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PARTICIPATION OF MANUFACTURING FIRMS IN GLOBAL VALUE CHAINS AND ECO-INNOVATION PERFORMANCE: A CASE OF LITHUANIA

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Abstract. In recent decades, international trade relations have changed significantly due to faster development of logistics, global brands, redistribution of production, and regional specialization. The increasing number of challenges has been observed in global value chains due to rapid globalization. Manufacturing firms, embedded in global value chains, have been found to be not only key players in the market, but also the main polluters. Therefore, the firms, aiming to respond to these challenges are forced to look for more environmentally friendly alternatives. As a consequence, eco-innovation has been recognized as a key factor in preventing a negative impact on the environment. The article aims to disclose the participation of the Lithuanian manufacturing sector in global value chains and eco-innovation performance. For this study, we employ literature review and statistical analysis methods. The results reveal the extent of Lithuania's participation in global value chains and its long-term changes, as well as the eco-innovation performance in the context of the EU. The insights for policy makers and future research are elaborated.

Keywords*: global value chains, eco-innovation, eco-innovation performance, manufacturing sector, Lithuania.*

JEL Classification: M10, M16

INTRODUCTION

In recent decades, the economic drive to optimize costs and the rapid development of technologies have led to an increase in the internationalization of the manufacturing sector. Accordingly, the processes had a direct impact on the lengthening of product value chains. While value chains became global due to rapid globalization, the notion of global *value chains* (hereinafter – GVCs) emerged. Arguably, one of the major challenges is the negative impact of GVCs on the natural environment. Embedded in GVC, manufacturing firms have been found to be not only key market players, but also the main polluters (Meng et al., 2022). Therefore, the firms are forced to look for more environmentally friendly alternatives, such as eco-innovation (Ghosh & Shah, 2015). From the perspective of environmental management, eco-innovation is assumed to be a key factor, which prevent the negative impact on the environment (Stosic et al., 2016). Moreover, for small and open economies such as Lithuania, global competitiveness depends on the eco-innovation performance.

The economy of Lithuania depends on exports and thus, it is inevitable to foster export activities of manufacturing firms. The article aims to disclose the participation

of the Lithuanian manufacturing sector in global value chains and eco-innovation performance, in order to obtain a better understanding of the prevailing tendencies and to formulate suggestions for future investigations.

1. METHODS AND APPROACH

The study is based on the literature review and secondary data synthesis methods. Firstly, the literature review was used to determine the theoretical background on global value chains and eco-innovation performance, as well as the interrelationships between the two. The literature review is conducted considering the following major steps (Levy & Ellis, 2006): 1) literature gathering and screening; 2) data extraction and analysis; 3) writing the literature review. Secondly, the secondary data synthesis was used to investigate the extent of participation of the Lithuanian manufacturing sector in global value chains and Lithuania's eco-innovation performance. Secondary data analysis (published data or original data) is considered to be the analysis of any pre-existing data (Weston et al., 2019), i.e. any data that exist before researchers formulate their research hypothesis. For the secondary data analysis method, we follow four steps based on previous research (Cahyadi & Magda, 2021): 1) identification of the source of information; 2) collection of existing data; 3) normalization of the data; 4) data analysis. Secondary data are mainly gathered from sources such as Eurostat and Eco-Innovation Observatory. Furthermore, studies on Lithuania's export performance, conducted by *Innovation Agency Lithuania* and *Lithuanian Innovation Centre,* were taken into account.

This study is qualitative and descriptive and focuses on the review of the extent of participation of the Lithuanian manufacturing sector in GVCs and Lithuania's eco-innovation performance. The second section of this article presents the participation concept in GVCs, as well as the participation of the Lithuanian manufacturing sector in GVCs. The third section of this article is dedicated to the measurement of eco-innovation performance and the eco-innovation performance of Lithuania compared to the EU Members States. The final section concludes.

