality, related to (high) sunk cost. Therefore, only the most productive firms can afford to serve foreign markets and serve more foreign markets through foreign affiliates (Helpman et al., 2004), while the less productive firms may be encouraged to invest in low-income countries (Head & Ries, 2003). Consequently, a hierarchy of markets is established: the more productive firms export to more developed countries and serve more markets, whereas less productive firms serve low(er) income countries and domestic markets. This is especially pronounced in the case of domestic market frictions, often existing in developing countries (Aoki, 1999; Clarida, Galí, & Gertler, 2001).

In testing the hierarchy of markets, Damijan and Kostevc (2006) found that the more productive Slovenian firms operate in more superior markets (primarily the EU, the US, and other developed countries), while less productive companies stick to domestic (Slovenian) and ex-Yugoslav markets. However, as observed in Damijan, Polanec, and Prašnikar (2007), countries of the former Yugoslavia receive a disproportionately high share of Slovenian firms' investment compared with other countries, and not only by the low productive firms. The proximity (and informational advantages) of neighbouring markets makes these markets appealing to the more productive Slovenian firms (by default also to the less productive). In contrast to the clear cut theoretical argument, the less productive Slovenian firms also serve the Western European markets, but primarily as subcontractors in lower value added.

Sources of innovative ideas

One of the critical aspects to innovation is the external sources of knowledge. More precisely, successful innovation depends on the development and integration of new knowledge into the innovation process. Part of this knowledge will reach the firm from external sources (Cassiman & Veugelers, 2006), where both the nature of ideas and the benefits of the linkages depend on the development of the economic environment in which the companies operate and the intensity and nature of this interaction (OECD, 2005). The availability of rich external knowledge sources and extensive networking opportunities increase the potential benefits (Roper, Du, & Love, 2008). In accordance with the open innovation model (Chesbrough, 2004), firms are prone to using any external source of innovation, including the so-called 'learning-by-exporting' hypothesis, which can boost their innovation performance and growth. Forbes and Wield (2000) suggest that learning is especially important for the technology-follower countries, where firms rely more on incremental innovation rather than radical innovation.

The communication between the external environment and the organisation is closely linked to the level of communication among the sub-units of the firm and the distribution of expertise within it (competences). According to Cohen and Levinthal (1990), a firm's absorptive capacity depends on the individuals who stand either at the interface of the firm and the external environment, or at the interface between sub-units within the firm. Emerging from these ideas, we introduce to our analysis a firm's competences and capabilities.

Firm's competences and capabilities

External sources help build companies' competences and capabilities, which represent a source of competitive advantage. Following Prahalad and Hamel (1990) and Rajkovič and Prašnikar (2009), we define competences as collective learning and knowledge. They act as coordination mechanisms that combine individual actions into collective functioning and are the linkages to the environment (suppliers, customers, etc.), and they are revealed in the behavioural and cultural characteristics of the firm. Capabilities are narrower and represent competences' main constituents. They refer not only to having knowledge or possessing skills and qualifications, but also as employing those qualifications, as Grant (1991) suggested. Externally stimulated learning thus enhances both, which is a source of long-run competitive advantage (Peteraf, 1993; Song, Droge, Hanvanich, & Calantone,

2005). Consequently, competences influence firm performance by affecting the rate and success of innovation (Tidd & Bodley, 2002).

Special attention is given to the technological, marketing and complementary competences and capabilities. Technological capabilities usually refer to the capacity of a company to utilise scientific and technical knowledge for research and development (R&D) of products and processes, which lead toward greater innovativeness and performance (McEvily, Eisenhardt, & Prescott, 2004). Marketing capabilities, however, represent an integrated system of processes, based on common knowledge and skills, which enable the company to create customer value and to respond to the marketing challenges in a timely and effective manner (Song et al., 2005; Vorhies, Harker, & Rao, 1999). The complementary capabilities refer to the interaction between the remaining two: marketing and technological (Song et al., 2005).

Firm's genetic material

The comparative outcome of the innovation process strongly depends on internal, firm specific elements, which Nelson and Winter (1982) term 'genetic material'. While competences and capabilities represent one important aspect of the firm's internal organism, companies are limited in general by the characteristics of their 'genetic material' (Nelson & Winter, 1982). Their processes and routines, relationships between the stakeholders within the company, decision-making, etc. represent genetic material (e.g. Cassiman & Veugelers, 2006; Tambe, Hitt, & Brynjolfsson, 2012). This implies that genetic material acts as a moderator between the opportunities of the external stimulus and innovation, and additionally also contributes to competences building. Simultaneously, genetic material itself is being developed within the 'learning-by-exporting' context. The argument is in line with the dynamic capabilities theory (Teece et al., 1997), which claims that competitive advantage derives from leveraging managerial and organisational processes (genetic material) within and outside of the firm. It largely depends on the firm's ability to renew and transform the capabilities in compliance with the changing business environment (see Lichtenthaler, 2009).

Following the literature review, we believe that exposure to more developed external sources available through exports impacts the genetic material, helps build competences and capabilities and stimulates innovativeness. Based on this general proposition, we test the following hypotheses:

Hypothesis 1. The exposure to more developed markets is positively related to the genetic material of the firm.

Hypothesis 2. The exposure to more developed markets is positively related to firm's marketing, technological and complementary competences.

Hypothesis 3. The exposure to more developed markets is positively related to innovative performance.

Hypothesis 4. A firm's genetic material is positively related to firm's marketing, technological and complementary competences.

Hypothesis 5. A firm's genetic material is positively related to innovative performance.

Hypothesis 6. Marketing, technological and complementary competences are positively linked to innovative performance.

Methodology and survey design

We investigate the link between innovativeness and related variables using a survey dataset on a sample of 100 Slovenian companies. The survey was conducted in 2010 and 2011. The questionnaires were sent to the 400 biggest Slovenian companies; one-quarter (100) of the companies responded. The questionnaires were filled out by the companies' CEOs.

The survey data used were gathered within a broader intangibles study. We rely on the data gathered from the innovation, genetic material and human resources questionnaires. The questionnaires required detailed information about the company in the previous 5 years. The questionnaires were carefully developed and supplemented through a series of testing interviews (details in Prašnikar, 2010).

Methodologically, questionnaires used were mainly based on a cascading approach following Miyagawa et al. (2010). Each question set contains three consecutive Yes/No statements. Each subsequent statement in the question set represents/describes a greater degree of complexity or stage of development, building into a cascading structure. We also collected specific data about individual characteristics of the surveyed firms, such as export orientation, the markets in which the companies operate, ownership type, industry and legal form.

