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Sustainable Innovation Implementation in the Baltic Sea Region SMEs: Barriers and Incentives

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Small and medium sized enterprises (SMEs) play a major role in the economic growth and provide most of new jobs. At the same time SMEs pose serious environmental problems due to their large numbers and their cumulative effect. In this context, extensive application of sustainable innovations in SMEs becomes a priority task.

This paper presents results of the analysis of SMEs innovativeness in the Baltic Sea Region, main barriers and incentives for development and implementation of sustainable innovations.

Results of the Lithuanian and other national research studies in the Baltic Sea Region Countries conducted in the framework of the international project "Sustainable Production through Innovation in Small and Medium Sized Enterprises" (SPIN) (implemented in the framework of the Baltic Sea Region Programme 2007-2013) have been used as a main source of information in writing the paper.

Keywords: *Sustainable innovation, small and medium sized enterprise, sustainable development, sustainability performance.*

1. Introduction

The Baltic Sea Region (BSR) constitutes about 15 % of the European land area and 10 % of its population. BSR consists of 8 EU member states countries (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Sweden) and Russia (Filho 2002). The BSR is a highly heterogeneous area in economic, environmental and cultural terms, yet the countries concerned share many common resources and demonstrate considerable interdependence (Baltic Sea Region Programme 2007-2013). In these circumstances, the area could be a model of regional co-operation where new ideas and approaches can be tested and developed over time as best practice examples (COM 2009).

It can be emphasized that research in the area of sustainable development, including innovation process, focuses strongly on big enterprises (Laurinkevičiūtė, Stasiškienė 2010). However, the role of micro, small and medium sized enterprises (SMEs) in the context of sustainable development is very important, because they are a major source of entrepreneurial skills, innovation and employment. In EU countries, 23 million SMEs provide approximately 75 million jobs and represent 99% of all enterprises. Definition of SMEs varies in different countries, but in most cases it is based on a number of employees. According to the EU definition, enterprises with up to 10 employees are called micro enterprises, enterprises with up to 50 employees – small and up to 250 employees - medium (European Commission 2005).

According to OECD's Small and Medium Enterprise Outlook, SMEs account for 60-70 % of employment in most of OECD countries and contribute more than half the EU's GDP (OECD 2000). At the same time, all together they make a quite significant impact on the environment (DG ENTR 2004). The EU commission report estimates that SMEs taken together could be responsible for up to 70 % of all industrial pollution and has suggested that there is a correlation between an enterprise size and its environmental engagement: it is more likely that bigger enterprises pursue more proactive environmental policy than small ones (DG ENTR

2004). A report on SMEs and the environment produced for the European Commission by the ECOTEC Research and Consulting mentions that SMEs are estimated to generate as much as 60 % of commercial waste and 80 % of pollution incidents (Commission of the European Communities 2000).

To reduce an impact on the environment, SMEs have to take an opportunity to use their technological flexibility and knowledge to adapt their economic strategies to these new challenges for minimization of pollution (Holger et al. 2010). However, the research shows that most of SMEs suppose that their impact on the environment is minimal and often see no reason to engage in the environmental improvement (Bradford and Fraser 2008; Drake et al. 2004; Hillary 2000; Pimenova and van der Vorst 2004; Revell and Blackburn 2007; Tilley 1999). Often SMEs believe that national and local government should take a lead in environmental issues (Revell and Rutherfoord 2003) and that these issues are more important for bigger firms (Drake et al. 2004) – actually, environmental research and policy have initially focused on them.

The Kyoto Protocol industrial countries have established legally binding emission limits and at the same time require the enterprises concerned to use innovative, market mechanisms for reducing the costs of emissions. The enterprises developing sustainable innovations are becoming an engine of sustainable development enabling business to achieve a high level of productivity and the quality of life. According to Jakubavičius, traditional factors of production based on economic growth are necessarily brief, but high productivity can only be based on innovation and industrial activities (Jakubavičius et al. 2008). The European Union Research and Development Co-operation Programme EUREKA defines innovation as a process in which the knowledge obtained during the research is transformed into new or improved products or services. Primary objective of sustainable innovations is to improve environmental, social and economic performance of enterprises simultaneously. Sustainable innovation is a process where sustainability considerations (environmental, social, and financial) are integrated into company systems from idea generation through to R&D and commercialization (Charter and Clark 2007). This applies to products, services and technologies, as well as new business and organization models.