2. PARTICIPATION IN GLOBAL VALUE CHAINS

Rapid globalization and rising competition on a global scale motivates firms to rearrange their operations internationally through outsourcing various activities (Mačiulytė-Šniukienė & Sekhniashvili, 2021). In the last decades, the GVC approach, has emerged as a key tool for analyzing labor division between independent actors from different countries with a focus on GVC development trajectories, governance structure, and innovative activities (De Marchi et al., 2013). The GVC analysis framework, comprising different types of GVC governance, was suggested by Gereffi et al. (2005). The GVC is a cross-enterprise network organization where different stages of the product life cycle, such as research, development, design, logistics and trading, manufacturing, logistics, and marketing services, are spread across countries (Bi et al., 2015; De Marchi et al., 2013; Javorsek & Camacho, 2015). The GVC involves all activities that bring a product from its conception to the end use and beyond. Moreover these activities are conducted by firms in the home country or abroad (Gereffi & Fernandez-Stark, 2016; OECD, 2013). According to OECD (2013), the GVCs rely on the following fundamental features of current global economy: 1) the growing interconnectedness of economies, where GVC activities are spread across different countries; 2)the specialization of firms in tasks and business functions, where different

firms are specialize in the specific functions to fulfil their role in GVC; 3) the networks of global buyers and suppliers, where firms control and co-ordinate activities of buyers and suppliers; 4) new drivers of economic performance, where GVC rely on productivity and competitiveness.

Notably, the countries are not equally engaged in international trade and GVCs. For example, different countries participate in GVCs from the perspective of the user of foreign input and as the supplier of intermediate products or services to the exports of other countries (OECD, 2013). It is widely accepted that for small and open economies such as Lithuania, it is crucial to participate in GVS. The observations suggest that such economies as compared to large economies source more inputs from abroad and produce more inputs for use in GVCs (OECD, 2013).

Participation in GVC can be measured by observing the origins of value added in exports (OECD, 2017). The GVC participation index provides an estimate of "how much an economy is connected to GVCs for its production and foreign trade" (WTO, 2018). Simply put, there are two ways for separate economies to participate in GVCs; 1) backward participation in GVC, ii) forward participation in GVC (WTO, 2018). Backward participation in GVC refers to import of foreign goods and services for the purpose to produce goods and services, which are exported by countries. Meanwhile, forward participation in GVC refers to export of domestically produced goods or services to the third economies for further processing and export through supply chains (WTO, 2018). The forward participation is assumed to be the real contribution of exports to the country's GDP (Versli Lietuva, 2021). Figure 1 shows the decomposition of the value of the gross exports: i) domestic value added (hereinafter – DVA); and ii) foreign value added (hereinafter FV) (Javorsek & Camacho, 2015; OECD, 2017; WTO, 2018).

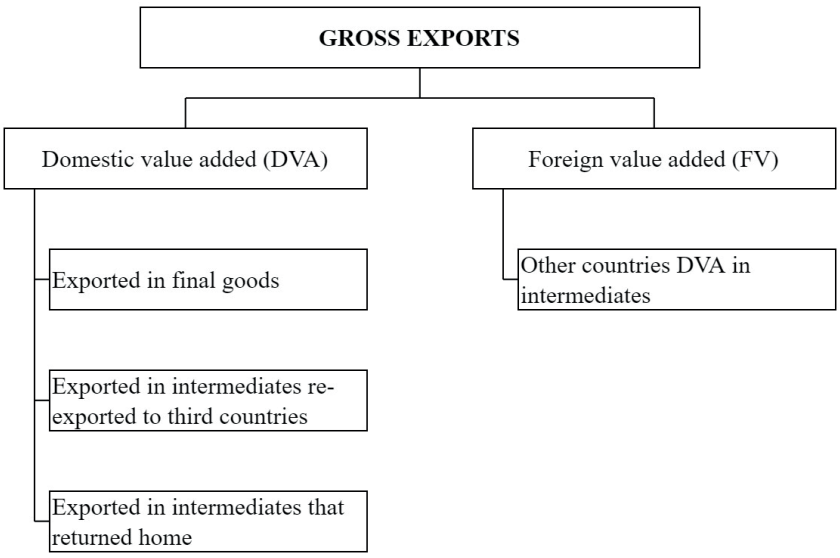

Fig. 1. The concept of gross exports value decomposition (created by the authors according to Javorsek & Camacho, 2015; Versli Lietuva, 2021; WTO, 2018).

