

Energy Efficiency Development in Lithuanian Furniture Industry

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Abstract—The paper analyses the energy efficiency development challenges and possibilities in Lithuanian furniture industry. Due to the conditions of modern business, ambitious targets of the EU energy policies, changing environmental priorities, dependence on energy import and rising energy price, furniture manufacturing enterprises have to search for more efficient ways to reduce the amounts of energy consumption. There are various possible energy efficiency improvements including the changes in production process, investment in R&D, implementation of energy-saving technologies or energy management systems. This paper not only provides the theoretical analysis of the energy efficiency development in Lithuanian furniture industry, but also presents the findings of in-depth analysis of the statistical data and interviews with the managers and specialists of furniture manufacturing enterprises. The results of the study reveal the importance of managerial initiative to implement energy-saving technologies, environmental management strategies as well as energy efficiency policies while developing energy efficiency within furniture industry in Lithuania.

Index Terms—energy efficiency, furniture industry, energy policy instruments

I. INTRODUCTION

Lithuania, as well as the whole EU, faces rather significant problems determined by the increasing dependence on energy import, poor energetic resources or economic instability. The efficiency of energy consumption would appear to be a valuable measure for the solution of the problems mentioned above since it could contribute to economically efficient reduction of greenhouse gases and thus mitigate climatic changes. Transition to energy-efficient economics should also accelerate the development of innovative management and technology solutions and so increase industrial competitiveness while promoting economic growth.

These relevant issues gained response among different scientific fields. In the studies of industrial energy efficiency in different countries, the results of the research revealed that, in developed countries, industrial

improvements in energy efficiency are achieved mainly through the changes in energy prices and investment whereas in the industry of developing countries, energy efficiency performance is achieved through the changes in productivity and implementation of new technologies [1]-[2]. The scientific literature recognises technology as one of the main strategic resources in any enterprise, and technological strategy of an enterprise is considered to be a functional strategy, determining the position of the enterprise in respect with technological changes. The importance of technologies as the tool of strategic industry performance has been stressed by many scientists [3]-[5]. Energy efficiency studies emphasize the importance of both implementation of efficiency measures and dealing with individuals and industrial organizations that are the entities implementing the technology. Other industrial studies also highlight the importance of technology, economies of scale, energy efficiency-oriented policies and management strategies in energy efficiency improvement within the particular industry [6]-[8].

The issues of the environmental problems, objectives and perspectives emerging in Lithuanian manufacturing sector are analysed by Lithuanian authors [9]-[11]. Several studies examined energy efficiency development in furniture and wood industry, highlighting the rational use of energy and innovative technologies alongside with appropriate management strategies [12]-[14].

The main objective of this research is to evaluate the current situation and highlight the main challenges and opportunities of energy efficiency development in Lithuanian furniture industry.

The evaluation methodology included quantitative and qualitative research methods: the analysis of primary and secondary sources of information. The relevant and available primary and secondary sources of information related to the object were identified at the beginning of the evaluation, then important factual and contextual information associated with the management of socio-economic and industrial development alternation tendencies as well as national and foreign requirements for environment protection and energy consumption in the industry was collected. The information necessary for

the evaluation was obtained from the strategic documents, statistical data sources, interviews with the managers and specialists of furniture manufacturing enterprises, evaluations that were previously accomplished in the fields of environment protection and energy efficiency and other sources. The evaluation process consisted of the content, comparative and statistical analysis of the primary and secondary information.

II. ENERGY EFFICIENCY IN LITHUANIAN WOOD AND FURNITURE INDUSTRY

A. Situation Analysis of Lithuanian Furniture Industry

Since the entrance of Lithuania in the EU in 2004, the industry of chemicals, chemical products and fibres has become the most significant industry in the country. However, it is important to note that the results shown by wood and furniture industry are not less significant for overall Lithuanian economics considering the fact that it is one of the engines of manufacturing and makes a substantial part in the industrial structure. According to the classification of Lithuanian Statistics, Lithuanian wood manufacturing sector is divided into:

- Manufacture of wood and products of wood,
- Manufacture of furniture (wooden furniture, upholstered seats with wooden frames, furniture parts of wood, etc.),
- Manufacture of paper and paper products.

The revival of wood and furniture industry and its prospects to grow after the economic crisis has contributed to the improvement of the overall economic structure. At present, wood and furniture industry is the type of manufacture which more than others contribute to GDP growth in the country (Fig. 1).