Structural model for enabling development and implementation of innovations leading to improved sustainability performance is presented in Figure 1. Generally, the level of development and implementation of sustainable innovations in enterprises largely depends on the framework conditions in which they operate. The framework conditions (external incentives) are needed to overcome internal barriers (e.g. economic, technical, those related to competence and capacity) for development and implementation of sustainable innovations (Parker et all 2009). External incentives could be categorized into two major categories: supply (push) and demand (pull). Supply instruments address propositional and prescriptive knowledge (e.g. information based policy instruments, financial support mechanisms), while demand instruments exert pressure on enterprises to improve sustainability performance (e.g. legal and economic policy instruments) (Ekins 2010). Different stakeholders have a role to play in creating the environment that would be seductive and supportive to enterprises for development and implementation of sustainable innovations (Steurer 2006). Co-operation between enterprises and research organizations is of particular importance in this regard.

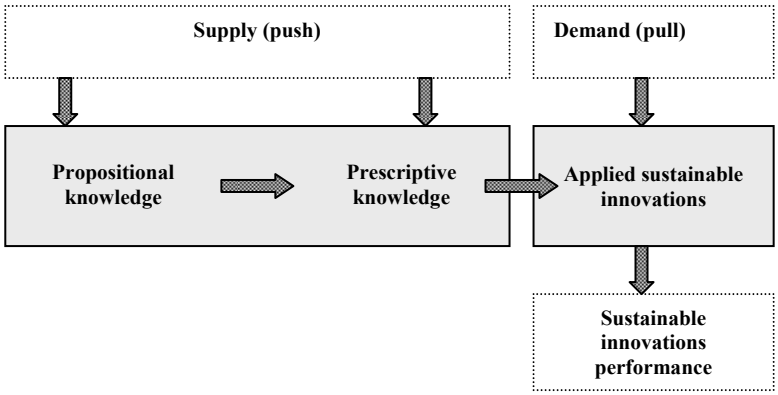

Fig.1. Structural model for enabling development and implementation of innovations

One of the projects implemented in the framework of the Baltic Sea Region Programme 2007-2013 is "Sustainable Production through Innovation in Small and Medium Sized Enterprises" (SPIN). This project brings together some of the most important institutions for sustainable innovations in the BSR and is supported by national governments, sector associations, research organizations and trans-national non-governmental organisations. The project is financed by the EU INTERREG programme. The Institute of Environmental Engineering, Kaunas University of Technology is Lithuanian partner organization in the project. The project aims to ensure an increase in exploitation of the innovation potential

in SMEs throughout the BSR, to enhance sustainable production processes in SMEs leading to the creation of public benefits and private profits whilst reducing economic and environmental costs. In the framework of this project, BSR countries participating in the project have conducted research studies to identify the key barriers and incentives for development and implementation of innovations in enterprises. Results of the country studies are analyzed and presented in this paper. Its objective is to identify main barriers and incentives for development and implementation of sustainable innovations in the BSR.

2. Analysis of SMEs sector innovativeness in the BSR

SMEs definition in BSR countries varies. In contrast to the EU definition, in Germany an enterprise with 250 – 500 employees is considered to be a SME. In Denmark and Estonia, SMEs are enterprises with up to 100 employees. Finland, Lithuania, Poland and Sweden use the EU definition. This should be taken into account when interpreting innovation indicators in different countries.

SMEs constitute the biggest part of all enterprises in the BSR countries. In Finland and Sweden, SMEs constitute 99.8 %, in Germany – 99.5 %, in Lithuania 99.3 % of the total number of enterprises. Analysis of distribution of SMEs in terms of the employees' number shows that micro enterprises constitute from 76 % to 97 % of all SMEs (Table 1).