The FV in exports shows the importance of imports for export performance and is usually referred to "backward GVC participation" or "vertical specialization" (OECD, 2017; WTO, 2018). The DVA in exports shows how industries within a country reach consumers abroad without direct trade relationships (OECD, 2017). The DVA can be decomposed into three elements: i) exports in final or intermediate goods or services; ii)

exports to third economies in intermediate goods or services exported to a partner economy that re-exports them to a third economy as embodied in other products (such an element is usually referred to "forward GVC participation"; and iii) exports intermediate goods or services that returned home. Such a round-trip highlights the DVA content contained in an economy's imports (WTO, 2018).

Notably, exports make up the majority of the country's GDP in the economic structure of Lithuania. According to observations in 2020 exports reached 74.1 % and by 27.3 % exceeded the EU average (48.8 %) (LIC, 2022). The studies revealed that in 2018 Lithuania's overall participation in the GVCs (both forward and backward) was above average with a participation index of 52 % (Versli Lietuva, 2021). Meanwhile, the OECD average was 28.3 %. Thus, in terms of participation in GVC, Lithuania in 2018 was 15th among 43 countries. In the long term, Lithuania has made great progress in increasing participation in GVCs (Versli Lietuva, 2021). Since 2005 (overall participation in GVCs 47.7 %) Lithuania increased participation in GVCs by 4.3 %, and in 2018 the participation index was 52%. Such increase was higher compared to the OECD countries and the main OECD partners (Versli Lietuva, 2021). In 2018, Lithuania's GVC participation index, composed of backward GVC participation and forward GVC participation, was 52%. However, Lithuania has a greater participation in backward GVC participation (29.9 % out of 52 %), compared to forward GVC participation (22.1 % out of 52%) (Versli Lietuva, 2021).

The participation of the Lithuanian manufacturing sector in GVCs is greater compared to other economic sectors (Versli Lietuva, 2021). For instance, in 2014 Lithuania's overall GVC participation index was 56.5 %. Meanwhile, the participation index of the manufacturing sector – 69.3 %. In addition, according to OECD, (2022), based on TiVA (Trade in Value Added) database report on Lithuania, in 2018 the share of domestic value added meeting foreign final demand was 41.3 %. However, for manufacturing activities the share was 64.7 % (OECD, 2022). From 2000 to 2014 the overall GVC participation index increased by 5.7 %. Meanwhile, the participation index of the manufacturing sector increased by 7.5 %. Consequently, the participation of manufacturing sector in the GVC appears to be more significant compared to the agriculture and service sectors. However, the growth of the GVC participation index of the manufacturing sector was determined by the increase in backward participation of GVCs – 10.6 % (Versli Lietuva, 2021). Meanwhile, forward GVC participation decreased by 3.1 %. Therefore, the Lithuanian manufacturing industry has shifted more towards the production of using intermediate goods imported from foreign countries, rather than supplying intermediate goods to foreign markets for further processing and production (Versli Lietuva, 2021). Lithuania's overall participation in the forward GVC decreased (8.8 %). However, the decrease of overall forward GVC participation was more significant compared to the decrease (3.1 %) of the manufacturing sector forward GVC participation. The overall GVC backward participation increased by 14.5%, as compared to the GVC backward participation of the manufacturing sector (10.6 %). To conclude, other Lithuanian sectors have shifted more towards the creation of goods or services for export using intermediate goods or services created in foreign countries, rather than producing such goods or services for further processing and production. Lithuania's overall GVC participation index increased less (5.7 %) compared to Lithuanian manufacturing sector's GVC participation index (7.5 %). This implies that in the long-term manufacturing sector increased participation in GVCs faster than other sectors of Lithuania. Notably, only five (out of 19) manufacturing industries contributed to the increase of the participation of manufacturing sector in GVCs: i) C19 - manufacturing of coke and refined petroleum products; ii) C20 - manufacturing of chemicals and chemical

