Knowledge and Innovation in MSE Companies in Transportation in Cascavel, Brazil

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DOI: 10.34190/EIE.20.023

Abstract: The micro and small enterprises (MSEs) have demonstrated fundamental importance for the functioning of all developed economies including BRICS countries like Brazil. According to OECD, they represented in 2016 close to 50% of all employment and 95% of the number of companies and they need higher investment in skills, innovation and tech to boost wages and productivity, (OECD, 2019). On this background we present a project where we analyze the innovation activities of 32 Micro and Small Enterprises (MSEs) in the logistics and transport sector in the city of Cascavel, Parana, Brazil, with special focus of the importance of knowledge transfer for the innovations. Cascavel is located on strategic place in Western Parana, an important Brazilian agribusiness region, in which logistics and transport sector has had key role in the competitiveness for trade. The empirical part of the project was based on data collection at two points in time – before and after an exchange of knowledge had taken place. This gave us the opportunity to study one of the key messages from the OECD – innovations need developments of skills – and we find that in most cases knowledge transfers has an effect on innovations via skill developments.

Keywords: innovations, knowledge transfers, micro and small enterprises, logistics, transportation

1. Introduction

We define Small and Medium sized Enterprises, or SMEs, as enterprises with up to 249 employees. We subsequently define Micro enterprises as firms with 1-9 employees and Small enterprises with 10-49 employees, forming the group we call MSEs. In 2016, SMEs accounted for 99% of all businesses and between 50% and 60% of value added in the OECD economic area, while the MSEs represented close to 50% of all employment and 95% of the number of all enterprises in the OECD area, OECD (2019). According to OECD, "MSEs are driving job growth, but need higher investment in skills, innovation and tech to boost wages and productivity.", OECD (2019, p. 5). Clearly, this group has demonstrated fundamental importance for the functioning of all developed economies including BRICS countries like Brazil.

In this project the aim is to study the relationships and linkages between knowledge and innovation in transportation sector and this raises several theoretical approaches. The first is that transport is a service sector and the innovation theory has to be adapted, considering that services (in the normal case) are produced and consumed at the same time. We will discuss the consequences of this further in the theory chapter. The second consideration is that innovations in transport are a multi-facetted feature. We have had a rapid and radical development in Information Technology Systems (ITS) in the transportation sector linked to the fundamental changes the Internet has brought like tracking systems and interactive maps. This has changed storage of goods for production from weeks to days/hours and thereby also reduced costs considerably.

The third consideration is about the technology and innovations of transportation vehicles, boats, planes and trains. The developments here are strongly influenced by environmental policies, plans and restrictions and we have seen innovative solutions here, like electric ferries transporting cars and people across fjords in Norway, that were inaccesible just a few years ago. The fourth consideration is the link between knowledge, technology, and innovations and here we have several examples revealing that new innovative initiatives and solutions demand higher skills and knowledge levels. It is mainly this perspective that is the focus of this article, but it is not possible to give a satisfactory treatment of this without being aware of the first three considerations.

To analyze innovation activities many methods and data collection procedures have been suggested. In this study we have considered different tools like the PINTEC (Brazilian's innovation research) questionnaire, the Berreyre model, and the Minnesota Innovation Survey methodology but chose The Innovation Radar because we found that the focus of this tool gave the best match to the innovations the companies emphasized. The

Innovation Radar also gave the most relevant framework for an analysis of links between knowledge transfers and innovations. The fundament of the project was based on data collection from two points in time – before and after an exchange of knowledge had taken place.

The research question in this article revolves around the analysis of how transfers of knowledge can influence innovations in the service sector by using transportation as the empirical case. The article will continue by looking at relevant theories of innovation and relationships to knowledge transfers. In the next part we will discuss different methodological procedures for operationalizing innovations and how to build our data into the model. The following section explores the results we find from the analyzed data and in the last section we give our final considerations and conclusions.

2. Theoretical background and literature review

Our way of looking at innovations starts, like most others, with Schumpeter (1934) and his ideas that (1) the development of the capitalist economy is based on a disequilibrium basis, (2) his definitions of innovations in five key elements where product, process and market innovations are the most important, and (3) the idea that "creative destruction" is the fundament for economic change. Schumpeter is looked at as contributing mainly to industrial innovative theory, but we must be aware that in his book "The Theory of Economic Development", Schumpeter (1934) he also spoke about innovations in the transport sector.