Table 1. Distribution SMEs according to the size in BSR countries

Number of employees:	Denmark	Estonia	Germany	Sweden	Lithuania	Finland	Poland
1-9 Micro	111.481 (81.3 %)	41.713 (83.9 %)	3250.928 (91.8 %)	493.601 (94.4 %)	47.683 (75.5 %)	317.855 (99.2 %)	1713.149 (96,6 %)
10-49 Small	21.004 (15.3 %)	6.529 (13.1 %)	237.636 (6.7 %)	4.880 (4.8 %)	12.657 (20 %)		45.184 (2.5 %)
50-249 Medium	4.651 (3.4 %)	1.489 (3 %)	51.383 (1.5 %)	4.414 (0.8 %)	2.847 (4.5 %)	2.441 (0.8 %)	15.452 (0.9 %)
Total	137.136 (100 %)	49.731 (100 %)	3539.947 (100 %)	502.895 (100 %)	63.187 (100 %)	320.296 (100 %)	1773.785 (100 %)

Source: Statistics Departments of the BSR countries.

Micro enterprises are dominant in the BSR countries followed by small enterprises. The number of big enterprises is generally small. For example, there are only 75 industrial enterprises with more than 250 employees in Estonia. Employment in SMEs accounts from 62 % to 74 % in the BSR countries. According to the statistics data, in Estonia 64 % of all people working in a private sector are employed by enterprises with less than 100 employees. In Finland, small enterprises employ 46.4 %, while medium enterprises employ 16.4 % employees. In Lithuania employment in SMEs accounts to 74 %, in Sweden – 63.2 %, in Germany – 60.4 %.

The SMEs' contribution to GDP is from 50% to 70 % (mostly in low technologies and services). In Polish SMEs, approximately 63.5 % of GDP is generated by micro companies. According to the data from the Lithuanian Statistics Department, the total value generated by SMEs (without financial intermediaries and agricultural companies) in 2004 – 2006 was 59 %.

Therefore, the role of SMEs in the context of sustainable development in the BSR region is very important. However, environmental sustainability awareness and competence in the SMEs sector is generally low. For example, a study in Poland showed that 68% of respondents believed that the impact of their activities on the environment was insignificant, 7% of respondents believed that their activities did not affect the environment at all. Results of the studies in other BSR countries confirm that many SMEs are not fully aware of the impact of their activities on the environment and this is one of the reasons for slow diffusion of sustainable innovations in the BSR region. Statistic data concerning innovation activity and co-operation of enterprises with other organizations in the BSR countries is presented in Figure 2. Data cover both industrial and service enterprises. Innovation activities concerned include product, process, organizational and marketing innovations. Innovation co-operation is defined as any partnerships of enterprises with other enterprises or non commercial institutions such as universities or public research institutes at both national and international levels.

The average figure for innovation implementation in SMEs in the BSR is approximately 30 %. Germany is a leading country in this regard as 80 % of enterprises in Germany are involved in innovation activities. Interestingly, co-operation of enterprises with other organizations in Germany is low. The highest recorded co-operation between enterprises and other organizations is in Denmark.

Research carried out in the BSR has revealed that bigger enterprises spend more financial resources on research and development mainly because SMEs have limited financial capacity and are more vulnerable to the risks associated with innovation

development. For example, more than 50 % of the big companies in Germany are already using technologies for recovery of kinetic and process energy, while only 20 % of the SMEs do the same. In Estonia, 43 % of small enterprises are innovative compared to 85 % of big companies and 64 % of medium-sized enterprises. In Lithuania, 40 % of SMEs are involved in innovation activities (Statistics Departments of Germany, Estonia and Lithuania). In Poland, big enterprises are also more often investing in riskier innovations such as the purchase of licenses, research and development or conduct their own research and development.