Although the innovation activity questionnaire was partially based on the Community Innovation Survey questionnaire, it was significantly extended following Rajkovič and Prašnikar (2009), innovation management theory (Forbes & Wield, 2000), trade theory (Helpman et al., 2004) and primarily own research experience. The questionnaire comprised 24 questions: the majority was of the cascading type, some were Likert scale, and some required very specific information on corporate performance (details in Prašnikar, Redek, Drenkovska (2016)). We first examined the target markets, clearly distinguishing between the developed (EU and other developed global) and less demanding national, local and regional (Western Balkan) markets. The next section of five questions examined product innovation, followed by two questions on process innovation. The purpose was to find out primarily the intensity of each of the two types, sources of ideas and performance in comparison to competition (for product innovation). We also examined the technological dynamics of the industry. The section on knowledge spillovers analysed the relevance of four different groups of sources of innovative ideas (categorised as internal, market, institutional, other), followed by the geographic location of innovation partners and types of cooperation. Then the attitude of the company towards R&D, organisation of the R&D department, and R&D expenditure was carefully studied. All of these represent the foundation for development of technological, marketing and complementary competences and capabilities, which are particularly important for innovations in developing countries (Forbes & Wield, 2000; Prašnikar, Lisjak, Rejc Buhovac, & Štembergar, 2008) and, thus, are followed by a section directly examining a firm's competences and capabilities. We also examined a firm's perceived performance in comparison to competition. The last question analysed the financing sources for R&D and the role of the state.

The questionnaire on genetic material was prepared by our research team based on theoretical foundations and previous research experience and was not based on any other questionnaire example. The questions examined: (1) decision-making; (2) adjusting employment; (3) wage setting; (4) role of labour unions; (5) participation of workers in risk sharing; (6) participation of workers in decision-making; (7) internal training; and (8) on-the-job training. First, we addressed the choice about the separation of strategic function (usually given to top management), day-to-day decisions (which are usually in the hands of

middle and lower management levels), the control function, which is in the hands of company owners (Wheelen & Hunter, 2010), and related agency problems and relationships between managers, owners and workers (stakeholders) (Aoki, 1984; Van Essen, Oosterhout, & Heugens, 2012). Related to this, we examine the bargaining process between managers and employees (including bargaining over employment and wages), which also provides information on unions, labour restructuring models, core employees groups, and wage levels (reservation wage, collective bargaining wage, firm's wage level) (Ehrenberg, Brewer, Gamoran, & Willms, 2001). We further examine workers' participation in decision-making, its impact on information exchange (Allen & Gale, 2002), cooperation, workers' loyalty and risk sharing (Aoki, 2010; Freeman & Lazear, 1995). Last, we examine human capital development, primarily internal training and on-the-job training, which are important for competences and capabilities development, represent a source of competitive advantage (Barney, 1991), and are the largest sub-category of human capital investment (Corrado et al., 2009). More details about the questionnaire are provided in Prašnikar (2010).

As already stated, the sample comprised 100 companies, 81 of which were from the manufacturing sector, with the remainder from the service sector. The sample represents one-quarter of all larger and medium-sized (+100 employees) firms in Slovenia and is, thus, a very good representation of the actual situation in larger companies in Slovenia, which are also the companies that are relevant for the study. Fifty percent of companies operated primarily in the business-to-business market, while the rest operated primarily in the final customers market. The vast majority of companies (85%) reported at least some export activities (at least 1%), and 60% of companies reported exporting more than one-half of sales. Thirty-nine percent of companies reported the national market to be their biggest market. The average company had 582 employees in 2010.

Results

Following the research agenda, we conducted first an exploratory clustering study based on questions on the firm's trade orientation to investigate how the development of the firm's biggest target market is related to its genetic material, development of competences and capabilities and innovativeness. The structural equation modelling is used as a confirmatory method.

Target market, competences, capabilities and innovativeness

Following the Helpman et al. (2004) idea that companies that serve differently developed markets differ in their characteristics, we first divide the companies into two groups by their dominant market: exporting globally (Western markets) or selling to proximity markets. The first group consists of firms that declare Western markets (including EU markets) as the main market, the second group proclaims ex-Yugoslav markets and domestic Slovenian market as the main market. Ex-Yugoslav markets are considered as 'proximity markets' in our study since the common 'Yugoslav experience' provided Slovenian companies with the historically set market position, brand recognition, market knowledge and also relationship advantages.

Having divided the companies by their main markets (Global developed and Proximity markets groups), hierarchical cluster analysis (Ward method) was used to divide them

Table 1. General company information: percentage of companies in a cluster with selected characteristics.

	Global markets		Proximity markets	
	Superior	Inferior	Superior	Inferior
Total number of observations	24	24	24	28
Size (250+) (% of all)	70.80	66.70	70.80	46.40
More than 50% of export (% of all)	100.00	95.80	25.00	21.00
Manufacturing (vs. services) (% of all)	95.80	91.70	70.80	53.60
Form (doo) (% of all)	50.00	45.80	41.70	46.40
B2B (% of all)	62.50	62.50	37.50	39.30

Source: Authors' own data.

further, since the variation of companies within each of the market groups was still significant in terms of their innovation characteristics. Eleven cascading variables related to innovation activities were used because we expect the companies to differ in innovation activity. We identified four clusters of companies, two within each of the above-mentioned groups. Given their characteristics, the clusters are referred to as 'Global–superior' cluster (oriented towards global developed markets) and 'Global–inferior' cluster (companies operating mainly in the EU markets), and 'Proximity–superior' cluster (operating mainly in both ex-Yugoslav and domestic Slovenian markets), and 'Proximity–inferior' cluster (operating mainly in the domestic Slovenian market). Table 1 summarises groups' characteristics.

On average, over 90% of sales in the Global group of firms is sold in the Western markets, while domestic Slovenian markets and ex-Yugoslav markets represent close to 80% of sales in the Proximity group. In addition, the Global group comprises strong manufacturing companies, both from the more propulsive as well as traditional industries, in both cases primarily B2B companies.

Regarding the four cluster shown in Table 1, the 'Global-superior cluster' comprises manufacturing companies, which all export most of their products worldwide. This is a cluster of strong Slovenian companies from the steel, construction related, electrical, machinery and automotive industries. Many of these represent important parts of European or global value chains (62% are B2B). The other cluster in this group, the 'Global-inferior' cluster, services mainly the EU markets. Although the majority of firms reported the EU markets as their most important (85%), and although they are similar to the first primarily manufacturing firms, the important difference between the two is that these are smaller companies operating in less propulsive and more traditional manufacturing industries (such as wood or electrical appliances). The 'proximity markets' also provided two clusters. The first cluster of 24 companies, dominated by larger manufacturing companies, demonstrates superiority to the second in many innovation aspects. The second cluster of 28 companies consists of smaller companies (less than one-half of them have more than 250 employees), many of which are from service industries.