products; iii) C17 - manufacturing of paper and paper products; iv) C27 - manufacturing of electrical equipment; v) C29 - manufacturing of motor vehicles, trailers, and semi-trailers. The highest contributors are C19, C20 and C27. According to OECD (2022), based on TiVA database report on Lithuania, in 2018 the manufacturing industries with the most foreign value-added contents in their exports were C19 (80.4 %), C20 (45.3 %), C27 (40.3 %). The GVC participation index of other manufacturing industries had different outcomes in the long term. The index of some industries (C10 - manufacturing of food products; C11 - manufacturing of beverages; C12 - manufacturing of tobacco products) decreased by 0.8 %. However, the index of other industries (C16 - manufacturing of wood and of products of wood and cork, except furniture; manufacturing of articles of straw and plaiting materials) decreased by 6.7 %. The most significant decrease (−14.4 %) was observed in industries C13-15 (C13 - manufacturing of textiles; C14 - manufacturing of wearing apparel; C15 - manufacturing of leather and related products) (Versli Lietuva, 2021).

To conclude, the country's exported production belongs to contract manufacturing - the export of intermediate consumption goods reaches about 51% of gross exports. A large share of the manufacturing of intermediate goods in the structure of export demonstrates a strong participation in GVCs (LIC, 2022). Notably, two approaches explain the relationships between participation in GVCs and eco-innovation performance. Firstly, eco-innovation improves the international performance of the firm and opens new market opportunities (Hojnik et al., 2017; Urbaniec & Tomala, 2021). Therefore, eco-innovation let the firm to expand into broader GVCs (Pananond, 2013), which are difficult to enter without meeting certain environmental standards. The nature of products sold shows the flexibility of the manufacturing sector, as well as investments in technological and/or product design solutions and marketing (LIC, 2022). Secondly, participation in GVCs leads to increased eco-innovation performance (Meng et al., 2022) and plays an important role in knowledge acquisition (Bi et al., 2015). Therefore, when considering the relationships of participation in GVCs and eco-innovation performance, it is argued that there exists a bilateral relationship.

3. ECO-INNOVATION PERFORMANCE

The scholars suggest that measurement of eco-innovation performance is vital for identifying eco-innovation patterns and designing eco-innovation policies (Brogi & Menichini, 2019). For such measurement, the Eco-Innovation Observatory (2020a, 2020b) developed the Eco-Innovation Index – a tool to assess and illustrate eco-innovation performance across the EU (Fig. 2). The aim of the index is to capture various aspects of eco-innovation by applying 16 indicators divided into sub-indicators: i) inputs – aimed at identifying country investments that trigger eco-innovation activities; ii) activities – aimed at identifying the extent of the activities of specific country companies in eco-innovation; iii) outputs – aimed at identifying the quantitative output of eco-innovation, such as patents, academic literature, etc.; iv) resource efficiency outcomes – aimed at identifying eco-innovation performance in the context of a country's resource efficiency and GHG emission intensity; v) socio-economic outcomes – aimed at identifying the extent of positive outcomes for social and economic aspects.