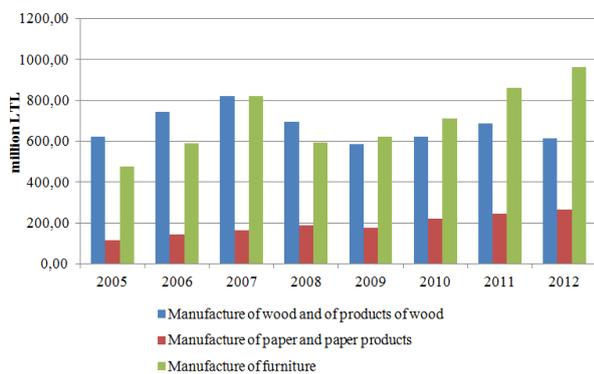


Figure 1. Gross value added by the wood manufacturing sector, LTL million (source: Statistics Lithuania)

The biggest part of the overall wood industry is taken by furniture manufacture growing since 2008. The growth of this industry has been determined by the increasing furniture export and creation of new furniture production companies. Among the numerous markets that drive the forestry-based sector, the furniture market stands out with a strong image worldwide due to its high level of technical and aesthetic quality [15].

In 2011, the share of wood and furniture manufacture made 11 % of the overall sold manufacture production in

Lithuania. Lithuanian furniture production manufacture is positively influenced by well-developed logistic infrastructure in the country. The qualitative road infrastructure integrated in trans-European nets allows the manufacturers to integrate in the EU and other countries' industry while dealing with international orders. It also ensures availability of raw materials in Eastern Europe and other countries.

Moreover, Lithuanian furniture manufacturers compete with both local and foreign companies since the majority of Lithuanian furniture is exported.

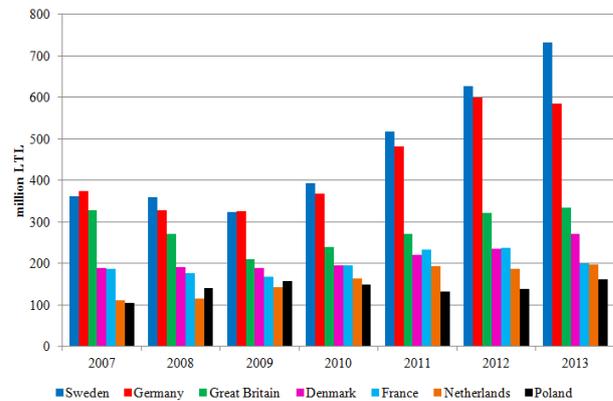


Figure 2. Major export destinations for Lithuanian furniture industry, LTL million (Source: statistics Lithuania)

As it can be seen in Fig. 2, the export of Lithuanian furniture has gradually been growing since 2009. Foreign demand recovery is linked with the global economic increase which has been observed since 2010. Such tendencies of export show Lithuanian competitive advantage and confirm the marketability of Lithuanian furniture in foreign countries. During all the researched period, the biggest part of the furniture was exported to the EU countries, namely Sweden and Germany, and since 2011, the export to these countries has increased even further. Before the beginning of the economic crisis, the biggest part of Lithuanian furniture was exported to Germany (nearly 375 million LTL in 2007); in 2009, the volumes of the export to Sweden and Germany were very similar, with export to Germany slightly (by 0.49 million LTL) exceeding the export to Sweden. Since 2010, the volumes of the export to Sweden have consistently grown and reached the leading positions. Such distribution of the countries by the volumes of the export has been determined by the activities of the largest Lithuanian furniture purchaser - Swedish concern IKEA. Thus, it is extremely important to evaluate the situation of Lithuanian furniture manufacturing companies in both global and regional context.

However, it should be noted that Lithuania has the advantage in international markets for its relatively cheap labour force as well as cheap local wood. As a result, little investment is made in other value chain components such as production capacity, quality and so forth. The products made by Lithuanian wood and furniture manufacture are often distributed to the final customer by the marketing channels managed by Western companies and trademarks such as IKEA, JYSK and others. This

way, the biggest part of Lithuanian wood and furniture manufacturers do not participate in the chains where the highest value added is created. Lithuanian furniture manufacturers focus on the needs of mass market and middle-class customers which means participation in fierce competition in international arenas and relatively low profit margins.