Schumpeter has been followed up by several writers like Freeman (1988) and Perez (1985) with emphasis on the importance of the endogenous nature of the innovative process. They underline the importance of the firm to develop their routines, not only in their company, but also in accordance with market structures, institutions and regions/nations.

Penrose (1959) and Nelson and Winter (2005) address the resource base and evolutionary logic as necessary to explain innovations in the capitalist economy. Dosi (1982, 1984) develops this further by emphasizing the learning process and the ability of the company to transfer knowledge as a part of the innovation process. Later developments, Westeren et al. (2018) show that an important part of the knowledge of the company is tacit and social, influenced by competitors, knowledge institutions and technological economic developments.

The study of innovations in the service sector increased in strength in the 1990's with founding work by Barras (1986), and Gallouj and Weistein (1997) , among others, introduced the concept of the "Reverse Product Cycle" as a characteristic innovation in services based on the observation that developments in services first started with improved efficiency, then improved quality and then new services based on innovative initiatives. Another approach was based on the fact that service production takes place in subsectors with very different production structures and market conditions. Physical services like transport, retail trade and hotels and restaurants have relatively low qualifications of labor, but we have seen large innovations based on advanced utilization of IT like in e. g. transport, which is the focus of this article. Another large group is called human services, where we have the health and social activities of both public and private sectors, education and research, the FIRE sectors (finance, insurance and real estate) and KIBS (knowledge intensive business services). It is often argued from a more systemic point of view that human services as an innovator itself and as an aide to innovations elsewhere, is one fundament for productivity of countries. The service part of Information technology; IT, is often singled out as a group of its own in the service sector, see Fagerberg, Mowery and Nelson (2005) and Hipp and Grupp (2005) but the success of most innovative actions in the service activities mentioned above is based on a productive integration from the IT services.

Service innovations come in a large variety because of great dispersion in products and processes and because service activities are to a large extent integrated with several other service and/or manufacturing activities. One fundamental characteristics of service production is that production and consumption take place within the same time frame. This means that the process and the product are linked together – the restaurant experience starts when you come inside the room, enjoy the smell from the grill, and see the bridge of sighs (in Venice) through the window. This example illustrates that innovations in services often are complex and evaluated (at least partly) through human experiences. In this project we deal with transportation which has a quite well-defined outcome, but innovations in transportation are often motivated to be productive for customers. Several writers like Djellal et al. (2003), Drejer (2004), Gallouj and Weinstein (1997) and Jensen and Westeren (2012) discuss how to establish a system of criteria to decide when an innovation can be defined as completed.

3. Road transportation and possibilities for innovations in Brazil

According to the National Transport Confederation in Brazil, CNT (2017), the distribution of total Brazilian cargo transport by method is roadways: 61.1%, railways: 21.2%, water transport: 13.1%, and air transport with 0.40%. The Brazilian economy is heavily dependent on processing of raw materials so an efficient transport system to secure supply chains is vital to the functioning of the Brazilian economy, IPEA (2016).

The transport services take place through both the companies' own fleet of transport operations and the contracting of carrier services which the logistics managers of the firms combine to reduce costs. The developments later years have favored the entry into the market of independent companies with specialized transport services, Bowersox, Closs and Cooper (2007) and IPEA (2016).

The need for innovation is present in several areas of transport companies and logistics operators. There are several activities capable of influencing the competitiveness of segments, such as the provision of services, organizational processes, marketing and market actions and supply chain. Actions include tasks for optimizing storage, separation, movement, and transportation operations. These innovations can be technological, linked to software and information technology, or simple tools for control and management (Ribeiro and Freitas, 2011).

The main innovations acquired or realized by service provider companies are related to warehouse management (production structure), transport management (types of services offered, fleet, freight, routes), planning of business resources (financial, human, quality, sales), inventory management, customer service, project/solution development and process control (Martins et al., 2011; Ribeiro and Freitas, 2011).

4. Methods to measure innovations

According to Fagerberg et al. (2007) and Westeren (2012) we have a debate on how the innovation concept shall be interpreted which again gives rise to discussions about how we generate methods for an evaluation of innovations in firms. We find a starting point for a definition of innovation in the Oslo Manual published by the OECD, which has been updated several times and the latest version now is OECD (2018).