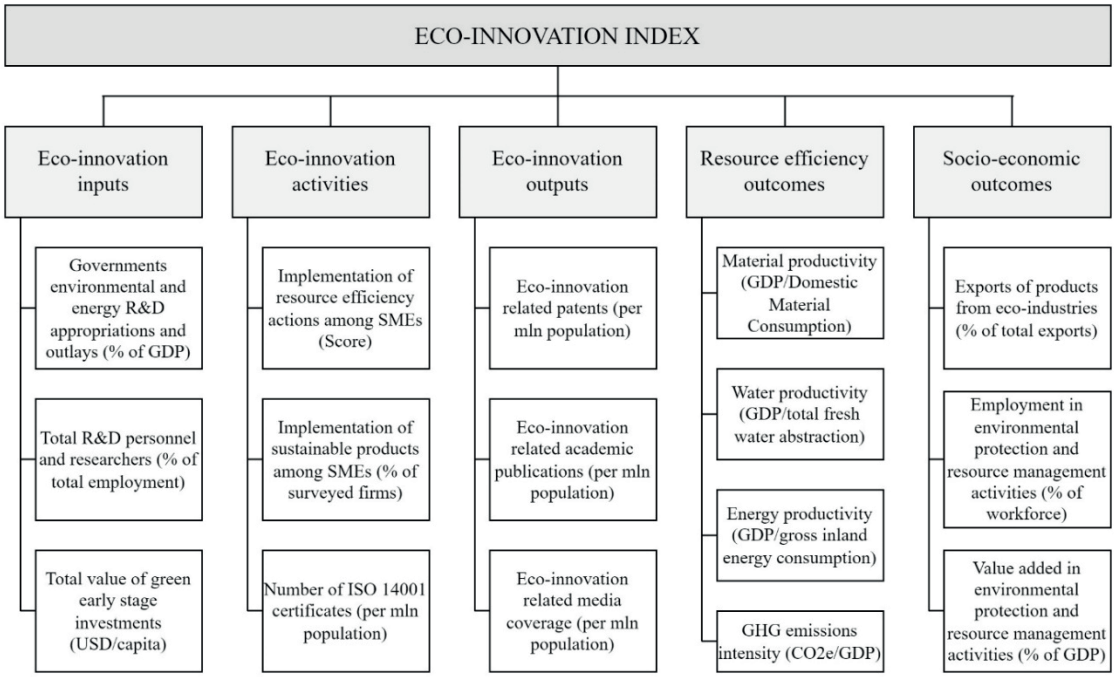

Fig. 2. Components and indicators of the EU Eco-Innovation Index: 2019 version (created by the authors according to Eco-Innovation Observatory, 2020b).

Figure 3 demonstrates eco-innovation performance based on the Eco-Innovation Index in 2021. The scores reveal the performance of the EU countries.

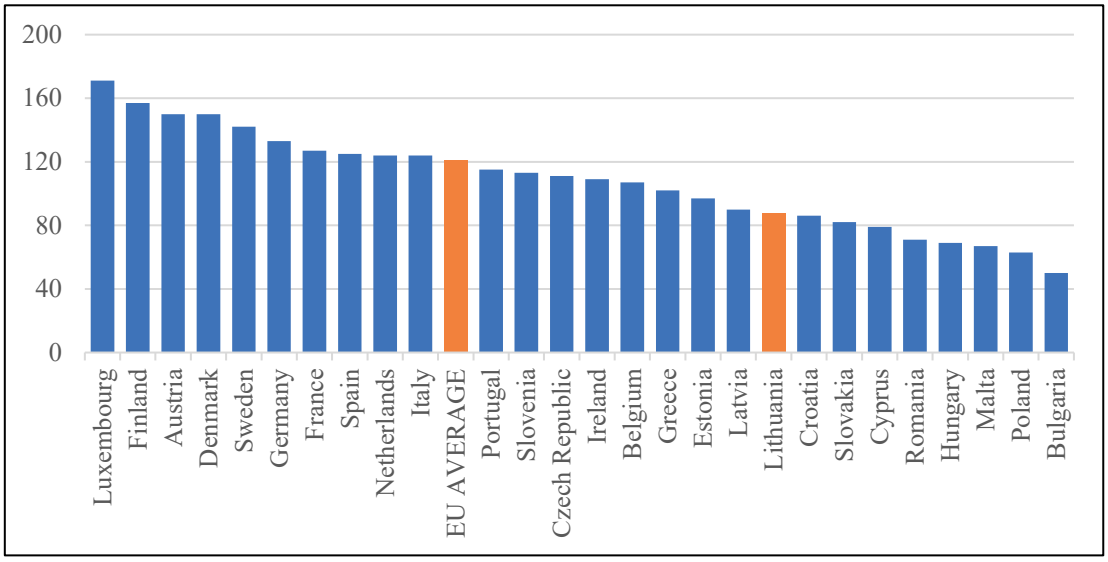

Fig. 3. Eco-innovation index in 2021 (created by the authors).