Table 2 presents the results on innovative activities across the four clusters of Slovenian firms. Since our fundamental division of the sample into two groups (each further divided into two clusters) was made taking into account main market orientation, we present statistical significances of the association between cluster membership and variables of interest for (1) two clusters in the same market-based group (columns 5 and 10) and (2) the two market-based broad groups (column 11). The 'Global–superior' cluster (see columns 1–2 for *n* and percentages) had the most intense innovation activity and also most developed

Table 2. Main characteristics of the four clusters: percentage of companies with an affirmative answer to a specific question.

	Global					Proximity					
	Superior		Inferior		Chi square (Global superior and inferior)	Superior		Inferior		Chi square (Proximity superior and inferior)	Chi-square sign. (whole Global and Proximity groups)
	Obs.=24		Obs.=24			Obs.=24		Obs.=28			
Question/Variable	*n*	%	*n*	%		*n*	%	*n*	%		
Column	1	2	3	4	5	6	7	8	9	10	11
1. Company's knowledge base is enhanced by:											
From environment into the company	24	100.0	22	91.7	0.149	24	100.0	27	96.4	0.350	0.470
Strategic partnerships	20	83.3	17	70.8	0.303	18	75.0	20	71.4	0.772	0.409
Extended outside - selling intellectual property rights	3	12.5	5	20.8	0.439	2	8.3	1	3.6	0.463	0.770
2. R&D expenditure											
At least 1% of revenue.	24	100.0	20	83.3	0.037	19	79.2	15	53.6	0.053	0.001
At least 2% of revenue.	22	91.7	14	58.3	0.008	11	45.8	3	10.7	0.004	0.000
At least 3% of revenue.	18	75.0	10	41.7	0.019	8	33.3	2	7.1	0.017	0.000
3. Perception of R&D expenditure											
Not solely as an unnecessary expenditure	24	100.0	21	87.5	0.074	23	95.8	19	67.9	0.011	0.050
Knowledge transfer among employees is very important	23	95.8	19	79.2	0.081	21	87.5	15	53.6	0.008	0.024
Of strategic importance to the company	22	91.7	16	66.7	0.033	18	75.0	9	32.1	0.002	0.004
4. Technological capabilities											
Exceed the average companies' in industry	22	91.7	10	41.7	0.000	24	100.0	11	39.3	0.000	0.557
Are more technologically competent as competitors	19	79.2	9	37.5	0.003	24	100.0	11	39.3	0.000	0.235
Tech. capab. are dynamically replaced by new	19	79.2	7	29.2	0.001	23	95.8	8	28.5	0.000	0.364
5. Marketing capabilities											
Exceed the average companies' in industry	23	95.8	1	4.2	0.000	21	87.5	7	25.0	0.000	0.427
Are more competent in marketing as competitors	22	91.7	1	4.2	0.000	21	87.5	5	17.9	0.000	0.497
Mark. capab. are dynamically replaced by new	20	83.3	1	4.2	0.000	20	83.3	2	7.1	0.000	0.522
6. Complementary capabilities											
Experts exchange informally tech. and mark. capabilities	24	100.0	13	54.2	0.000	20	83.3	21	75.0	0.463	0.511
Experts cooperate in all stages of NP	24	100.0	10	41.7	0.000	20	83.3	18	64.3	0.123	0.489
New products in the pipeline at all times	9	37.5	2	8.3	0.016	12	50.0	2	7.1	0.001	0.409
7. Introducing new products (NP-new products)											
Significant number new to the firm	23	95.8	21	87.5	0.296	23	95.8	17	60.7	0.003	0.040
Majority of them new to the market	18	75.0	12	50.0	0.074	20	83.3	6	21.4	0.000	0.145
Also novelty in the global markets	12	50.0	7	29.2	0.140	10	41.7	0	0.0	0.000	0.021
8. Product innovation (NPs-new products)											
NPs primarily NOT developed by imitation	22	91.7	19	72.9	0.220	24	100.0	24	85.7	0.054	0.218
NPs developed primarily in company/group	22	91.7	17	70.8	0.064	24	100.0	18	64.3	0.001	0.577
NPs developed with cooperation	14	58.3	15	62.5	0.768	17	70.8	6	21.4	0.000	0.078

9. Company performance compared to competitors											
Least on a par with peers	22	91.7	19	72.2	0.220	23	95.8	21	75.0	0.038	0.568
Better than peers	15	62.5	8	33.3	0.043	21	87.5	11	39.3	0.000	0.122
One of the leaders in industry	11	45.8	5	20.8	0.066	19	79.2	4	14.3	0.000	0.181
10. Process innovation (NPcs – new processes)											
NPcs primarily NOT developed by imitation	21	87.5	20	83.3	0.683	23	95.8	21	75.0	0.038	0.568
NPcs developed primarily in company/group	20	83.3	15	62.5	0.104	23	95.8	15	53.6	0.001	0.581
NPcs developed with cooperation	11	45.8	11	45.8	1.000	17	70.8	10	35.7	0.012	0.342
11. Fields of process innovation in the last five years (5y)											
introduced process innovation in past 5y	23	95.8	19	79.2	0.081	17	70.8	14	50.0	0.127	0.002
Improved production processes	21	87.5	17	70.8	0.155	20	83.3	12	42.9	0.003	0.044
Improved logistics, delivery, distribution	17	70.8	9	37.5	0.020	18	75.0	14	50.0	0.065	0.293
Improved support services (maintenance, sales, IT, accounting etc.)	19	79.2	11	45.8	0.017	23	85.8	18	64.3	0.005	0.057

Source: Authors' own data.

'innovation culture'. Ninety-six percent of companies introduced new products that were new for the firm. Out of these, 75% introduced at least one product, which was new to its most important market, and 50% of companies introduced globally new products in the past five years (global niche producers). Ninety-two percent of companies consider R&D to be strategically important for the company and three-quarters of firms invested at least 3% of revenue in R&D. Ninety-one percent report that product development was not a result of imitation, but primarily resulted from the work within the company and cooperation with partners (60%). Regarding process innovation, more than 80% of firms stated that they developed processes mainly inside the company and almost 50% in cooperation. Innovation ideas were largely obtained from within the chain (54% of firms compared with only 29% in the 'Global–inferior', (see columns 3–4 for *n* and percentages), which indicates a high dynamics of cooperation in the chain.