B. Energy Efficiency in Lithuanian Furniture Industry

In spite of being easily-managed, energy costs in energy non-intensive companies operating in furniture industry are often considered as fixed overheads. However, due to the constant growth of energy prices, furniture production companies face the need to use energy efficiently and practice innovative ways of energy management with a view to increasing their profits, which leads to restructuring towards lower energy intensity and higher value-added manufacturing. The shift to energy-efficient production should also accelerate the development of innovative technological solutions and increase industrial competitiveness while promoting economic growth. From the perspective of furniture manufacturing enterprises, the role of energy efficiency is significant as it leads to direct economic benefits, increased competitiveness and higher productivity.

In the EU, industrial energy intensity fell down by about 15% during the period of 2005-2012. However, a recovering economy requires more energy, especially for Lithuania whose economic structure and sectors bearing a high vulnerability to energy sources are predominant, i.e. the manufacturing industry.

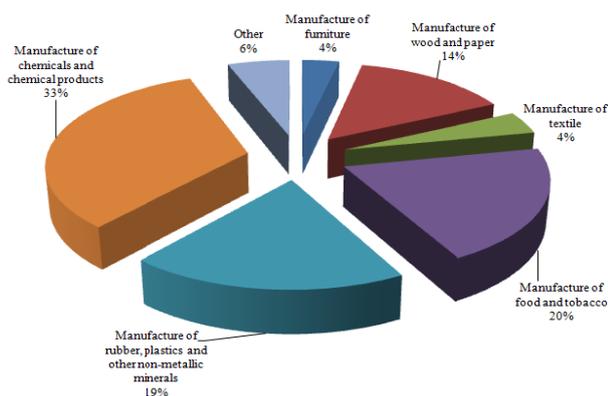


Figure 3. Total final energy consumption (TCF) in manufacturing sector in 2012, %. (source: Lithuanian Energy Institute report, 2013)

Wood and furniture industry is engaged in manufacturing and assembly of furniture parts alongside with appropriate finishing operations. Wood and wood-based materials are the main types of raw material used in this industry. Recently, business companies, manufacturers and building administrators show their increased interest in energy efficiency solutions and saving. In the furniture industry, the companies have made substantial investment in infrastructure and equipment: more than 50 per cent of wood and furniture companies use modern technologies in their activities. Efficient waste management technologies are wide-

spread in wood subsector while the use of modern technological equipment, computer-aided production planning and management systems as well as process automation technologies prevail in furniture production subsector. Increasing global competition requires more efficient strategies of investment in technologies linked with creation, development and implementation of new technologies. Evaluation of technological intensity by the industry and by the product is based on R&D intensity analysis. R&D intensity reveals the significance of scientific research on technological development, but other important characteristics of high technologies stay aside [16]. Summarizing, it can be stated that while attributing particular activities to the industry of high technologies, a complex evaluation should be carried out considering the researched factors and their comparability.

That is why revelation of the extra role of the government and industry in early stages of technologic development as well as creation of basic technical infrastructure (infra technologies and related standards) are extremely important components in the models of the growth of technology-based economics. Both technology platforms and infrastructure development require the new attitude towards the efficiency of resource distribution, especially when it concerns long-term processes since long-term global competition requires the specific and balanced resource distribution in each possible cycle of technological activity. Such measures can be applied only if public and private sectors collaborate in the spheres of technologies and the supporting infrastructure.

C. The Main Challenges of Energy Efficiency in Lithuanian Furniture Industry

Although furniture industry is one of the strongest industries with modern technologies and application of new software, it faces numerous challenges the main of which emphasized by the experts are as follows:

- Increasing export of raw material causing the utilization of smaller raw wood quantities in the national industry and the rise of raw material prices for local furniture production companies.

Lithuania has 830,000 hectares of state-owned forests, run by 42 companies. The government now proposes to set up a single forestry company, charged with managing the industry on a commercial basis. The absence of the systematic approach towards the interaction between wood and furniture sectors determined the paradoxical situation in Lithuanian wood sector: investors retreated due to the lack of raw material, and foresters could not sell the raw material due to high prices, especially during the period of economic recession. The lack of raw material has also been determined by the surplus of the number of sawmills in the market and invariable supply of raw wood during the periods of wood industry growth. Due to the lack of wood, which has been determined by the development of the equipment, the prices of raw wood are inevitably increasing. The main reasons of the increase are as follows: increasing competition between the stakeholders using wood as fuel and the manufacturers of pressed fuel and wood panels, inexpedient use of cutting waste and the development of chipboard

manufacture. In addition, recently wood prices went up every six months, and furniture manufacturers had no other alternative but to adapt to the new prices in order to complete their orders. With the emergence of the lack of raw material, furniture manufacturing companies pay higher costs, but they cannot increase furniture prices to avoid the decrease of competitiveness.