According to the Eco-Innovation Index, the first group of countries on the eco-innovation scoreboard is labelled "eco-innovation leaders". Notably, ten countries demonstrate scores above the EU average (121) and are assigned to the eco-innovation leaders. Luxembourg (171) is the eco-innovation leader among all countries, followed by Finland (157), Austria and Denmark (150 each), Sweden (142), Germany (133), France (127), Spain (125) and the Netherlands (124). Meanwhile, seventeen countries demonstrate

scores bellow the EU average (121). The second group on the eco-innovation scoreboard is labelled "average eco-innovation performers". Eight countries are assigned to this group: Portugal (115), Slovenia (113), Czech Republic (111), Ireland (109), Belgium (107), Greece (102), Estonia (97), and Latvia (90). The third group on the eco-innovation scoreboard is labelled "countries catching up with eco-innovation". Nine countries are assigned to this group: Lithuania being the first in the group with a score of 88, followed by Croatia (86), Slovakia (82), Cyprus (79), Romania (71), Hungary (69), Malta (67), Poland (63) and Bulgaria (50). Lithuania is the 19th country on the eco-innovation scoreboard (out of 27 EU countries), with a score – 88, which is below the EU average.

Taking a closer look at the dynamics of the EU average and Lithuania's eco-innovation index (see Fig. 4), a steady increase is observed.

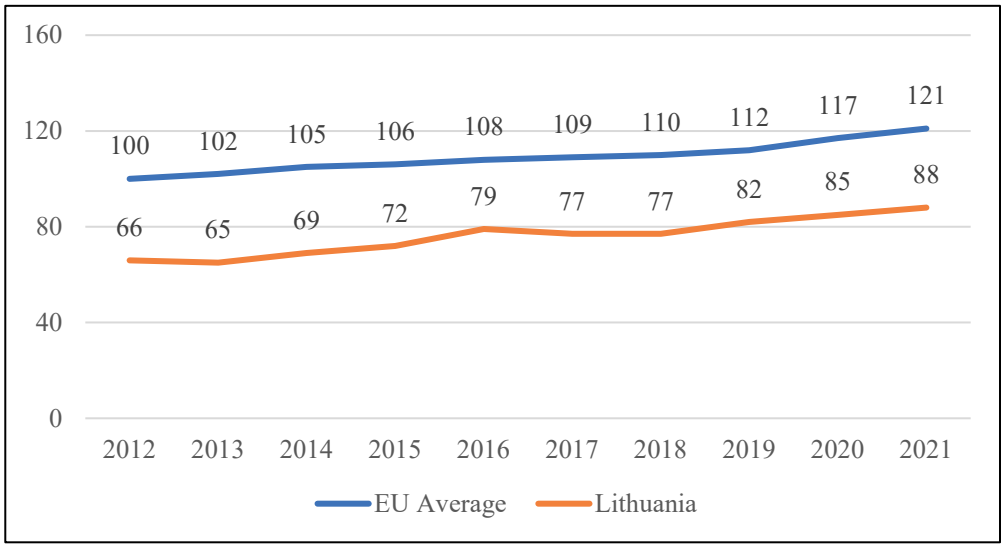

Fig. 4. The dynamics of the EU average and Lithuania's eco-innovation index (created by the authors).

For instance, in 2012 Lithuania's index was 66 and in 2021 - 88. The EU average increased from 2012 (100) to 2021 (121). In spite that both the EU average and the Lithuania's index increased steadily almost every year (with the exception of Lithuania in 2017), the gap decreased by 6.7 % from 2012 (34 % below the EU average) to 2021 (27.3 % below the EU average). In order to identify each countries strengths and weaknesses we analyze each of the five dimensions of eco-innovation index and compare the separate indicators of the EU average and Lithuania (see Fig. 5).

Eco-innovation inputs comprise investments (financial or human resources) aiming to trigger eco-innovation activities. Lithuania's score in eco-innovation inputs indicator was 65 in 2021, which is 42.5 % below EU average (113). Eco-innovation activities includes indicators to monitor the scope and scale of eco-innovation activities undertaken by companies. The component focuses on efforts and activities rather than on actual results of innovation activity. Lithuania's score in eco-innovation activities indicator was 39 in 2021, which is 61 % below EU average (100). Eco-innovation outputs describe the immediate results of eco-innovation activities. Indicators in this component are used to monitor the extent to which knowledge outputs generated by businesses and researchers relate to eco-innovation. Lithuania's score in eco-innovation outputs indicator was 92 in 2021, which is 34.3 % below EU average (140). Resource efficiency outcomes relate to wider effects of

eco-innovation on improved resource productivity. Eco-innovation can have a twofold positive impact on resource efficiency: it can increase the generated economic value, while at the same time decrease pressures on the natural environment. Lithuania's score in resource efficiency outcomes indicator was 140 in 2021, which is 4.8 % below EU average (147). Socio-economic outcomes of eco-innovation depict wider effects of eco-innovation activities for society and the economy. This includes changes in employment, turnover or exports that can be related to broadly understood eco-innovation activities. Lithuania's score in socio-economic outcomes indicator was 115 in 2021, which is 9.5 % above EU average (105).