The 'Global–superior' cluster is very confident about their capabilities (marketing, technological and complementary), the advancement of R&D, establishing long-term relationships with customers, and in the within-firm cooperation at all levels (question sets 4–6). This is very important for both absorption and knowledge transfer from the outside and also within the firm.

The 'Global–inferior' cluster invests a smaller percentage of revenues in R&D and places considerably less strategic importance on R&D than the 'Global–superior' cluster. In that sense it is not surprising that merely one-half of them reported introducing a product that is a novelty in their main market. These companies primarily rely on simpler types of innovation, such as improving existing products, and fall behind the first cluster in this group, especially with regard to new product lines and extensions to existing product lines. Similarly, considerably fewer firms regard their capabilities better than those of the other companies in the industry, especially when it comes to marketing capabilities. These, and consequently the complementary capabilities, are evaluated worst in the entire sample (only one company believed it exceeded the average compared with 95% of the Global–superior and 87% of the Proximity–superior cluster).

The 'Proximity–superior' cluster reported more cooperation with other companies or institutions in the innovation processes (columns 6–7 for *n* and percentages). Interestingly, these companies graded their capabilities second highest in the whole sample, ranking far above the second cluster in the 'Global' group of companies. Their confidence in technological capabilities was especially evident. Namely, they all believed they exceeded their industry competitors. The 'Proximity–superior' cluster is quite innovative, 96% of companies introduced new products, and as many as 42% reported the products were novelties, not only for the firm but also new for their main market. Seventy-nine percent believed themselves to be leaders in the industry in terms of innovation in their target market.

The fourth subgroup of companies, or the second cluster in the second group, the 'Proximity–inferior' cluster, placed least strategic importance on R&D and had the lowest share of revenues invested in R&D among the four subgroups (only 7% of firms spent 3% or more on R&D activities). Indeed, the cluster ranks lowest regarding the innovative performance in comparison with the other subgroups. None of the companies in the cluster introduced a globally novel product in the past five years, and only 21% of them introduced a novelty to the market, which does not predict a bright future. Regarding the perception of their capabilities, they significantly fall behind the 'Proximity–superior' cluster. Interestingly,

however, these companies rank their marketing and complementary capabilities higher than the second cluster in the Global group (the Global–inferior cluster).

The results consistently show the innovative superiority of the Global-superior cluster: the anticipated result. On the other hand they also reveal the solid performance of the Proximity–superior cluster, while both groups leave the two inferior clusters behind. As hypothesised, the explanation could be found partially in firms' genetic material.

Target market, innovativeness and genetic material

Table 3 presents the differences in the genetic material between the clusters. Again, a Chi-squared test is presented (1) for pairs of clusters that constitute two groups of firms (columns 5 and 10), and (2) for the two broad groups (column 11).

The results illustrate higher coordination between owners, managers, and workers in decision-making in the 'Global–superior' cluster. The 'Global–superior' cluster also included more often at least 50% of workers in internal training, empowered workers more, and had a higher transfer of knowledge among employees. Their workers are more loyal and have high inclination towards risk.

In terms of genetic material, the 'Global–inferior' cluster reports the least cooperation in decision-making among all four clusters (columns 3 and 4 for *n* and percentages). Similarly, wages were lowest, as only 25% reported having higher wages than those determined by the collective agreement (compared with 60% of the 'Global–superior' cluster and 46% of the 'Proximity–superior' cluster). Workers in this cluster are, on average, the least involved in decision-making relative to the other clusters. The companies from this cluster seem also to perform poorly in terms of internal training and on-the-job training. Namely, only 53% of companies offered training to at least one-half of employees, compared with 80% of the 'Global–superior' cluster, 60% in the 'Proximity– superior' cluster, and 56% in 'Proximity–inferior' cluster companies. The lack of cooperation, trust and investment in human capital could also explain the poor evaluation of capabilities compared with competition, which definitely is a strong deficiency of the group both in terms of absorption and innovation.

When comparing the two clusters in the second group of firms (Proximity group), the 'Proximity–superior' excels the 'Proximity–inferior' cluster in two sets of questions: workers inclination towards risk and decisions on wages. The two could be related: higher wages could imply higher loyalty of workers. However, the 'Proximity–superior' cluster reports higher loyalty compared with the two clusters in the Global group. Owing to the high values 'for on-the-job training' variables, this cluster (besides the 'Global–superior' cluster) has the highest potential of genetic material. However, there are two observations to be made here. First, the 'Global–superior' cluster is exposed to the developed global markets and the 'quality of knowledge and ideas' can be expected to be higher and more stimulative to innovation. In addition, the confidence of the 'Proximity–superior' firms in their capabilities stems from their focus on comparatively less competitive markets. This could have a detrimental impact on their motivation to invest and their consequent long-run growth.

The 'Proximity–inferior' cluster seems to be quite strong regarding 'cooperation in strategic decision-making,' with 63% of companies reporting relying on coordination among all three stakeholders. It only falls short of the 'Global–superior' cluster. In addition, compared with the 'Proximity–superior' cluster, the workers are more unionised but have lower wages. In addition, their inclination to risk is lower, and is, in fact, the lowest among all clusters.

Table 3. Main characteristics of firms' genetic material by clusters.

