Research Article

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Sustainable Development and Forest-Based Industries: Main Considerations and Policy Measures. The Bulgarian Example

Abstract: Industrial policy determines the industry's orientation for growth, in line with the economic development stage. The main objective of this article is to establish the sustainability of the relationship between the development of forest resources, on the one hand, and their use in wood and furniture products in the Republic of Bulgaria, on the other hand. The main tasks are to find out the sustainability in the production of timber and products from it, to assess the tendency of development and needs of policy measures. The methods used include statistical methods for trend analysis, descriptive methods and others. Forestry is a clear example of the transformation of natural resources into consumer products, where sustainability in the development of society can easily be disturbed. Forestry policies should support the use of tree resources in products with the highest possible added value.

1 Introduction

Sustainability means that the achieved progress of an existing generation creates a potential which is necessary to meet the needs of future generations (Pearce et al. 2000). Manufacturing is one of the most important value-adding alternatives of forest-based industries. Processed wood production volumes have increased rapidly in the last few years all over the world and especially in the Asian countries. In this new environment, the European countries face the great need for sustainability improvement. In these sophisticated conditions, the forest-based industries can either do better, extracting the best they can and providing sustainable manufacturing and development, or go down to painful environmental, social and economic inefficiency.

In this regard, the World Commission on Environment and Development issued in 1987 a report "Our Common Future" on sustainable development, prepared for all nations. It was a sign of growing concern to protect the environment and resources for future generations (Baglou, 2017).

The sustainable development could be defined as comparable growth in all the regions all over the world and sectors of national economies (Wiśniewska, 2015). According to I. AdrianaTisca's et al. (2015) definition for sustainable tourism, the sustainability of forest-based industries can be defined as the development that respects the natural, social and economic integrity of the environment, to ensure the exploitation of natural resources for future generations.

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To achieve sustainable development, industry should be able to perform sustainable production processes that are environmentally friendly (Nur et al., 2018), affecting the three fundamental dimensions (economic, environmental and social) (Grefrath et al., 2017). Sustainability in a manufacturing context means enabling an eclectic pool of industrial participants (primary, public and secondary stakeholders) to pursue economic growth without undermining Sustainable Manufacturing: Challenges, Approaches and a Roadmap social and environmental issues of workforce management, building community relations, use of natural resources, carbon dioxide emissions, waste management and product and services responsibility (Uusitalo et al., 2017).

According to J. P. Liyanage (2017) sustainable business rests on a blend of economic prosperity, environmental quality, and social equity, capturing a much broader scope and presenting a composite picture of a legitimate business. Sustainable development in the forest sector depends on managing its resources, activities and outputs at present in ways that do not curtail their future availability and use (Gane, 2007).

2 Literature review

According to Harmsen and Powell (2010), there exists a myriad of sustainability indices, indicators, and metrics, as well as tools and methodologies for implementation. Many authors explore these indicators at the level of industry or industrial organizations. Some studies like Dobrota and Iancu (2015) conceptually explore sustainable development (SD) and place theoretical framework that could be used to compose indicators in industrial organizations as well as Wiśniewska (2015) for agribusiness. Many authors provide such a conceptualization of SD implementation and possibilities indicators to be induced. Throughout particular peculiarities of economic systems like: energy consumption (Nur et al., 2017), value creation (Seliger, 2012; Moflih et al., 2012);

According to Harmsen and Powell (2010) for process industry the Environmental Sustainability Index (Sands & Podmore, 2000; Sutton, 2003), indicators developed by the European Environmental Agency, assessments and performance measures reported by the U.S. Environmental Protection Agency, and the environmental performance index method of the Association of the Dutch Chemical Industry are examples of relevant indicator sets and methodologies for use in footprint assessment. Some researchers (Landeta Manzano et. al., 2015; Lu et. al., 2012; Hemdi et. al., 2012) provide framework of stepwise decomposed indicators into levels and implement different approaches to assess them. Authors like Gospodinova and Krachunov (2010), Nedeva (2010), Ivanova and Todorov (2017) propose to implement an index of sustainable development with indicators needed to the particular economic system or goal. Todorov and Marinova (2009) give a possible typology of indicators that can be described as universally implementable to global or regional systems. The indicators are also developed by the international organizations it regards namely the EU, whose statistical bureau EUROSTAT also monitors the area of environment (Jenicek, 2013) or OECD (Hass et al., 2002).