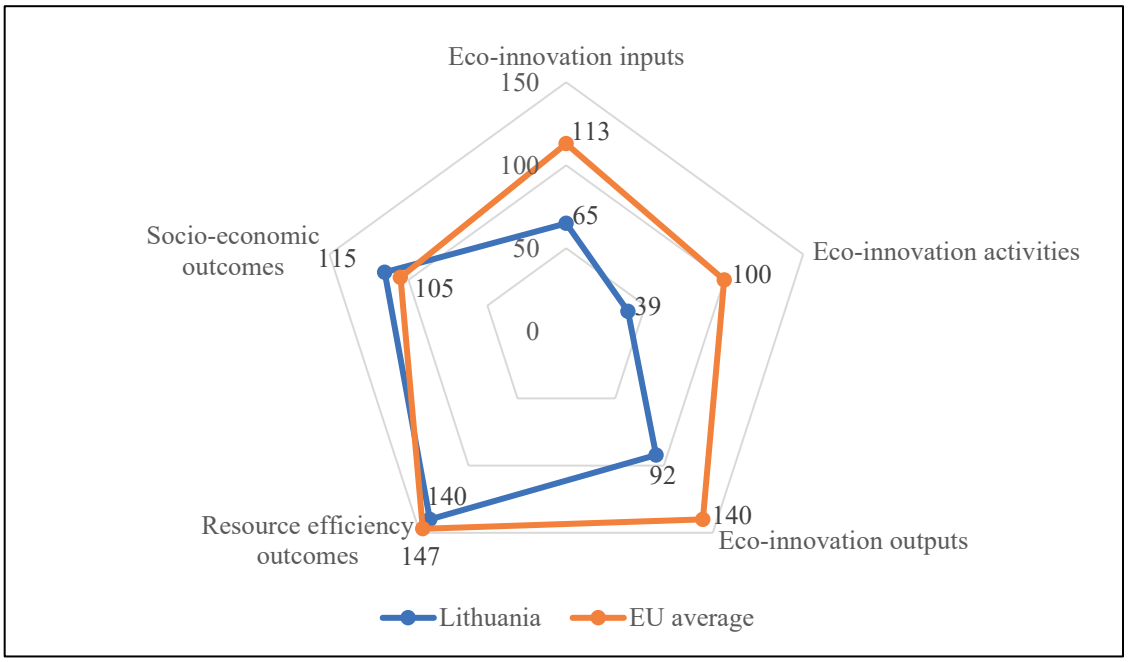

Fig. 5. Eco-innovation performance in 2021 (created by the authors).

The results of Lithuania's eco-innovation performance in 2021 compared to the EU average (see Fig. 5) are in line with the overall eco-innovation policy landscape in Lithuania. Lithuania still does not have one separate document that exclusively targets eco-innovation policy for the country, the policy is distributed across various legal documents where eco-innovation is covered under general innovation policy programs and measures, such as Law on Taxes on State Natural Resources; National Environmental Protection Strategy Law on Energy from Renewable Sources; Lithuanian Smart Specialization, etc. One of the core values of the circular economy, circular materials, green business, and eco-innovations are stated in the "National Strategy for Climate Change" and "Lithuania 2030".

However, the Eco-innovation Index is an aggregated index that illustrates the eco-innovation performance of each country; therefore, for this reason it is not possible to exclusively analyze the Lithuanian manufacturing sector. Nevertheless, the Lithuanian manufacturing sector has been the target of certain strategic policy frameworks and programs that support eco-innovation. Lithuanian policies, strategies, and regulations support solutions are in line with the EU policy and are seeking to promote innovation, increase the usage of renewable resources, environmental protection, control pollution, regulate waste management, etc. (EIO, 2019).