- Energetic vulnerability increasing due to rising prices of energy resources.

With insufficient own resources of primary energy, Lithuania's economy depends on the import of these resources (gas from a single supplier); thus, it is vulnerable, especially in the event of disruptions of supply or considerable fluctuations in prices. Looking at the period between 2008 and 2012, industrial electricity prices in EU Member State have gone up by about 3.5% per year, while industrial users in countries such as Estonia, Lithuania and Latvia have experienced annual growth of more than 8% [17].

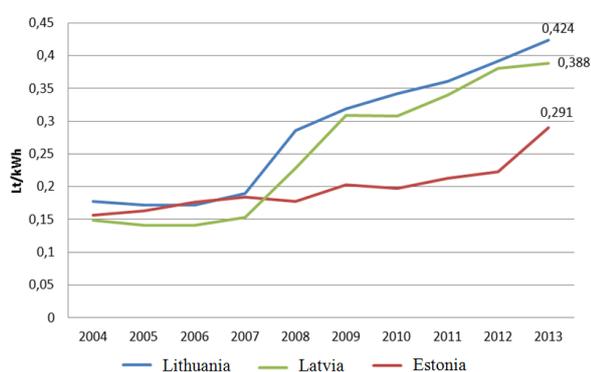


Figure 4. Retailing price of electricity for industrial consumers in Baltic States, 2004-2013, Lt/kWh without VAT. (sources: <https://www.energia.ee>, <https://www.lesto.lt>, <http://www.latvenergo.lv>)

An increase in energy demand is considerably influenced by the dynamics of the macroeconomic indicators (GDP growth, structure of branches of the economy, etc.), increasing fuel and energy prices, consumer response to rising income and increasing energy prices, energy efficiency enhancement and other factors. Increasing energy prices are causing challenges for both managers and shareholders; rising costs for fuel, electricity and thermal energy are eating into company profit and weakening such enterprises' competitiveness in international markets. What is more, both gas and electricity prices have significantly increased, so increasing volumes of production determine higher general and administrative costs.

- Lack of competent, skilled and motivated workers, the lack of production organization experts.

Lithuanian furniture industry employs around 24 thousands workers in 1.165 enterprises. It is a labour-intensive and dynamic industry, dominated by SMEs and micro firms. The ageing workforce combined with difficulties to attract young workers may lead to disruptions in maintaining a skilled workforce and continuity of traditions and craftsmanship. Furthermore, boosting research and innovation requires sufficient finance, which is often inaccessible to SMEs [18].

Assessing the human resources in this industry, it should be noted that the quality of the resources is medium or low. In addition, by particular aspects (e.g. the quality of managers and engineers' training), the situation in the industry is poorer than that in other industries or all over the country.

Implementation of advanced technologies and computer-operated equipment in furniture industry determines the need of skilled employees with higher education to perform technical, maintenance and management functions. Employees' skills to work with digital machines and maintain them, apply proper furniture finishing methods and complete sewing, cutting and modelling works for soft furniture production are required. Organization of work is also important, for instance, operative and cooperative work in groups is sometimes much more efficient; it significantly reduces the order completion time and improves exploitation of equipment. However, such organisation of work requires multi-skilling of employees, which make even bigger challenges for the enterprises.

- Increasing dependence on strategic actions of IKEA concern.

Swedish concern IKEA is planning a double expansion by 2020 which means that Lithuanian furniture companies will also need to increase the volumes of production since at present the concern buys 90-98% of Lithuanian furniture export. However, this determines a serious problem: the policy of the IKEA concern is making cheap furniture and prompting suppliers to reduce prices. That is why most companies are forced to produce furniture at the lowest costs; they cannot increase prices and accumulate the funds for modernization, new technologies and new furniture design.

