Challenges for Reaching Innovativeness in Lithuanian Low-Tech Sector: Case Study

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Abstract

The analysis of the scientific literature has revealed that low technology sector has wantonly been left aside in terms of technology adaptation and generated potential for innovation (Santamaria et al., 2009; Hirsch-Kreinsen, Hahn and Jacobson, 2008). Recent studies emphasise that there is a need to unify the standards of industry classification since the classification provided by the Organization for Economic Co-operation and Development (OECD) seems to be working improperly (Yin, 2011; Hirsch-Kreinsen, 2006). This discourse in the scientific level is a pretext to analyse the phenomenon of innovation in low-tech sector from the qualitative approach focusing on the challenges that this sector faces while implementing innovations. Considering the broad concept of innovation, many qualitative and quantitative aspects should be disclosed including the most cited innovation dimensions such as process innovation, product innovation, marketing innovation and organisational innovation.

The paper aims to explore the peculiarities of innovative activities in low technology sector focusing on the challenges that the companies face during the process of innovation implementation. Low-tech sector in this paper refers to the industrial companies that prefer the usage of traditional technology in the following three branches of manufacturing industry: wood, wood products and paper production; furniture production; textile and the wearing apparel production.

The results of the research suggest that the ability to solve the issues of innovation adaptation, to follow a new attitude towards production, to satisfy the dynamic demand and to reach higher productivity level may lead low-tech sector companies to a more innovative performance, and this way could enable them to gain competitive advantage over their rivals.

INTRODUCTION

Although it might sound paradoxical, there are many studies concerning the phenomenon of innovation in low-tech sector (Von Tunzelman, Acha, 2005; Hirsch-Kreinsen, Hahn and Jacobson, 2008; Santamaria et al., 2009; Heidenreich, 2009; Pridotkiene, Laskiene, Venckuviene, 2013). The analysis of the scientific literature has revealed that low-tech sector is an important catalyst of innovation in economics, although it is more related to the innovation of a technological process than that of a product (Von Tunzelman, Acha, 2005; Hirsch-Kreinsen, Hahn and Jacobson, 2008; Heidenreich, 2009). Hirsch-Kreinsen, Hahn and Jacobson (2008) argue that low and medium technology (hereinafter - LMT) sector is associated with productivity growth as well as generated capacity for innovation while others state that "regions with a high proportion of LMT industries have a lower gross domestic product" (Heidenreich, 2009). The nature of innovation in low-tech sector was analysed by Hirsch-Kreinsen, Hahn and Jacobson (2008), Santamaria et al. (2009), Heidenreich (2009). The discourse on the scientific level is a pretext to analyse the phenomena of innovation in low-tech sector from the qualitative approach focusing on the challenges that this sector faces while improving its innovation capacity. The research question is what are the challenges for innovativeness in low-tech sector companies?

Recent studies highlight the need to unify the standards of industry classification since the classification provided by OECD seems to be improperly adaptive (Yin, 2011; Hirsch-Kreinsen, 2006). On one hand, the indicator of R&D intensity (the ratio of investment in R&D and the output) has been substantiated in OECD classification. However, it does not represent the multifaceted nature of innovation. Specifically, it measures only a few aspects of innovativeness in particular companies. In addition, Yin (2011) contends

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that the indicator of R&D intensity does not provide any information about high-efficiency. Thus, he suggests considering a new criteria - "R&D investment, quality of the research and innovation of the products"(Yin, 2011). Roberts and Smith (2008) provide a critique for the classification of OECD manual innovation; they notice that it has concentrated on knowledge creation neglecting many other innovation activities which are inherent in the modern theory of innovation, i.e. learning as horizontal activity integrated in many fields in a company. Learning embeds firm-level processes by interacting with the surrounding environment, technology implementation, design improvement and other activities (Roberts and Smith, 2008). Roberts and Smith (2008) also state that the focus on the knowledge based on R&D investment neglects the fact that there are other sources of knowledge, and the second limitation occurs when too much effort is put into the knowledge creation ignoring the complexity of economics (Roberts and Smith, 2008).

Thus, the reviewed literature provides enough evidence for estimating innovation from the qualitative perspective. What is more, in order to classify the sectors into low, medium and high-tech, the broad concept of innovation should be considered.

The paper aims to explore the peculiarities of innovative activities in low technology sector focusing on the challenges that the companies face during the process of innovation implementation.