In Bulgaria the sustainable development of forest-based industries is somehow underestimated at the expense of forestry SD. Recent research focus mostly on: the technological perspectives and approaches to forestry SD like water resources (Ignatova & Mladenova, 2014; Bogdanov, 2014), sustainable relationships inside forest stands (Dimitrov, 2014); policies and strategies (Paligorov, 2007a, b; Paligorov & Dobrichov, 2007) and opportunities for SD throughout water resources, infrastructure and new management (Paligorov et al., 2017).

The wood-processing and furniture industries are essential for the countries that use their forest resources. Their strong relationship with forest resources (Klein et al., 2009) and their location in more backward areas provide income in rural areas with small settlements and high unemployment. Transforming AdrianaTisca's et al. (2015) definition for sustainable tourism, forest-based industries sustainability can be defined as the development that respect the natural, social and economic integrity of the environment, to ensure the exploitation of forest resources for future generations.

All the theoretical issues define sustainability of the particular industry as incrementally actual and strategically purposed. Forest-based industries exploit forest resources in a manner of products with low

and high added value. Therefore, here sustainability involves the tiny balance between social needs to provide fuel to the poorest social groups, wages to people in vulnerable forest regions and technologically improved manufacturing of value-added products. There are very few studies on the subject of sustainable development, devoted to the forest-based industries and their scope is quite limited as authors pay attention mainly to the technological issues of the topic.

3 Materials and methods

The industries, analyzed in this article, are part of the NACE Rev. 2 of Eurostat and include "Manufacture of wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials" and "Manufacture of paper and paper products". All the data is derived by the Eurostat database, but the numerical results are calculated by the authors.

In the current study we implement an adapted methodology in the manner of Hemdi et al. (2012) and Nedeva (2010) of several levels of indicators that form the sustainability index. The methodology is very useful for grouping and classifying indicators of a particular system. Hemdi et al. (2012) used three levels of indicators incorporated into elements of sustainable development (as first level grouping) and afterward calculated its index (the overall level or the top of the pyramid). In this study we apply this methodology, but unlike Hemdi et al. (2012) we use indicators specific to Forestry, grouped in the three first level indicators used in Hemdi et al. (2012). The top of the pyramid is again the sustainable development index. All the indicators are weighted by their number. The levels of indicators are presented in Table 1.

Table 1. Indicators of SD and their influence to the index value

First level indicator – perspectives FLI_i	Second (comprehensive) level indicator– SLI_i	Influence
Ecological	Energy efficiency	Positive
	Forest stock	Positive
	Fuel wood production	Negative
	Other environmental protection activities	Positive
	Protection of ambient air and climate	Positive
	Plant protection products and pesticides	Negative
Economic	Forest available for wood supply	Positive
	Production value	Positive
	Wage adjusted labour productivity (Apparent labour productivity by average personnel costs) – percentage	Positive
	Enterprises – number	Positive
	Gross operating surplus – million euro	Positive
	Gross investment in construction and alteration of buildings – million euro	Positive
	Gross investment in existing buildings and structures – million euro	Positive
	Gross investment in land – million euro	Positive
	Gross investment in machinery and equipment – million euro	Positive
Social	Employer's social charges as a percentage of personnel costs – percentage	Positive
	Labour cost per employee FTE – thousand euro	Positive
	Share of employment in manufacturing total – percentage	Positive
	Share of employees in persons employed – percentage	Positive
	Share of personnel costs in production – percentage	Positive
	Share of personnel costs in total purchases of goods and services – percentage	Positive
	Share of personnel costs in total purchases of goods and services – percentage	Positive
	Unpaid persons employed – number	Negative