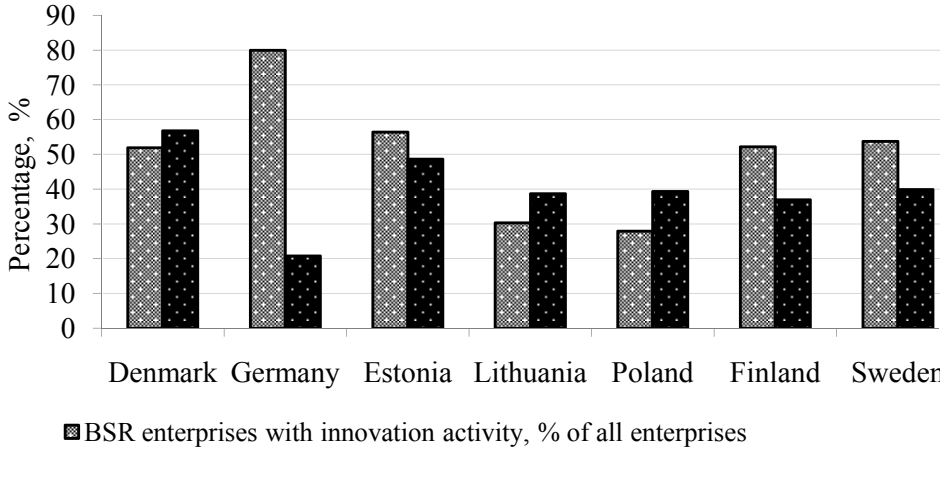

Fig. 2. BSR enterprises with innovation activity, and cooperation % in 2006- 2008
Source: Eurostat news release

3. Barriers to SMEs in the BSR

Theoretically, there is a big potential for improvement of sustainability performance in SMEs in the BSR. However, the process of sustainable innovation development and implementation is too slow due to a number of internal and external barriers in SMEs. Internal and external barriers identified in the BSR could be categorized under the following headings (Table 2):

- Financial;
- Awareness and competence;
- Business and market/ policy framework.

Access to capital is identified as the most important barrier for innovations development and implementation in the BSR countries. This includes limited financial capacity of SMEs and difficulties in securing external financing, e.g. loans from banks.

Despite the fact that a number of different financing programmes to support innovation implementation operate in the BSR countries (including the EU funded programmes) a number of shortcomings in these programmes restrict participation of SMEs in them. Complicated administrative procedures, limited support for innovation development (often financial support is provided exclusively for innovation implementation) and the fact that these programmes rarely include sustainability, or more specifically - environmental criteria, have been identified as main shortcomings.

One of the basic internal financial barriers that restricts investments for development and implementation of sustainable innovations is risk associated with innovations and fear, and then return to such investment might be long. The research has also shown that majority of SMEs fail in long-term planning. Generally, SMEs tend to focus on incremental innovations and organizational change, while involvement in research development is very limited.

Availability of sufficiently qualified human resources (limited capacity) is another important barrier. It is coupled with limited availability of information about sustainable innovations and their potential in improving economic, environmental and social performance of enterprises as well as scarce possibilities for SMEs to obtain necessary training and technical assistance. Moreover, research in the BSR countries shows that awareness/ competence of SMEs in the environmental area is limited. SMEs are generally neither motivated nor able to make decisions that would improve their environmental performance. Lack of competence in making business out of new technologies and, more generally, commercialization of innovations are also perceived as an obstacle in some countries. It is observed in several BSR countries that customers have la negligible impact on SME operations and products. Generally, life cycle thinking is not a case in SMEs yet. Limited multidisciplinary research and co-operation between SMEs and research organizations is another important barrier, because only joint efforts of business and science could lead to more intense innovation development.

Market and policy framework related barriers have different impact on development and implementation in different BSR countries.