The data collection in this work is based on Arroniz, Wolcott and Sawhney (2006) and is called The Innovation Radar. Its main feature is the idea of visualizing business innovation in defined dimensions. The tool's objective is to direct innovation actions in companies in order to reduce the waste of good business opportunities. Innovation Radar considered discussions with managers about fundamental efforts to maintain a cycle of innovation generation in these companies Arroniz, Wolcott and Sawhney (2006).

The Innovation Radar is an assessment tool for business innovations suitable for measuring the degree of innovation in small companies and is discussed and used in many connections, see e. g. Bachmann and Destefani (2008), Garcia (2008), Carvalho, et al. (2015) and Claudino (2015). According to Arroniz, Wolcott and Sawhney (2006) the innovation can be seen in 12 dimensions which correspond to four primary axes. Our model is extended with one more dimension:

<u>Definition of dimension:</u>
Offerings: Develop innovative new products or services.
Platform: Use common components or building blocks to create derivative offerings.
Solutions: Create integrated and customized offerings that solve end-to-end customer problems.
Customers: Discover unmet customer needs or identify underserved customer segments.
Customer Experience: Redesign customer interactions across all touch points and all moments of contact.
Value Capture: Redefine how company gets paid or create innovative new revenue streams.
Processes: Redesign core operating processes to improve efficiency and effectiveness.
Organization: Change form, function or activity scope of the firm.
Supply Chain: Think differently about sourcing and fulfillment.
Presence: Create new distribution channels or innovative points of presence, including the places where offerings can be bought or used by customers.
Networking: Create network-centric intelligent and integrated offerings.
Brand: Leverage a brand into new domains.
Innovative Ambience: The support received in the generation of business innovations.

5. Data collection and analysis

5.1 Introduction

This transportation sector is, in general, of great importance for the functioning of economic activities, in Brazil the transport segment accounted for 4.2% of GDP in 2015 with approximately 60% of cargo handling carried out by land routes (IPEA, 2017). Cascavel has a geographical position that stimulates entrepreneurship in the transportation sector. The city is located in the western region of the state of Paraná, in a roadway nucleus where the supply of grain and other agricultural products flows to the states of Santa Catarina, São Paulo, Mato Grosso do Sul and Mato Grosso, as well as to important coastal ports like Curitiba, and to other countries such as Paraguay and Argentina. This situation requires a continuous demand for trucks and services related to it. In 2017 the truck fleet associated with Cascavel numbered 8,130 vehicles, representing approximately 25% of the fleet in western Paraná (Schulze, 2013; IPARDES, 2018).

Logistics operators have great incentive for reducing transportation costs, as they generate economies of scale by sharing their capabilities and resources with multiple customers. However, this sector has challenges to innovation due to specific characteristics, such as low technology use and reduced range of services (Ribeiro and Ferreira, 2002).

Given the importance of the situation for regional development, this project will be focused on the development of innovative efforts by MSEs in the transport sector of the city of Cascavel-PR. The research question that forms the basis for data collection and analysis is:

What is the relevance of the transfer of knowledge in the generation of innovation in MSEs in the transport sector?

The choice of the transport sector for the study is centered around the hypothesis that SMEs have difficulties in absorbing knowledge and practicing it in business routines thereby hampering changes of routines that can be developed into innovations.

The research question can be divided in the following way:

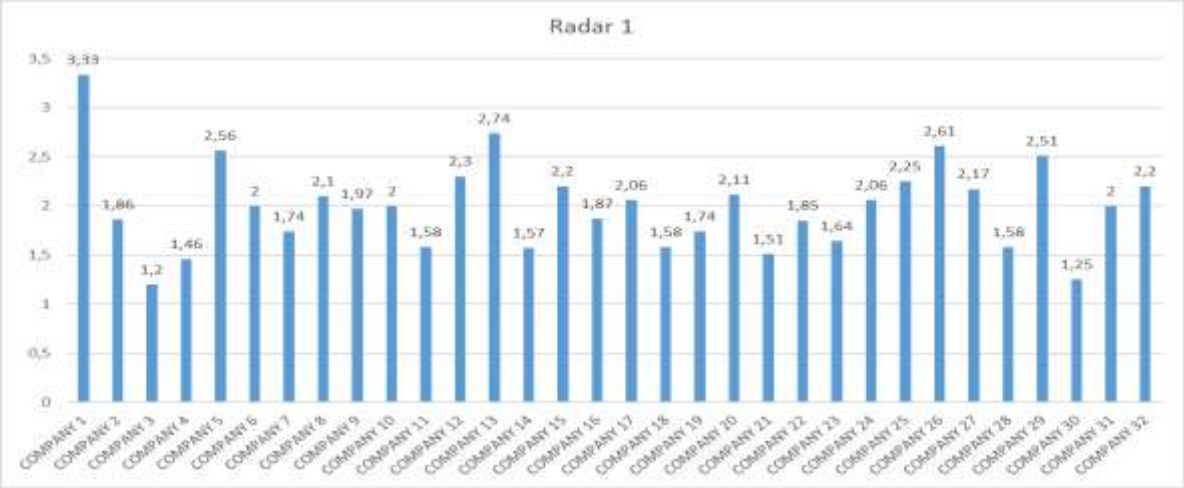
- 1. What characterizes the innovative situation in a select number of participating MSEs before a process of knowledge transfers takes place?
- 2. How can we identify knowledge transfers within these firms?
- 3. How can we analyze the alteration of the innovative situation after the transfer of knowledge has taken place and has this transfer of knowledge changed the innovative performance of the firms?
- 4. How can we explain possible variations in innovative behavior between the firms?