	Global					Proximity					
	Superior		Inferior			Superior		Inferior			
	Obs.=24		Obs.=24		Chi-square significance	Obs.=24		Obs.=27		Chi-square significance	Chi-square sign. (Global vs. Proximity)
Question/variable	*n*	%	*n*	%		*n*	%	*n*	%		
Column	1	2	3	4	5	6	7	8	9	10	11
1. The decision making											
Operation/strategic management separation	24	87.5	24	70.8	0.155	24	79.2	27	81.5	0.835	0.879
Managers and owners act unanimously	24	87.5	24	50.0	0.005	24	70.8	27	74.1	0.796	0.678
Owners, managers and workers coord.	24	75.0	24	50.0	0.074	24	58.3	27	63.0	0.735	0.861
2. Decisions on employment											
Short term adjust. to shocks	24	100.0	24	100.0	.	24	91.7	27	96.3	0.483	0.088
Achieving desired level of employment	24	79.2	24	87.5	0.439	24	75.0	27	70.4	0.712	0.197
Core group of employees	24	54.2	24	70.8	0.233	24	37.5	27	37.0	0.973	0.012
3. Decisions on wages											
Higher than alternative wages	24	79.2	24	54.2	0.066	24	75.0	27	59.3	0.234	1.000
Wages higher than collective agreement	24	58.3	24	25.0	0.019	24	45.8	27	29.6	0.232	0.653
Wages among the highest in the country	24	20.8	24	20.8	1.000	24	33.3	27	0.0	0.001	0.507
4. The union role											
Workers organised in unions	24	91.7	24	83.3	0.383	24	91.7	27	96.3	0.483	0.252
One union organisation	24	54.2	24	58.3	0.771	24	54.2	27	81.5	0.036	0.203
Unions concerned with a firm's success	24	12.5	24	16.7	0.683	24	16.7	27	18.5	0.863	0.679
5. Workers inclination towards risk											
Prepared to do 'more' for the firm	24	87.5	24	79.2	0.439	24	95.8	27	77.8	0.061	0.683
Would stay with the firm in bad times	24	54.2	24	45.8	0.564	24	75.0	27	44.4	0.027	0.378
Willing to make finan. invest. in a firm	24	25.0	24	20.8	0.731	24	37.5	27	14.8	0.064	0.765
6. Workers participation											
Workers are informed	24	91.7	24	83.3	0.383	24	91.7	27	88.9	0.739	0.670
Open dialogue with managers	24	83.3	24	70.8	0.303	24	83.3	27	81.5	0.863	0.514
Workers are members of gov. bodies	24	50.0	24	41.7	0.562	24	50.0	27	59.3	0.507	0.367
7. Internal training											
Existence of organised forms in the firm	20	100.0	17	100.0	.	20	90.0	18	94.4	0.612	0.081
More than 50% of workers participate	20	80.0	17	52.9	0.080	20	60.0	18	55.6	0.782	0.387
Other methods of evaluation than survey	20	60.0	17	58.8	0.942	20	65.0	18	38.9	0.107	0.551
8. On-the-job training											
Existence of organised forms in the firm	20	100.0	17	100.0	.	20	95.0	18	100.0	0.336	0.321
Knowledge transfer among employees	20	95.0	17	70.6	0.045	20	85.0	18	72.2	0.335	0.591
Successors for most of key employees	20	40.0	17	17.6	0.138	20	60.0	18	33.3	0.100	0.117

Source: Authors' own data.

Overall, it seems that in Slovenia genetic material works in favour of innovative activities of firms, especially in the 'Global–superior' cluster of firms. What sets this cluster most obviously apart from the other is its focus on export-orientation, genetic material and innovation. The 'Global–inferior' cluster is lagging behind the 'Global–superior' cluster in many aspects, including the genetic material. The 'Proximity–superior' cluster does possess significant confidence and quite solid genetic material. Finally, a firm's poor investment in human capital, combined with weak evaluation of capabilities shows that 'Proximity–inferior' firms lag behind. They are, to a large degree, services firms, mainly exposed to the domestic Slovenian markets. As also shown by Bole, Prašnikar, and Trobec (2014), services firms (especially small and medium-sized firms) also face severe difficulties in obtaining bank loans due to the low levels of collateral and low domestic demand imposed by austerity measures in Slovenia after the global crisis.

The model and results

In continuing, structural modelling is used to investigate the main proposition of the paper, stating that exposure to more developed markets and external sources of knowledge and ideas impact the formation of corporate genetic material, which in turn improves the overall innovative performance. We analysed our theoretical model using partial lest squares structural equation modelling PLS. As proposed by Hair, Sarstedt, Ringle, and Mena (2012), the rationale for using PSL-SEM is its propensity to handle relatively complex models in the condition of a small sample size. It is also recognised that this method can effectively manage the high number of variables in the model and the low possible causal relationships between the constructs (Longo & Mura, 2011).

In studies on the impact of foreign markets on the productivity of firms (learning by exporting hypothesis), export-to-sales ratio is usually taken as an explanatory variable. However, as shown in the previous chapter, the exploratory clustering analysis revealed the divergent effect of the market orientation of Slovenian firms: besides the innovative firms, the less innovative, cost-competing firms also serve foreign developed markets. In addition, the highest performing firms in the proximity markets, although exporting high, are not the most important innovators (process innovations are mostly present). To capture the impact of the availability of quality ideas and information from foreign markets, but also avoid this complication of two 'very open, but very different in quality' clusters, we abstain from including export/sales as the explanatory variable and rather examine the concept of external influence through the external sources of information and ideas. The rationale behind this is that firms exporting to more demanding markets use more advanced (external) sources of information and ideas.

The model comprises five constructs. As a dependent variable, the construct 'Innovative performance' is used. It includes three indicators: (1) an indicator for the variety of new products in the firm (NUM_NP); (2) an indicator that determines the comparative time-efficiency in adapting products to changed demand and is, according to the theory, also an indicator of incremental innovation efficiency (TIME_ADPT); and (3) an indicator of the time-effectiveness of new product development (TIME_DVLP), which is considered a measure of radical innovation and its efficiency.

To evaluate the sources of information we develop a construct 'External sources', which is based on items measured on a three-point Likert scale (from low = 1 to high = 3). The

external sources construct comprises buyers, competitors and other companies in the field, and scientific, commercial and technical journals. From the perspective of the hypotheses, it should be noted that those firms that serve more developed markets cooperate more deeply and with more innovative and technologically advanced suppliers, and deal with fiercer competition (see data in Table A1 in the Appendix).

The 'Genetic material' construct was built using variables with a dichotomous scale (yes = 1; no = 0). The combination of the indicators that measure the strategic decision-making process, the role of the workers, and the transfer of knowledge revealed the best construct reliability (Table 4).

The items of the constructs 'Technological competences',[1] 'Marketing competences' and 'Complementary competences' are measured on a five-point Likert scale. Surveys asked companies to evaluate their perceived performance with respect to their competitors' in the areas of interest. Technological competences were measured by the perceived performance in the development of R&D, the contribution of strategic partnership and the ability to predict technological trends. Marketing competences were measured by the perceived success in knowing the consumers and managing suppliers and customers. Complementary competences were captured through a set of questions examining transfer of knowledge between businesses, strategic partners, cost-efficiency of product development and the clarity of business units' activity division (Table 4).

Table 4. Questions for indicator variables.