Difficulties in the regulatory and administrative framework have been mentioned in German, Lithuanian and Polish studies. If reported at all, the degree of enforcement of legal requirements is often low. Many of the SMEs encounter problems in awareness and reassurance of compliance with regulations, especially with environmental legal requirements. Tax burden and bureaucracy have been identified as obstacles in Estonia, Finland and Lithuania, but this might also be a problem in other BSR countries. BSR countries have insufficiently taken an advantage as yet of the Green Public Procurement (GPP) potential. In many cases, public procurement supports not sustainable innovations, but rather the existing solutions.

Table 2. Identified barriers in SMEs of the BSR countries

	Financial	**Awareness and Competence**	**Business & market/ policy framework**
Denmark	Difficult financing of start-up; Lack of necessary capital for further sustainable innovation development.	Lack of human resources; Lack of knowledge building & dissemination; Lack of information and communication technologies.	Lack of resources; Sustainability has to be an issue when choosing subcontractors.
Estonia	Lack of finance for sustainable innovation development; Too high Innovation costs; Lack for venture capital; Lack of finance from external sources; Long pay-back time;	Lack of qualified personnel; Lack of information on technology; Lack of know-how and competence; Lack of innovative culture; Lack of co-operation partners for innovation.	Lack of information on markets; Lack of marketing experience; Lack of long-term strategies; High tax burden; Burdensome legislation and bureaucracy; Markets dominated by established companies.
Finland	Lack of innovative financing tools; Lack of support for commercialization and marketing of products or services.	Lack of skilled workers; Lack of customer feedback; Lack of international co-operation; Lack of competences in making business out of technology.	Lack of information on market, Lack of the development of inventions to products the marketing of innovations knowledge and foresight of environmental regulation and international contracts; Bureaucracy.
Germany	Lack of investment capital; Difficult access to loans and risk capital; Long pay-back time; Lack of financial resources for external know-how.	Lack of informational, technological and organizational competences.	Difficult regulatory, administrative framework; Lack of enforcement extensive permit procedures; Lack of standardized solutions.
Lithuania	Lack of financial resources for start up; Lack of financial support for capacity building; Lack of finance for sustainable innovation development.	Lack of human resources; Lack of competences in the environmental area; Lack of suitable training programmes; Lack of co-operation between enterprises and research organizations; Lack of information on sustainable innovations.	Difficult regulatory, administrative framework; Bureaucracy; Limited market pressure for sustainable innovations.
Poland	Lack of funding for R&D; Difficulties to get funding for further innovation development; Lack of public support.	Lack of strategic planning; Lack of innovative culture, Lack of competences in the environmental area; Lack of cooperation partners for sustainable innovation implementation; Lack of knowledge about available public support.	Limited demand for a new products; Difficult regulatory administrative framework.
Sweden	Lack of own capital Lack of internal and external sustainable innovation financing; Difficult to get loans; Lack of co-ordination between different programmes.	Lack of competence; Difficult to find the right way to contact research providers; Lack for better support to find right competences; Lack of co-operation; Lack of information about ongoing research.	Inadequate knowledge or relations between investments and benefits; Lack of standards; Public procurement today not supporting innovative solutions from SME, due to regulations and long term contracts.

Finally, business conditions for SMEs became worse in 2009 due to economic crisis. Insolvent customers and "optimization" of human resources in enterprises (reduction in personnel and exclusive focus on key functions) have certainly had a negative impact on development and implementation of sustainable innovations in SMEs.

4. Incentives for sustainable innovation development and implementation

There are a number of potential internal incentives for SMEs to develop and implement sustainable innovations:

- Cost reduction and increase in efficiency due to more efficient use of raw materials and energy;
- Improvement in productivity and product quality;
- Increased competitiveness and possibilities to expand markets;
- Increased motivation and qualifications of employees;
- Improved enterprise image;
- Preparedness for changes of environmental legal requirements;
- Improvement in work conditions and reduction in accidents.

Despite these benefits, SMEs are often reluctant to take actions due to a number of internal and external barriers existing in the BSR countries discussed in the previous section. Overall, overcoming barriers is a matter of several critical factors, including stronger external incentives to stimulate motivation and commitment of SMEs to develop and implement sustainable innovations; and sufficient technical and financial support from external stockholders to compensate lack of competence and capacity in SMEs.