The methods used in the research include systematization and logical analysis of the scientific literature. The interview method was applied in order to collect the primary data for the case study. The data of the interview was analysed using the method of content analysis.

The results of the research suggest that the ability to solve the issues of innovation adaptation, to follow a new attitude towards production, to satisfy the dynamic demand and to achieve higher productivity level may lead low-tech sector companies to a more innovative performance, and this way could enable them to gain competitive advantage over their competitors.

The multifaceted nature of innovation shed a light on the need to reconsider the concept of low-tech sector while emphasising the aspect of technological intensity due to the importance of technology in the manufacturing process. It is obvious that the concept of innovation varies in terms of industries and firms. Thus, it is a complex phenomenon, and there is a need of complex instruments to account it in micro level.

The paper deals with innovation dimensionality in low-tech sector. The main challenges for the innovativeness of the companies operating in low-tech sector have been identified.

PECULIARITIES OF INNOVATIONS IN LOW-TECH SECTOR

The analysis of the scientific literature has revealed that low-tech sector should receive more attention from policy makers due to its ability to adapt technologies and generate potential for innovations (Santamaria et al., 2009; Hirsch-Kreinsen, Hahn and Jacobson, 2008). The debates in the scientific literature show that policy instruments have still been directed to the promotion of high-tech sector (Trippl, 2010).

The abundance of the research in the field of innovation in low-tech sector indicates the importance of the topic. For instance, the innovations in the U.S. furniture industry were analysed covering the following three dimensions: a product, production processes and company's culture (Barcic, Vlosky and Motik, 2011); German perspective was presented in several studies (Hirsch-Kreinsen, 2006; Kirner, Kinkel and Jaeger, 2009). The majority of the studies emphasize adaptation of technology in manufacturing process as the core advantage of low-tech. For example, Kirner, Kinkel and Jaeger (2009) emphasize the process of innovation as the advantage of low-tech sector. Still, product innovations are not typical of low-tech sector as they are in high-tech one. The findings made by Cox et al. (2002) confirmed the relation "between product innovation and high technology industries". Moreover, in terms of innovation implementation, high-tech industries focus on internal resources while low-tech sector is based on external resources especially with regard to process innovation (Cox et al., 2002; Heidenreich, 2009). Yet, Heidenreich (2009) states, that "regions with a high proportion of LMT industries have a lower gross domestic product".

The analysis of the scientific literature has enabled to distinguish the main features of low-tech and high-tech sectors (see Table 1).

Table 1. Distinctions between low-tech and high-tech sectors

Criterion	Low-tech	High-tech
Firm feature	Relatively mature companies	Relatively young companies
	Large proportion of workers are low-skilled	The biggest part of the required personnel are qualified engineers
Product feature	Standard products (distinction between the technologies used)	New/ improved products
Risk	Lower risk due to standard products	Higher risk and uncertainty due to product innovation
Technology functions	Using technologies	Creating and selling technologies
Market feature	Broad market	Narrow market
Competition criterion	Quality and price	Uniqueness

Source: *compiled by the author.*

Obviously, these features differ across branches and firms in both industries. However, some features are typical of the low-tech sector as a whole. According to Von Tunzelman and Acha (2005), maturity is the main feature distinguishing low-tech sector from high-tech one. The technological aspect of low-tech sector was emphasized by many researchers. For instance, Heidenreich (2009) named "a process, organisational and marketing innovations" as typical of this sector. It has been admitted that unlike in high-tech industries, low-tech industries have "weak internal innovation capabilities" (Heidenreich, 2009). Cox, Frenz, and Prevezer (2002) agree and contend that in terms of innovation process, low-tech sector differs from high-tech sector because it relies on external resources for innovation.

According to Von Tunzelman and Acha (2005), low-tech sector "may place less emphasis on technology functions and more on product/marketing functions" compared to high-tech sector companies.

Zen, Reichert Quimi Pufal and Zawislak (2012), who researched the changes in the low-tech sector companies in Brazil, revealed some interesting aspects: they contend that low-tech companies tend to innovate themselves by "optimizing their processes and commercializing their products" as well as improving their transactional capability, i.e. "developing new forms to communicate and provide services to their clients".

Low-tech sector is characterised by using technology in a process rather than selling it. Market conditions in this sector are also different than those in high-tech one. The market is broad; it embeds many competitors, the products are rather similar, and thus, competition much depends on the price and quality of the products (Von Tunzelman & Acha, 2005).