5.2 Data collection and analysis

According to IPARDES (2018) there were a total of 615 SME enterprises registered in the transport sector in Cascavel-PR in the research period from 2015 to 2017. The sample studied comprised 32 MSEs registered in this category selected because they were willing to participate in the research project and because they were participants of the Local Innovation Agents (ALI) program. The ALI program was created by Brazilian Micro and Small Business Support Service (SEBRAE) and National Council for Scientific and Technological Development (CNPq) and it was centered on knowledge transfer and incentives for companies to improve in innovations (SEBRAE/CNPq, 2013).

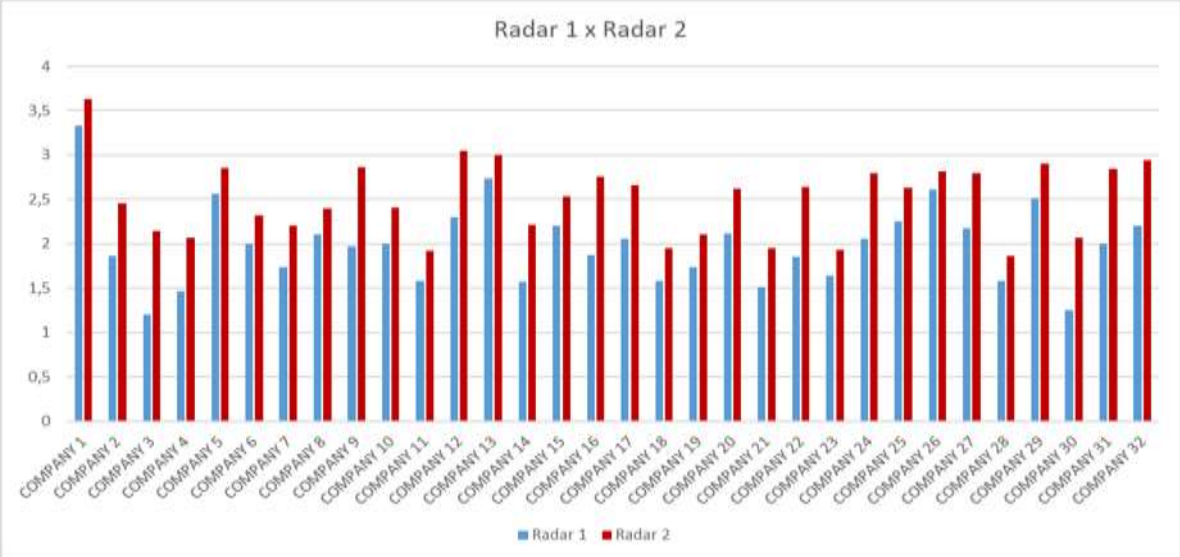
The ALI program conducted a measurement of the level of innovation of the company when entering the program in May 2015, reflected in the first data collection, R1. During the program period the companies were encouraged to innovate using knowledge transfers from competent professionals as a part of the program. The firms' actions were monitored monthly by the program. After the period of implementation of knowledge transfers for improvements and innovations the companies did a second diagnosis in June 2016, measuring their developments, reflected in the second data collection, R2,. The 32 companies carried out 222 innovation actions between R1 and R2 covering all dimensions of the Innovation Radar. Figure 1 shows an overview of the distribution and frequency of activities.