The main external incentives identified in the BSR countries used to promote and support development and implementation of sustainable innovations are presented in Table 3.

Table 3. Main measures used to promote sustainable innovations in the BSR countries

Measures	Description
Financial	
Financial support to promote and support development and implementation of sustainable innovations	Measures include micro-credits, financial guaranties, risk capital funds, innovation vouchers to be used by SMEs to purchase research services from research organizations.
A system to finance development and implementation of sustainable innovations	A revolving facility providing soft loans for development and implementation of sustainable innovations in Lithuania
Environmental investment funds	Environmental investment funds should provide financing for sustainable innovations by inclusion of particular criteria for project applications.
Awareness and competence	
Awareness raising and demonstration measures, training programmes	Information exchange and dissemination of information on sustainable innovations; training programmes based on both theoretical and practical training and development of case studies.
Education in universities.	Educational courses at universities, post-graduate programmes related to sustainability management.
Business & market/ policy framework	
Enforcement of legal requirements	Periodic review of legal requirements, simplification of permitting, monitoring and reporting procedures, improvement of environmental inspections practices.
Economic policy instruments	Measures include public subsidies, tax reduction, green public procurement

To promote and support development/ implementation of sustainable innovations financial measures such as micro-credits, financial guaranties, risk capital funds have been used in the BSR countries. Unfortunately, information concerning effectiveness of the application of these measures is unavailable. One of the effective financial instruments that help increasing co-operation between SMEs and research organizations is use of innovation vouchers. The appeal of the innovation vouchers scheme is related to its simplicity and low administrative burden to both beneficiaries and administrators. The success of this scheme is linked to effective dissemination activities and provision of assistance to SMEs in using vouchers. To help SMEs identify the most appropriate financing sources, some countries established public consultancy services on existing research and development funding schemes.

One of the mechanisms that proved to be effective to promote development and implementation of sustainable innovations is a system for identifying preventive environmental innovations developed by the Institute of Environmental Engineering, Kaunas University of Technology in Lithuania. Financing of innovation implementation in the framework of this system has been ensured by a special revolving

facility to finance cleaner production investments in Lithuania, Latvia, Estonia and the Russian Federation, established by the Nordic Environment Finance Corporation (NEFCO) in 1998. The main objective of that facility was to provide soft loans for the implementation of high-priority investments with rapid payback that yielded environmental and economical benefits ("win-win projects"). The facility provided financing directly for a project and the loan was repaid by the company in accordance to the pay back period. 52 projects have been financed by NEFCO in the framework of this system. Reported average pay-back period of the implemented projects is approximately 3 years.

Some countries have established national environmental investment funds to finance certain environmental expenditures. There are several possible ways of financing such funds: a contribution from the general government budget or revenue from pollution charges. Such investment funds could be a good instrument to promote sustainable innovations, but unfortunately, with a few exceptions, these funds finance basically high cost end-of-pipe investments projects. A positive development was observed in Lithuanian Environmental Investment fund when pollution prevention priority was included for the investment projects.

To ensure information availability to SMEs in the BSR countries, different external stakeholders provide information on new technologies, potential for performance improvement, recommend financing possibilities, show best practice examples, assist in finding new partners and recommend specialized consultants. While projects demonstration could be effective in promoting sustainable innovations, to achieve desired objectives such projects should include more than a piece of equipment: hardware should be seen as a means, not an end in itself. Training programs are a particularly important capacity building activity. Short-term training programs promote development and implementation of sustainable innovations, communicate commercial benefits. Long-term training programs focused on particular sectors of industry or mixed industry groups usually include both theoretical and practical training. For education of future specialists, education models related to development of sustainable innovations are introduced in universities in some BSR countries. Some universities have established specialized post-graduate programmes (e.g. international M.Sc. Programme in Cleaner Production and Environmental Management developed by the Consortium of Technical Universities in the BSR (BALTECH).