In their book, Tidd, Bessant and Pavitt (2001) distinguished five technological trajectories: 1) scale-intensive; 2) specialised suppliers; 3) science-based; 4) information-intensive; 5) supplier dominated. The latter is inherent in low-tech sector; the firms of this category exclusively depend on suppliers of machinery meaning that technologies typically originate from machinery industries (Tidd et al., 2001).

Trippl (2010) provides the analysis of low-tech sector innovation in the context of regional innovation system. From this perspective, low-tech sector is the core element in the regional innovation system interacting with other innovation partners, adding value to the supply chain of regional clusters and influencing high-tech sector performance. Some studies argue that low-tech sector can complement high-tech sector and, in the long term perspective, both of them can benefit (Robertson & Patel, 2007).

To sum up, it can be stated that low-tech sector's competitive advantage mainly depends on the technology that it adapts while making products because the competitive advantage enables to achieve higher productivity and cost efficiency. Thus, low-tech sector also plays a special role in economics. Its main function is a technology enabler, so the process of technology transfer is becoming increasingly important for this segment.

METHODOLOGY
The in-depth research strategy was chosen in order to reveal the innovation activities in Lithuanian low-tech sector companies as there is a shortage of statistical data on this phenomenon. The in-depth research perspective is common in social science, particularly in case studies while analysing the peculiarities of low-tech sector (Hirsch-Kreinsen, 2006; Roberts and Smith, 2008; Zen et al., 2012). Still, this method often earns some criticism considering the validity and robustness of the data in such kind of research.

In this paper, we focus on the identification of innovation activities and the challenges for innovativeness in Lithuanian low-tech sector. Specifically, the managers of some leading companies representing three Lithuanian manufacturing industries - textile and the wearing apparel; wood, wood products and paper; furniture – were interviewed. On the whole, 10 companies from the previously mentioned industries were selected for the research. The main criteria for the sample were as follows: rate of export, features of technology intensity and financial success.

The semi-structured interviews were organised with the top manager of each company. The structure of the interview embedded the core questions about the innovation activities, international competition and the threats rising for the competitive advantage from newly growing economic centres and factors. The qualitative content analysis was employed to analyse the data of the interviews.

Qualitative content analysis is a rather popular method for analysing the interview data. Coding of information is prime in the process of qualitative content analysis (Yin, 2009; Hsieh and Shannon, 2005; Mayring, 2000). In this research, coding was based on the categories withdrawn directly from the raw data in the interview protocols. Zhang and Wildemuth, (n.d.) distinct the following main features of qualitative content analysis (Zhang and Wildemuth, n.d.):
1. it has developed primarily in "anthropology, qualitative sociology, and psychology";
2. it aims to explore the meaning of text;
3. it focuses on "unique themes that illustrate the range of the meanings of the phenomenon rather than the statistical significance of the occurrence of particular texts or concepts".

RESULTS
The theoretical background of this research has revealed that innovation in low-tech sector is characterised by technological innovation, but still there is evidence that marketing, networking and product innovation are inherent in this sector as well.

The results of the case study were compiled with reference to the approach of qualitative content analysis. The aim of the qualitative research was to explore the challenges for innovativeness in low-tech companies in Lithuania. While analysing the data of the interviews, the main structure of the categories was disclosed (see Table 2).

In the context of the changes in political, economic and technological environment, low-tech sector companies face many obstacles for their innovative activities. Table 2 summarises the challenges for innovation in low-tech sector in Lithuania.

Analysing the data of the interviews, the first category - Innovation adaptation issues – was induced. It covers the constituents which are related to the personalities working in a company and their attitudes towards the changes in it. The ability to adapt innovations corresponding to the employees' interests in terms of changes of work places or systems is a core element for the efficiency of innovation adaption.

Table 2. The challenges for innovativeness in low-tech companies (extracted from the case study material)

Category	Sub-category (codes)
Innovation adaptation issues	*Unchanging employees' attitude towards the changes in a company*
	The process of changes in a company is difficult and slow
	Lack of good employees in every organisational level
	Lack of work culture
	Inappropriate attitude of managers towards the employees
New approach to production	*Efficient production*
	Being in front of other rivals