In general, it is expected that the larger number of tasks performed during the transfer of knowledge, the larger possibility of implementing innovations. The measurement of innovation of the companies is done by using the Innovation Radar tool as earlier explained. Each dimension is given a score between one and five, five being the maximum degree of innovation that the company can achieve (Bachmann and Destefani, 2008) measured between the points of time R1 and R2. A paired Wilcoxon test was performed in order to analyze whether the transfer of knowledge had effect on innovations. The innovation scores at R1, Radar 1, is shown in Figure 1, and a comparison of the results from R1 to R2 (Radar 2) is shown in Figure 2. Figure 3 shows the innovative behavior of companies by dimensions of The Innovation Radar.



Source: Research data from the project.

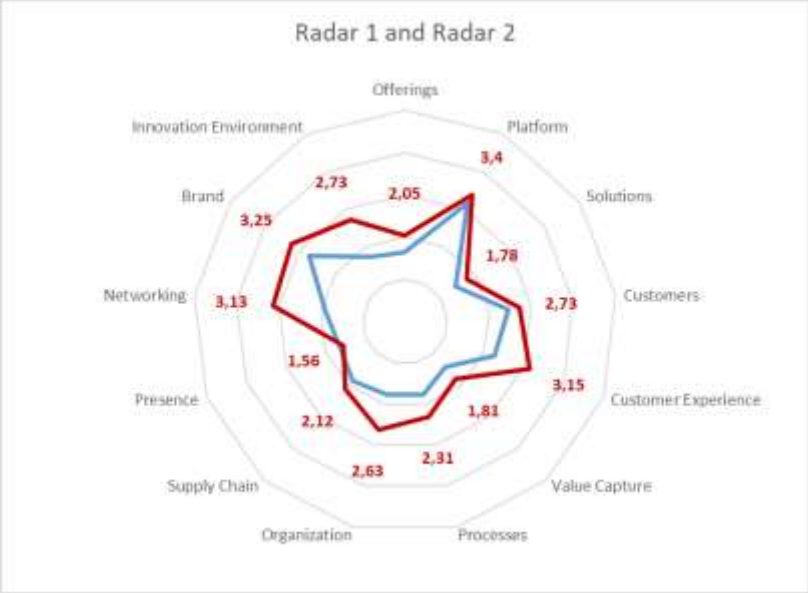
Figure 1: Results of the innovative situation of the companies at the start of the project R1



Source: Research data from the project.

Figure 2: Comparing the results of the innovative situation of the companies from R1 (May 2015) to R2 (June 2016)

The results are in line with Silva, Menezes Filho and Komatsu (2016) and show that the transport sector part of the services sector is not very innovative. Barbosa and Sousa (2011) consider that transport companies need to increase the degree of both internal competitiveness and external elements to innovate. Considering that a large percentage of the Brazilian fleet is owned by self-employed individuals with their own vehicles, this partly explains the low degree of innovation. Based on Figure 2 we observe that the transfer of knowledge has influenced the degree of innovation in all companies. However, it is important to highlight the differences, some firms are more impacted than others, indicating that the transfer of knowledge and the implementation of innovations are not homogeneous.



Source: Research data from the project.

Figure 3: Innovative behavior of companies by dimension of the Innovation Radar from R1 to R2

Positive changes occurred in almost all dimensions, see Figure 3. The exception was **Presence** which indicates that the companies did not create any new distribution channels or find new distribution places where offerings could be bought or used by customers. Also, the **Platform** dimension changed very little from R1 to R2. This means that the firms to a very small degree used common components or building blocks to create derivative offerings.

Table 1: Results of innovative behavior of the companies from R1 to R2

Dimension	Radar 1	Radar 2	Absolute change	Change in %
Offer	1,64	2,05	0,41	25,00
Platform	3,18	3,4	0,22	6,91
Solutions	1,46	1,78	0,32	21,91
Customers	2,45	2,73	0,28	11,42
Customer experience	2,25	3,15	0,90	40,00
Value capture	1,43	1,81	0,38	26,57
Processes	1,77	2,31	0,54	30,50
Organization	1,78	2,63	0,85	47,75
Supply chain	1,87	2,12	0,25	13,36
Presence	1,65	1,56	-0,09	-5,40
Network	1,88	3,13	1,25	66,48
Brand	2,75	3,25	0,5	18,18
Innovative Ambience	1,74	2,73	0,99	56,89
Global Innovation Degree (GID)	1,98	2,50	0,52	26,26

Source: Research data from the project.