External sources	
BYRS	Buyers
COMPS	Competitors and other companies in the field
JOURN	Scientific, commercial, and technical journals
Genetic material	
SYS_TRANS	Do you systematically induce knowledge transfer among employees?
dialogue	Is there an established open dialogue with the workers about key decisions for the firm?
COORD	Are the basic strategic decisions in the firm coordinated among owners, managers and workers
Technological competences	
RD_ADVNC	Research and development in the firm is advanced
TECH_CAP	Number of available technological capabilities inside the firm or through strategic partnership is quite large.
PRED_TRND	We are good at predicting technological trends
Marketing competences	
INFO_CUST	Obtaining information about changes of customer preferences and needs
INFO_COMP	Acquiring real time information about competitors
CUST_REL	Establishing and managing long-term customer relations
SUPP_REL	Establishing and managing long-term relations with suppliers
Complementary competences	
KNOL_TRANS	Good transfer of technological and marketing knowledge among businesses
RD_COOPER	Intensity, quality and extent of R&D knowledge transfer in co-operation with strategic partners
COST_EFF	Product development is cost efficient.
Innovation performance	
NUM_NP	Number of new, adapted or completely new products
TIME_ADPT	Time needed to adapt existing products to new/changed market demand
TIME_DVLP	Time needed to develop a completely new product

Source: Authors' own data.

The analysis was done on a sample of 73 companies with a complete dataset. We first assessed the measurement model and then tested for significant relationships in the structural model. Reflective measurement models should be assessed with regard to their reliability and validity (Henseler, Ringle, & Sinkovics, 2009). For the construct reliability we look at the Composite Reliability column in Table 5. According to Nunnally and Bernstein (1994), values of 0.60 to 0.70 in exploratory research and values from 0.70 to 0.90 in more advanced stages of research are regarded as satisfactory. To determine the convergent validity, we look at the average variance extracted (AVE) by each construct. According to Fornell and Larcker's (1981) criterion, an AVE value of 0.50 and higher indicates a sufficient degree of convergent validity, meaning that the latent variable explains more than one-half of its indicators' variance.

In addition to composite reliability, the reliability of constructs is confirmed under the Cronbach's Alpha column, where all values are above the minimum requirement of 0.5. The discriminant validity of the research instruments was also established using the Fornell-Larcker Criterion according to which the average variance extracted (AVE) of each latent construct should be higher than the construct's highest squared correlation with any other latent construct.

Summary statistics in Table 5 reveal that confidence was gained with respect to the measurement model assessment and signifies that we can move on to evaluation of the structural model and test its associated hypotheses. PLS relies on bootstrapping techniques to obtain t-statistics for the path coefficients and hypothesis tests. To obtain these statistics, the number of cases was increased twice and re-sampled 400 times. We have additionally performed several tests to rule out the presence of common method bias.

Table 5. Statistics summary for the model.

Construct	Indicator	Loadings	AVE	Composite reliability	Cronbach's Alpha
External sources			0.5661	0.8004	0.5751
	BYRS	0.8627			
	COMPS	0.7422			
	JOURN	0.6559			
Genetic material			0.5348	0.7715	0.5354
	KNOL_TRANS	0.8020			
	dialogue	0.8021			
	COORD	0.5653			
Marketing competences			0.7122	0.9078	0.7122
	INFO_CUST	0.8349			
	INFO_COMP	0.7455			
	CUST_REL	0.8875			
	SUPP_REL	0.8990			
Technological competences			0.7898	0.9182	0.7892
	RD_ADVNC	0.9206			
	TECH_CAP	0.8763			
	PRED_TRNDS	0.8673			
Complementary competences			0.6465	0.895	0.7402
	KNOL_TRANS	0.8040			
	RD_COOPER	0.9061			
	COST_EFF	0.8679			
Innovation performance			0.5477	0.8829	0.7155
	NUM_NP	0.8766			
	IMPROV_PR	0.8225			
	TIME_DVLP	0.8375			

Source: Authors' own data.

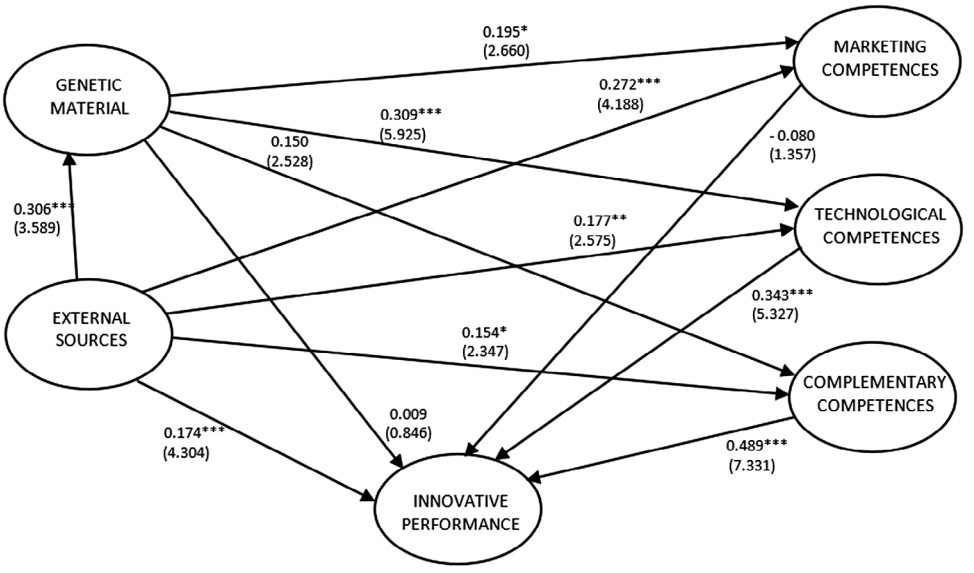

Figure 1. Results of the analysis of the structural model.
Notes: *$p < 0.1$; **$p < 0.05$; ***$p < 0.001$.

Figure 1 reveals the estimated path coefficients and corresponding t-values in brackets. As studies argue, firms do not operate or innovate in isolation, but rather through enduring inter-relations with other firms, institutions, and even buyers (see for example Gulati, Nohria, & Zaheer, 2000). Our results confirm Hypothesis 3, revealing a positive and significant direct link between the external sources of innovative ideas and the company's innovative performance. In this case, the external environment acts as innovation-generating informal exchanges and learning.

However, the external sources of innovative ideas further reveal a positive impact on genetic material (Hypothesis 1 is confirmed). The results confirm the proposition that firms with developed genetic material tend to benefit more from utilising external sources of innovative knowledge.

Our results also confirm Hypothesis 2 and reveal a positive influence of the external sources on the firm's competences. As competences are processes and include interconnected sharing of knowledge, the path coefficients support the notion that this learning is enhanced by information incoming from the environment.