	Ability to understand customers' needs
	Respond to customers' needs
	Ability to accumulate knowledge
	Attitude towards formation of creativeness/innovativeness
	Learning from others
	Looking for know-how in communication
	Looking for know-how in production
	Looking for know-how in technology
Satisfaction of dynamic consumers' needs	*Producing a clean article*
	Producing a qualitative article
	Producing an ecological article
	Diminishing of allergens
	Satisfying hygiene norms
	Baby-product line
	Product presentations with reference to the convenience for buyers
	Solving the ergonomic problems
Patenting issues	*Complex test of patent purity*
	Requires much of time input
	Huge labour costs
	Unsophisticated product
	Reluctance to disclose information about the product
	Unclear benefits of patenting
Issues on productivity growth	*Old factory –old equipment*
	Large proportion of old workers
	Ability to produce quickly
	Standardization of production
Accounting for innovation	*Difficulties in accounting for innovation*
	Huge time costs
Innovation payback (return)	*The need for large orders to make large investments*
	Costly technologies
	Specific product needs for large investment
	Lack of investment efficiency
	Empowerment of possessed technology (commercialization)

New approach to production is the second category representing the challenges for increased innovativeness. The managers of the low-tech companies emphasised the persistent need for knowledge accumulation and learning process as the core elements of innovativeness. The category Satisfaction of dynamic consumers' needs represents the dynamics in the market and the demand for specific products in order to satisfy the customers' needs such as the ones for a clean qualitative, ecological article, diminishing of allergens, satisfying hygiene norms and others. Therefore, the competitive advantage of the companies is mostly dependent on the core element – how fast a company can react to fast changing customers' needs.

Patents are not inherent in low-tech companies, but still the category Patenting issues was extracted. Here the main arguments against patenting have been expounded (see Table 2). First of all, the majority of the products are unsophisticated and mainly standardized. Secondly, there is a complex test of patent purity, and the process itself requires much of time input and labour costs.

Issues on productivity growth is a category that is related to human resource aspects and current infrastructure level in a company which is directly associated to productivity. Thus, the ability to overcome the problem of an old factory - old equipment as well as the one of the old workers could have a positive effect on productivity growth. The ability to produce quickly and standardization of production are also essential for productivity growth.

Accounting for innovation is a challenge inherent in low-tech sector as well as other sectors The representatives of the low-tech companies find it difficult to identify the scope of innovation in their companies due to the heterogeneous innovation measurement system. The lack of a unified innovation measurement system causes misunderstandings among researchers and practitioners considering classification of the sectors in terms of their innovativeness.

Innovation payback (returns on investment) is another relevant problem inherent in low-tech sector companies since it is related to uncertainty and difficulty to forecast an expected return on innovation. It has been substantially documented that innovation requires large investment. Therefore, the guarantees for the return on innovation are necessary. The same problem arises when we consider a specific product as innovation, and manufacturing of this product raises production costs. Thus, the market share for production realisation must guarantee the returns in order to achieve the efficiency of investment. Moreover, the process of commercialisation is becoming increasingly important seeking for higher return on investment.

The interviews with the managers of the low-tech companies have revealed the significant categories related to the challenges for innovativeness in these companies. In order to become more innovative and gain the competitive advantage, low-tech sector companies have to reconsider the old organisational structure and reform the work culture and personnel attitude towards necessary changes. More specifically, companies have to find the ways to become more dynamic and respond to changing market needs. Although the results reflect only the features of low-tech sector, some of them could represent high-tech sector as well.

CONCLUSION/ DISCUSSION

The interviews with the top managers of the leading Lithuanian manufacturing companies have revealed that current typology of innovation can cause particular misunderstandings. More specifically, it is too narrow for measuring of innovation. The research results are in line with Heidenreich's (2009) findings presented above. The respondents note that the product and adaptation of new technologies earn the majority of effort. However, they still emphasise the need for the development and implementation of new solutions for marketing issues (like new brands or packages).

Moreover, the findings have revealed that seeking to become more innovative, low-tech sector companies have to overcome some obstacles, i.e. to develop the ability to solve the innovation adaptation issues, to implement new attitude towards production, to satisfy the dynamic demand and to reach higher productivity level. All this may lead low-tech companies to a more innovativeness performance, and this way could enable them to gain competitive advantage over their rivals.

In this research we note that the accounting for innovation and, specifically, the assigment of the investment to R&D are difficult to implement in practice. Moreover, although some qualitative measures of innovation performance are considered in the theoretical level, they can hardly be justified in practice. We argue that the low-tech sector companies are heterogeneous, so the estimation of their innovativeness following the narrow perspective (in terms of R&D intensity) is inappropriate.

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