In terms of policy framework, enforcement of legal requirements remains to be a key problem (disincentive) for sustainable innovations, particularly in new EU member countries. Periodic review of legal requirements, simplification of permitting, monitoring and reporting procedures, and improvement of environmental inspection practices have been used to improve the situation. Market-oriented incentives (tax schemes, tradable permits) in several BSR countries proved to be both effective and flexible measures to reach the targets set and support the uptake of sustainable innovations in the market. As an incentive to improve research and development and innovation in SMEs, the removal of taxes on R&D activities is considered in some BSR countries. To increase potential of green public procurement in promoting sustainable innovations, some countries offer the Internet portal and guidelines.

5. Conclusions and Recommendations

1. SMEs play a major role in the economic growth and provide most of new jobs. At the same time SMEs pose serious environmental problems due to their large numbers and their cumulative effect. To survive in the rapidly changing business environment, SMEs have to be flexible, dynamic and open. In this context, there is an evident need for more intensive development and implementation of sustainable innovations.
2. Theoretically, there is big potential for improvement of sustainability performance in SMEs in the BSR. However, the process of sustainable innovation development and implementation is too slow due to a number of internal and external barriers in SMEs (related to financing, competence and framework conditions).
3. Access to capital was identified as the most important barrier for innovations development and implementation in the BSR countries. Different financing programmes to support innovation implementation provide limited support for innovation development and rarely include sustainability criteria. Limited capacity is another important barrier for development and implementation of sustainable innovations in the BSR countries. This barrier is coupled with limited availability of information about sustainable innovations as well as scarce possibilities for SMEs to obtain necessary training and technical assistance. In terms of policy framework, difficulties in regulatory and administrative framework, weak enforcement of legal requirements, tax burden and bureaucracy have been identified as the main obstacles.
4. Overcoming barriers is a matter of several critical factors, including stronger external incentives to stimulate motivation and commitment of SMEs for sustainable innovation development and implementation; sufficient technical and financial support from external stockholders to compensate lack of competence and resources in SMEs; and effective flows of information from external stockholders.
5. To promote and support development/ implementation of sustainable innovations financial measures such as, micro-credits, financial guaranties, risk capital funds have been used in the BSR countries. One of the effective

financial instruments that help increasing co-operation between SMEs and research organizations is use of innovation vouchers. However, one of the most effective instruments is a system for identification, development and implementation of preventive environmental innovations that includes a revolving facility providing soft loans. In addition to information availability about sustainable innovations, both long-term and short-term training programs as well as relevant education courses and study programmes at universities are needed to ensure effective capacity building. Periodic review of legal requirements, simplification of permitting, monitoring and reporting procedures, and improvement of environmental inspection practices as well as effective tax schemes could also be considered.

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Darniųjų inovacijų diegimas Baltijos jūros regiono mažose ir vidutinėse įmonėse: kliūtys ir skatinantys veiksniai

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Mažos ir vidutinės įmonės (MVĮ) turi didelę įtaką ekonomikos augimui ir sukuria naujų darbo vietų. Tačiau kartu sukelia didelius taršos kiekius dėl to, kad šių įmonių yra gana daug ir didėja neigiamas poveikis aplinkai. Atsižvelgiant į šias aplinkosaugines problemas, svarbus uždavinys – plačiai taikyti darniąsias inovacijas MVĮ.

Straipsnyje yra pateikiami inovatyvumo analizės Baltijos jūros regione (BJR) rezultatai, nustatytos pagrindinės kliūtys ir skatinantys darniųjų inovacijų diegimą ir plėtrą veiksniai.

Straipsnio pagrindinis informacijos šaltinis yra Lietuvos ir kitų BJR šalių partnerių, dalyvaujančių tarptautiniame projekte „Darnios gamybos inovacijos mažų ir vidutinių įmonių plėtrai“ – SPIN, tyrimų studijos, atliktos remiantis šiuo projektu. SPIN projektas yra vienas iš Baltijos jūros regiono programos 2007–2013 m. vykdomų projektų.