The more developed the competences, the better translation of the knowledge into the innovation process. This is confirmed in the paths that lead from the competences to the innovative performance. The complementary competences have the strongest impact. The interlocked influence of marketing and technological competences on innovative performance is mirrored through complementary competences. This is especially true for the manufacturing companies, where new products must first offer new technological solutions and must only then obtain a market valuation, with the product being the combined 'result' of all three types of competences. Technological competences also exhibit a strong and significant impact on innovative performance. However, this is not true for marketing competences. Hypothesis 6 is therefore only partly confirmed. The deviation from the

hypothesised link in the case of marketing competences can be attributed to several reasons. As shown in the previous chapter, the Global–inferior cluster reported extremely poor marketing competences. On the other hand, innovation in this cluster, driven by survival need, was quite vibrant despite reliance on simpler types of innovation and process innovation (cost-competitors). In addition, quite a number of companies in the sample (23%) are service companies. These are less innovative than the average (primarily captured in the fourth cluster). However, they have strong marketing sections in comparison to the average company and especially B2B companies.

In the estimated structural model the genetic material is not directly related to the innovative performance (Hypothesis 5 is not confirmed), but it rather impacts innovative performance through its positive influence on a firm's competences (Hypothesis 4 is confirmed). The notions of competences (and dynamic capabilities) serve as higher level, meta- or second-order routines (Winter, 2003), a notion already anticipated in Nelson and Winter's (1982) treatment of 'dynamic routines'. Such routines (embodied in the genetic material) reflect the ability of the organisation to reflexively revisit what it routinely does, particularly in the dynamic, changing environments (Felin & Foss, 2009). The mediation effect of all three constructs of competences between genetic material and a firm's innovative performance was also confirmed through the Sobel test for mediation. The statistics reveal a full mediation in the case of the technological and marketing competences, and partial mediation in the case of complementary competences.

The fact that genetic material has the strongest impact on technological competences requires additional explanation. Since technological competences depend largely on the quality of processes in the firm, such a result should not be surprising. With the flows of information inside and from the outside of the firm, the genetic material (organisation of the firm, cooperation, cohesion, and investment in workers) successfully transmits the information and develops competences that serve as a base for developing new products and services.

An important conclusion of the model is that external sources of information impact the innovativeness of Slovenian firms. A presence in global (developed) markets implies that the linkages with buyers, competitors or other sources of information (such as scientific, commercial and technical journals) will be sourced from more developed (better ideas) and consequently more demanding markets (additional stimulus). The direct impact on innovativeness is rather small, but the indirect impact through genetic material and competences is very obvious, as these linkages are strong and significant. In addition, they are in line with the results anticipated by the exploratory analysis using the clustering approach.

Discussion and conclusions

Many studies have attempted and confirmed the link between innovativeness and export orientation and productivity. But from the perspective of management, the main questions are 'why and how' the link operates at the firm level. What should be changed to become a more export-oriented firm that, in the longer run, is more innovative, more productive and pays higher wages? According to our results, genetic material and competences/capabilities capture the essence of a firm's evolution and competitiveness, and provides the missing link.

We examined the situation in a sample of large companies from a developing country, Slovenia. As argued, export orientation is very important for such economies. Besides

increased demand, export markets, especially those more advanced in comparison to that of the country of origin should be seen as a learning opportunity. But not all companies actually exploit the 'learning-by-exporting' hypothesis. First, we showed that the ability to learn is related to genetic material of the firm and existing competences and capabilities. External sources of ideas, genetic material, competences, and capabilities build into a positive spiral that ends in a more innovative company. To the best of our knowledge, this link was studied in such a manner for the first time, and the results carry an extremely important message to the management of all companies, not just for those from developed countries. Learning opportunities cannot be exploited if the firm does not nurture – gradually, by the management in cooperation with all stakeholders – a suitable environment.

Second, the results also speak in favour of studying competences and capabilities within innovation studies. First, they possess a significant amount of explanatory power and are also at the heart of absorption power, building a bridge between the availability of external information and the actual absorption and transfer into own products. Actual absorption is furthermore impacted upon by the attitudes towards building own resources from the available outside information and general focus and dedication towards progress in the firm, which is captured by the genetic material. Therefore, innovation survey methodology should also try to incorporate competences and capabilities into the standardised questionnaires. Although the study was performed in a developing country, all economies are characterised by a great diversity of companies. Regardless of a company's development level, both leaders and followers can learn and grow by the same pattern as suggested here, and both would find these results relevant.

The paper extends several strands of literature. Primarily, it links the standard growth theory and its export-led approach in the case of emerging economies (Borgersen & King, 2014; Wagner, 2007; Damijan & Kostevc, 2006) with the management literature focusing on the firms' competitiveness and the role of genetic material and competences (Grant, 1991; Porter, 1985; Teece et al., 1997 and other) by relying on the very recent intangible capital literature (Corrado et al., 2009) and trade theory (Helpman et al., 2004). By merging these strands of literature and applying the theoretical foundations to the dataset for Slovenia we show that the characteristics of the market, where firms operate, impact first of all the firms' behaviour and primarily and also consequently their development of different competences (including competences to innovate). Thereby, we show that the popular 'learning-by-exporting' model (Javorcik & Spatareanu, 2011; Wagner, 2007) and technological transfer (see Forbes & Wield, 2000) is in fact closely related to the firms' internal characteristics. Generally, data imply that firms, which are present in more developed and competitive markets, have to or do in fact invest into increasing their absorptive capacity by changing their internal setting (genetic material, competences and capabilities) as well as focusing on innovation.

However, the caveat to the robustness of such a conclusion is the sample size. The sample mainly corresponds to larger Slovenian firms. In the future, it could be extended by surveying small and medium companies. Additionally, a comparative analysis of the link between export orientation and innovativeness with other developing countries is a challenge for the future.

Note

1. In the descriptive part, we rely primarily on the description of firm characteristics based on capabilities (Table 2). Capabilities were measured using the cascading approach, where firms were primarily focusing on the comparison with the industry average. Such an approach is also in line with the theoretical underpinning of capabilities. On the other hand, for the structural modelling, competences were used. Competences are principles that can be similar in companies or industries. Therefore, the characteristics of each type were captured for each individual company on a 5-point Likert scale, focusing on how much a specific dimension pertaining to a certain competence is present in this specific company. Since the purpose of the modelling was to capture the characteristics of a specific firm in relation to its specific performance, competences were used instead of capabilities, which allowed ranking of the firm against the industry.