As a furniture manufacturer, Lithuania is a promising country, but during the period of economic crisis, it produced labour-intensive production with low value added. It was because the value added created by a single worker was more than ten times lower than that in the countries leading in furniture manufacturing. It is considered that furniture transportation to other countries makes a significant part of prime costs. Thus, if the prime cost increased, Lithuanian furniture industry could lose the largest customer. Such companies as "Vilniaus baldai", "Freda", "Klaipedos baldai" and "Silutes baldai", which are the main furniture suppliers for IKEA, would experience the most significant loss. It can be stated that Lithuanian furniture companies are dependent on this concern, but the advantage is that event during the period of crisis, IKEA's sales were intensive. The experts of this field point out the following advantages that IKEA concern brings to Lithuanian furniture industry: increased productivity, lower costs, increased efficiency, optimized processes of production and management, investment in new technologies, increased personnel qualification and increased competitiveness [19].

IKEA has not only provided the economic stability to the Lithuanian enterprises, but also contributed to their level of technological and managerial knowledge (especially what concerns energy efficiency development

issues). Negative tendencies in respect of the IKEA concern are linked with the concentration of sales and the dependence. Thus, Lithuanian enterprises have to look for production diversification sources, create strong product lines and brands, gradually decreasing their dependence on large international customers.

- Stringency of the EU regulations on the impact the industrial companies make on environment and the requirements for the quality of products.

During the recent decade, the European Union has been dealing with the issues of global warming which has led to the implementation of numerous policy instruments such as the EU Emission Trading Scheme (ETS) and the European Energy End-Use Efficiency and Energy Services Directive (ESD) following which each member-state is obliged to formulate and design a National Energy Efficiency Action Plan (NEEAP). Implementing European Energy Efficiency Plan (COM(2011)0109), Kyoto Protocol concluded under United Nations Framework Convention on Climate Change (UNFCCC) and energy efficiency goals “20-20-20” for 2020, the European Commission and Council focus on the legal acts regulating the promotion of energy efficiency measures. The acts which are considered to be the most important to industrial companies are presented in Table I. In all these documents, mentioned above, implementation

of advantageous technologies in manufacturing enterprises for production, management and control improvement is named as one of the most important priorities [20]-[21]. Requirements of these directives are transferred in a short form into international and national European legislation. We have to admit that in Lithuania there are quite a lot of problems and gaps which are encountered during implementation of this legislation. The main reasons indicated in the literature sources are the lack of administrative competence and organizational resources.

A framework for assessing these barriers would need to go far beyond the analysis of financial support to energy research, but might include an assessment of institutional capacities, policies and measures and their use and interplay [23]. An integrated approach would also be needed due to the fact that technological innovation comprises of various distinct steps. However, the innovation process should not be understood as a linear process but rather as a cyclical process with various feedback loops between the different phases [7]. Through the application of new solutions in business, formation of waste and by-products in the production process can be minimized or such waste and by-products can be reused in the form of raw materials.

TABLE I. SUMMARY OF MAIN EUROPEAN COMMISSION DIRECTIVES ON ENERGY EFFICIENCY APPLIES IN INDUSTRY

| Directive code | Purpose | Description |
|------------------------------|--|---|
| <i>directive 2012/27/EU</i> | on energy efficiency | This document is treated as obligation to encourage investment in low-carbon dioxide technologies, especially in those industrial sectors which are characterized by high risk of carbon dioxide leakage; it requires to carry out energy consumption audits in the companies and to increase the part of cogeneration during production of heat, coolness and electricity. |
| <i>directive 2010/31/EU</i> | on the energy performance for buildings | Companies are obliged to set energy performance requirements for buildings while maintaining the balance of investment and saved energy costs during the whole building lifecycle; in addition, they are required to implement in buildings advanced measurement/management systems. |
| <i>directive 2010/30/EU</i> | on the indication by labelling and standard product information of the consumption of energy | Companies are obliged to label the products providing the information on the consumption of energy and other important resources; they have to change labelling classification considering technological advancement and energy saving opportunities. |
| <i>directive 2008/98/EU</i> | on waste and recycling | Companies are obliged to ensure the prevention of environmental pollution by applying the principles of electric and electronic equipment and natural waste prevention, management and safe recycling. |
| <i>directive 2009/125/EC</i> | on eco-design requirements for energy-related products | Companies are obliged to design their products accurately with a view to saving energy and reducing the negative impact on environment which, in turn, would form the conditions for cost saving for business entities and final consumers; eco-design integration in small and medium enterprises (SMEs) is also strongly promoted. |
| <i>directive 94/62/EC</i> | on packaging and packaging waste | Companies are obliged to reduce the quantities of all kinds of packaging and packaging waste by promoting packaging reuse, recycling and other forms of packaging waste utilization. |
| <i>directive 2008/1/EC</i> | concerning integrated pollution prevention and control | Companies are obliged to set the measures for the implementation of integrated pollution prevention and control; the strict procedures for pollution permits issuing and process coordination have been established. |

- Lack of working capital and increasing debts are the main barriers while making the decisions on the implementation of technological innovations in companies.