When it comes to policy measures that support the development of eco-innovation, one of the priority investments by the EU in 2014–2020 was the promotion of competitiveness of SMEs, specifically increasing the investments of SMEs in eco-innovation and other resource-efficient technologies. Few of the most well-known measures and a part of the EU structural funding period 2014–2020 are the "Eco-innovation LT" – promotion of the introduction of process and organizational eco-innovation, such as ISO 14001, eco-labelling, and introduction of eco-design principles in production processes; "Eco-innovation LT+" – introduction and promotion of the adoption of eco-innovation technologies; and "Eco-Consultant" – support of consultancy services on more efficient use of resources, preservation of natural resources, eco-technologies and eco-related issues. During 2018–2019, Lithuanian SMEs invested in eco-innovations that increase material efficiency. Lithuanian businesses, have been primarily interested in developing /using metal, wood, glass, biodegradables, paper, and plastic as secondary materials; particularly furniture manufacturers have been primarily interested in eco-innovations that support the use of plastic and wood as secondary material.

However, in the 2014–2020 EU funding period, the impact of eco-innovation measures (and the spill-over effects) has not manifested because of the lack of critical mass of companies that implement and understand the benefits of eco-innovation. (Ministry of the Economy and Innovation of the Republic of Lithuania, 2020). The share of companies that have implemented eco-innovations from 2012–2014 to 2014–2016 decreased more than twice from 20.7 to 8.9 %. Such results are in line with the separate indicators of the Eco-innovation index "eco-innovation inputs; activities; and outputs". The main barriers of implementation are related to administrative costs that do not offset the benefits of funding; lack of specialists and information about the benefits of the measures; restrictions and requirements for potential applicants; low maturity of market participants, as well as few service providers who can provide quality consultations and carry out eco-design. The low interest in such measures may be explained by the lack of absorptive capacity of Lithuanian SMEs. Currently, there are active EU funding programs for Lithuanian SMEs and especially for the manufacturing sector, such as "InterInoLT" – integration of Lithuanian business into international development and innovation value chains; "Smart InoTech industry" - facilitation of implementation of smart specialization R&D results by digitizing production processes in industrial enterprises; "InoLink" - innovation networking stimulation and development; "Inospurtas" - innovation consulting and support services for business.

CONCLUSION

Today's growing demand for environmentally friendly products and manufacturing processes, as well as the energy crisis push the Lithuanian manufacturing sector to rethink the overall eco-innovation strategy and consider the eco-innovation strategy not as one of the strategic alternatives to increase competitive advantage and participate in GVCs, but as an imperative of the overall firm's strategy.

When it comes to participation in GVCs, on the positive side, the Lithuanian manufacturing sector is more involved in GVCs compared to other Lithuanian economic sectors and the participation is still increasing. The nature of the Lithuanian manufacturing sector, the ongoing increase in GVCs participation, and the products sold shows the flexibility of the manufacturing sector, as well as investments in eco-innovations, such as technological and/or product design solutions and/ or marketing. However, on the negative side, over time, the Lithuanian manufacturing industry has

shifted more towards the production of using intermediate goods imported from foreign countries, rather than supplying intermediate goods to foreign markets for further processing and production. When it comes to eco-innovation performance, it can be stated that though the eco-innovation overall score has increased during the last years, Lithuania still faces many challenges from wide range of environmental and economic problems. Eco-innovation inputs, activities, and outputs are the weakest components in overall eco-innovation index compared to EU average.

This study outlines the future research directions, whilst separating the input and the outcome on interrelationships of participation in GVCs and eco-innovation performance. It is argued that exists a bilateral relationship between participation in GVCs and eco-innovation performance, thus from strategic business management perspective firstly, future research should consider investigating: the micro-level business strategies in the context of eco-innovation and increased participation in GVCs. Secondly, what are the driving and hindering factors for firm's to implement eco-innovation in order to increase participation in GVCs. Thirdly, how does increased participation in GVCs and eco-innovation performance affect other areas of business performance.

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