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Appendix

Table A1. ANOVA analysis of importance of relevant sources of information between the two main groups of clusters.

Global markets												Proximity markets										
Sources of information*	Scale	N	Mean	SD	95% confidence interval		min	max	Homogeneity of variances	ANOVA Sig.	Robust test of eq. Of means	Scale	N	Mean	SD	95% confidence interval		min	max	Homogeneity of variances	ANOVA Sig.	Robust test of eq. Of means
Internal sources	Inside the company								0.730	1.000	1.000	Inside the company								0.676	0.905	0.906
	Global superior	24	2.46	0.721	2.15	2.76	1	3				Proximity superior	24	2.63	0.576	2.38	2.87	1	3			
	Global inferior	24	2.46	0.884	2.09	2.83	0	3				Proximity inferior	28	2.61	0.497	2.41	2.80	2	3			
	Total	48	2.46	0.798	2.23	2.69	0	3				Total	52	2.62	0.530	2.47	2.76	1	3			
Market sources	Suppliers of equipment								0.946	0.246	0.246	Suppliers of equipment								0.439	0.396	0.410
	Global superior	24	2.13	0.797	1.79	2.46	1	3				Proximity superior	24	2.00	0.885	1.63	2.37	0	3			
	Global inferior	24	1.83	0.917	1.45	2.22	0	3				Proximity inferior	28	2.18	0.612	1.94	2.42	1	3			
	Total	48	1.98	0.863	1.73	2.23	0	3				Total	52	2.10	0.748	1.89	2.30	0	3			
	Suppliers of materials, components and programme equipment								0.234	0.086	0.086	Suppliers of materials, components and programme equipment								0.922	0.924	0.923
	Global superior	24	2.33	0.816	1.99	2.68	1	3				Proximity superior	24	2.38	0.647	2.10	2.65	1	3			
	Global inferior	24	1.92	0.830	1.57	2.27	0	3				Proximity inferior	28	2.39	0.685	2.13	2.66	0	3			
	Total	48	2.13	0.841	1.88	2.37	0	3				Total	52	2.38	0.661	2.20	2.57	0	3			
	Buyers								0.000	0.014	0.017	Buyers								0.912	0.765	0.769
	Global superior	24	2.96	0.204	2.87	3.04	2	3				Proximity superior	24	2.63	0.711	2.32	2.93	0	3			
	Global inferior	24	2.42	1.018	1.99	2.85	0	3				Proximity inferior	28	2.57	0.573	2.35	2.79	1	3			
	Total	48	2.69	0.776	2.46	2.91	0	3				Total	52	2.60	0.634	2.42	2.77	0	3			
	Competitors and other companies in the field								0.783	0.855	0.855	Competitors and other companies in the field								0.437	0.958	0.959
	Global superior	24	2.21	0.779	1.88	2.54	1	3				Proximity superior	24	2.17	0.868	1.80	2.53	0	3			
	Global inferior	24	2.25	0.794	1.91	2.59	0	3				Proximity inferior	28	2.18	0.772	1.88	2.48	0	3			
	Total	48	2.23	0.778	2.00	2.46	0	3				Total	52	2.17	0.810	1.95	2.40	0	3			
	Consultants, private research or R&D facilities								0.307	0.616	0.616	Consultants, private research or R&D facilities								0.161	0.003	0.003
	Global superior	24	1.58	0.776	1.26	1.91	0	3				Proximity superior	24	1.88	0.680	1.59	2.16	0	3			
	Global inferior	24	1.46	0.932	1.06	1.85	0	3				Proximity inferior	28	1.21	0.833	0.89	1.54	0	3			
	Total	48	1.52	0.850	1.27	1.77	0	3				Total	52	1.52	0.828	1.29	1.75	0	3			

Institutional sources	Universities or other higher education institutions								0.473	0.754	0.754	Universities or other higher education institutions								0.605	0.028	0.029
	Global superior	24	1.71	0.859	1.35	2.07	0	3				Proximity superior	24	1.67	0.868	1.30	2.03	0	3			
	Global inferior	24	1.63	0.970	1.22	2.03	0	3				Proximity inferior	28	1.14	0.803	0.83	1.45	0	3			
	Total	48	1.67	0.907	1.40	1.93	0	3				Total	52	1.38	0.867	1.14	1.63	0	3			
	Government or public research institutions								0.391	0.864	0.864	Government or public research institutions								0.353	0.215	0.217
	Global superior	24	1.25	0.737	0.94	1.56	0	3				Proximity superior	24	1.33	0.868	0.97	1.70	0	3			
	Global inferior	24	1.21	0.932	0.81	1.60	0	3				Proximity inferior	28	1.04	0.838	0.71	1.36	0	3			
	Total	48	1.23	0.831	0.99	1.47	0	3				Total	52	1.17	0.857	0.93	1.41	0	3			
Other	Conferences, market fairs, exhibits								0.441	0.857	0.857	Conferences, market fairs, exhibits								0.123	0.018	0.020
	Global superior	24	2.21	0.721	1.90	2.51	1	3				Proximity superior	24	2.29	0.690	2.00	2.58	1	3			
	Global inferior	24	2.17	0.868	1.80	2.53	0	3				Proximity inferior	28	1.86	0.591	1.63	2.09	1	3			
	Total	48	2.19	0.790	1.96	2.42	0	3				Total	52	2.06	0.669	1.87	2.24	1	3			
	Scientific, commercial and technical journals								0.284	1.000	1.000	Scientific, commercial and technical journals								0.852	0.106	0.114
	Global superior	24	1.96	0.624	1.69	2.22	1	3				Proximity superior	24	2.00	0.885	1.63	2.37	0	3			
	Global inferior	24	1.96	0.806	1.62	2.30	0	3				Proximity inferior	28	1.64	0.678	1.38	1.91	0	3			
	Total	48	1.96	0.713	1.75	2.17	0	3				Total	52	1.81	0.793	1.59	2.03	0	3			
	Industrial associations and chambers								0.226	0.716	0.716	Industrial associations and chambers								0.681	0.837	0.838
	Global superior	24	1.63	0.647	1.35	1.90	1	3				Proximity superior	24	1.83	0.868	1.47	2.20	0	3			
	Global inferior	24	1.71	0.908	1.32	2.09	0	3				Proximity inferior	28	1.79	0.787	1.48	2.09	0	3			
	Total	48	1.67	0.781	1.44	1.89	0	3				Total	52	1.81	0.817	1.58	2.04	0	3			

Source: Authors' own data.