The significant part in the structure of Lithuanian furniture production industry is made by borrowed capital. During the last five years, it made more than 50%, but recently has decreased. It means that enterprises have more opportunities to finance their activities from their

own resources. During all the period, the authorized capital accounted the biggest share of the borrowed capital, but at the end of the period, its share decreased, although the volumes increased. Thus, Lithuanian furniture manufacturers issued more shares. During the period of 2010-2012, the part of equity grew up due to the increased retained earnings.

The growth of the sector is restricted by the underdeveloped capital market infrastructure and poor innovation infrastructure. The common problems are stuck in settlements and a vicious circle of debts. These problems are faced by the enterprises with credit obligations. Banks limit lending, and business companies' lack of working capital. Companies often need a bank loan not for investing in production, but for covering existing debts. On the other hand, different environmental initiatives such as eco-design, cleaner production, implementation of energy efficient technologies, environment management systems and so forth are supported by the government making the conditions to participate in various projects, this way attracting additional funds for activity development.

The main funds are intended for the financing of the projects of industrial enterprises: COSME - for promotion of corporate competitiveness, growth and entrepreneurship; Horizon 2020 - for the funding of scientific research and innovation; Lithuanian Environmental Protection Fund (LEPF) - for the projects of environmental protection, rational use of natural resources, climate change, waste management; the Program of Green Industry Innovation - for the projects of implementation of innovative environment protection technologies and creation of green products [23].

Summarizing the results of the analysis of energy efficiency development in Lithuanian furniture industry, it follows that the industrial activities are influenced by various internal and external factors such as increasing flows of products, human resources and overall management decisions; dynamic growth and increasing competition; emerging need for environmental information [24]. In the light of these factors, Lithuanian furniture industry has undergone significant changes - restructuring, technological advances and business model innovations, allowing it to be more export-oriented and focus on upgrading quality, design and innovation. Continuing investment in skills, design, creativity, research, innovation and new technologies can result in new products which are in line with the changing population structure, lifestyles and trends, as well as with new business models and supplier-consumer relationships. Improved energy efficiency may result in other benefits that outweigh the energy cost savings, including:

- Decreased business uncertainties and reduced exposure to fluctuating energy costs;
- Increased product quality and switch to higher added value market segments;
- Increased productivity;
- Reduced environmental compliance cost, e.g. greenhouse gases and criteria air pollutants [8].

Long-term prospects of Lithuanian furniture industry will depend on the volumes of investment, concentration level, price changes in the energy and labour market and the effective consumption of raw material and energy resources. A significant role here will be played by the politics of Lithuanian government in respect of wood and furniture industry.

III. CONCLUSIONS

The results from this study show that the main challenges for the energy efficiency development in Lithuanian furniture industry are: the shortage of raw wood and rise of its prices for the national furniture enterprises; the rising prices for energy resources; the lack of competent and multi-skilling employees; increasing dependence on actions of IKEA concern; strictness of the EU regulations; the lack of working capital and increasing debts.

Lithuanian furniture manufacturing enterprises have to search for more efficient ways to overcome these challenges, it can be sought through change the approach to business, industrial processes and energy efficient consumption, implementing the measures of sustainable industry development: improving production processes, projecting the products in accordance with the principles of cleaner production. The efficiency of energy consumption could contribute to economically efficient reduction of greenhouse gases and thus mitigate climatic changes. Moreover, the research in advanced manufacturing technologies can result in the creation of high technology and knowledge intensive jobs, which would provide the furniture industry with the attractiveness for new generations. This could help to rejuvenate the sector while keeping it highly competitive on the world stage. Lithuanian furniture manufacturers, being recognised world-wide for their quality and design, also create opportunities to further seize other markets, in particular, the high-end segments and emerging markets. The synergies with construction and tourism could also be exploited, building up on the sector's excellent track record in sustainability. Specifically, reliance on raw materials from sustainable sources used in furniture production could have a positive impact on sales among environmentally concerned end-users in global scale.

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