Table 1 shows the variation of the degree of innovation between Radar 1 and Radar 2 and the changes were large in several dimensions. 7 dimensions had a variation of more than 25%. This also reinforces the notion of low innovative potential before the transfer of knowledge. The Global Innovation Degree (GID), representing

the average of all dimensions, gives an absolute value of 2,50 and a change of 26,26%. In the literature about the Innovation Radar, Arroniz, Wolcott and Sawhney (2006) an average score of 3,0 is viewed as the level to characterize systemic innovation. Even though the change in percent from R1 to R2 is quite high, the situation for the group as a whole is still quite low in terms of innovative potential.

Table 2: Results from Wilcoxon test (Z Value) about variation of the degree of innovation between Radar 1 and Radar 2

Dimension	Z Value	Prob. Statistics	Significance
Offer	-3,310	0,0009	*
Platform	-1,710	0,0870	**
Solutions	-2,820	0,0048	*
Customers	-2,200	0,0200	*
Customer experience	-4,370	< 0,0001	*
Value capture	-2,470	0,0130	*
Processes	-4,180	< 0,0001	*
Organization	-4,560	< 0,0001	*
Supply chain	-2,000	0,0450	*
Presence	0,099	0,9211	**
Network	-3,640	0,0003	*
Brand	-2,920	0,0035	*
Innovative Ambience	-4,930	< 0.0001	*

*: Z value significant on 5% level (or better) **: Z value not significant on 5% level.

We chose a (non-parametric) Wilcoxon test to analyze dimensional averages because then we do not need to make any assumptions about the distributions of the results for the dimensions. Table 2 shows that we have significant results for 11 of 13 dimensions. This indicates that the ALI program to a reasonable degree fulfilled its objective to significantly improve the innovative activities of the companies from R1 to R2.

Regarding the dimension **Offererings** (Develop innovative new products or services), a study conducted by Barbosa and Sousa (2011) for 400 small transport companies showed that these companies do not feel encouraged to create transports that contribute to the diversification of services. For the **Customers** dimension (Discover unmet customer needs or identify underserved customer segments) the results converge with the analyses of Martins et al. (2011) and Barbosa and Souza (2011) who argue that transport companies prioritize the fields that generate greater satisfaction for consumers. With regard to the **Process** dimension the results are consistent with the fact that innovation in the service sector is closely associated with process innovation (Gallouj and Weinstein, 1997; Djellal and Gallouj, 2005; Lubeck et al., 2012). For the **Presence** dimension we observed that the transfer of knowledge did not influence the indexes of innovation yet the opposite was found for **Network** and **Brand**. The result for the **Presence** dimension was expected because this was the only dimension where the innovation index fell after the transfer of knowledge. This may be related to stable points of sale and the recession of the Paraná economy and the transportation sector specifically during the research period. For the dimension **Innovative Ambience** (The support received in the generation of business innovations), it is likely that the transfer of knowledge contributed by the ALI program and the relative low cost of implementation stimulated innovations, see Stal, Nohara and Chagas (2014).

6. Conclusions and suggestions for further research

This project has analyzed the influence of knowledge transfer on the degree of innovation in a group of 32 MSEs in the transport sector in the city of Cascavel-PR. The presentation of R1 data showed low innovative behavior of companies, only one was classified as occasional innovator with an index above 3, all the others had a low innovative potential according to our classification system. In general, the transfer of knowledge increased the

index of innovation in all companies and in almost all dimensions. Based on the paired Wilcoxon test the transfer of knowledge was statistically significant for 11 of 13 dimensions.

Based on this work, it is concluded that it is valid for SMEs to seek knowledge and apply them in their business routines, and use this knowledge to change routines, which is a sound start for innovative actions. The project showed that the transfer of knowledge proved to be an effective way to increase the competitiveness of companies and create bases for supporting economic development. This also supports the view that an institutional apparatus is important in the innovative process of business development and this project contributed to the view that the objective of transferring knowledge in a concrete way can be achieved. Sometimes even the scarcity of innovations in small businesses is significant and quite simple and cheap activities can have a positive impact on the operation of the businesses and, consequently, on the market.

Continuous research is needed in this field – it is necessary to get a more detailed view on how the knowledge processes take place and how transfer of knowledge has both barriers and enablers inside firms, between firms and between firms and professional services providers. It is also therefore necessary to study larger samples of firms especially in the lower knowledge segments of the service sectors like transport, hotels and restaurants, and retail.

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