Indicators presented in the table are included in the index in the following way:
- Individual increment of the particular (i) second level indicator (SLI): for these with positive influence

$$\Delta SLI_i = \frac{SLI_t - SLI_{t-1}}{SLI_{t-1}} \qquad (1)$$

where:

SLI_t – second level indicator for year t;

SLI_{t-1} – second level indicator for year t – 1.
- for these with negative influence

$$\Delta SLI_i = \frac{SLI_{t-1} - SLI_t}{SLI_{t-1}} \qquad (2)$$

- All second level indicators are averaged for every year just obtaining the first level indicators – perspectives: FLIj
- SD index is calculated by the weighted average of all first level indicators.
- Weights are evaluated in clear quantitative manner by dividing the number of second level indicator for each perspective to the overall number of second level indicators:

$$SDI = 0{,}26 * FLI_{ecological} + 0{,}43 * FLI_{economics} + 0{,}31 * FLI_{social} \qquad (3)$$

4 Results and discussion

The main result for SD index derived in the study is presented on Fig.1 in comparison with the sub-indexes.
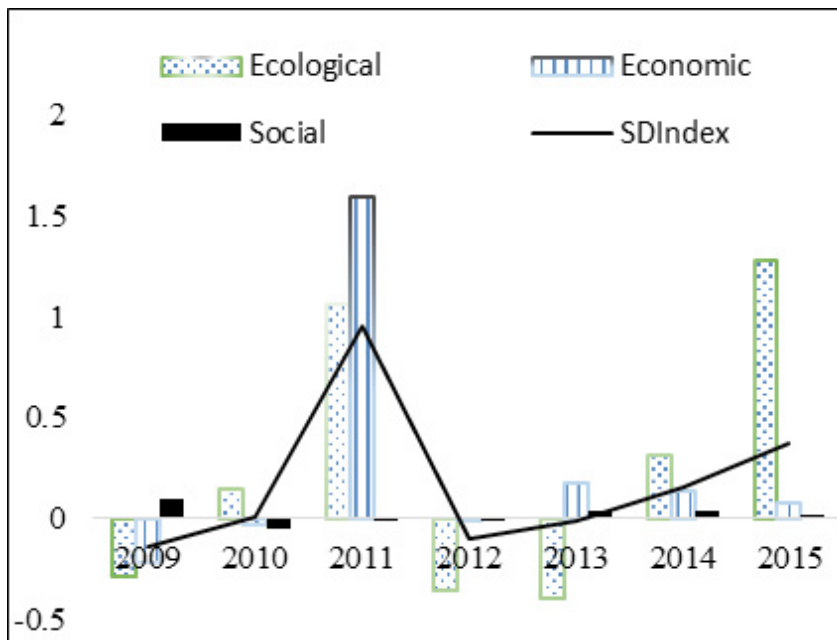

Fig. 1. SD of the Bulgarian forest-based industries

The graph presents a very interesting development of the index for the years surveyed. Two main periods can be distinguished – before and after 2011. Until 2011, the index has an exponential development due to the exceptional development of two of its components. Environmental factors are increasing their leaps and bounds due to the increased costs of Environmental Protection and Climate. After this year, the compensatory mechanism of environmental costs pulls the index down.

Environmental factors have become a leading driver of sustainable development in the sectors studied. Economic factors leapfrogged index growth in 2011 due to the increased investment in land. In the coming years, economic factors have a negative impact on growth and sustainable development. The main reasons for this are the decrease of gross investments in buildings and infrastructure, as well as in land. This result clearly reveals the negative effect of market booms on SD stability, due to the compensation after the boom. Social factors can be named as the "bad boys" of forest-based industries SD. For the whole studied period no growth of the second level indicators analyzed is determined. Some of them have greater variance like "Share of personnel costs in total purchases of goods and services" while some are more stable, i.e. "Labour cost per employee". The latter is the main problem leading to structural problems of sectors SD such as the lack of qualified workforce willing to work in the forest-based industries.

Here we share the hypothesis that industries surveyed pull the Bulgarian SD up and down, not the opposite. In this context, the SD index is compared to the index of real GDP per capita – one of the most used indicators for the development of a particular country (Fig. 2).
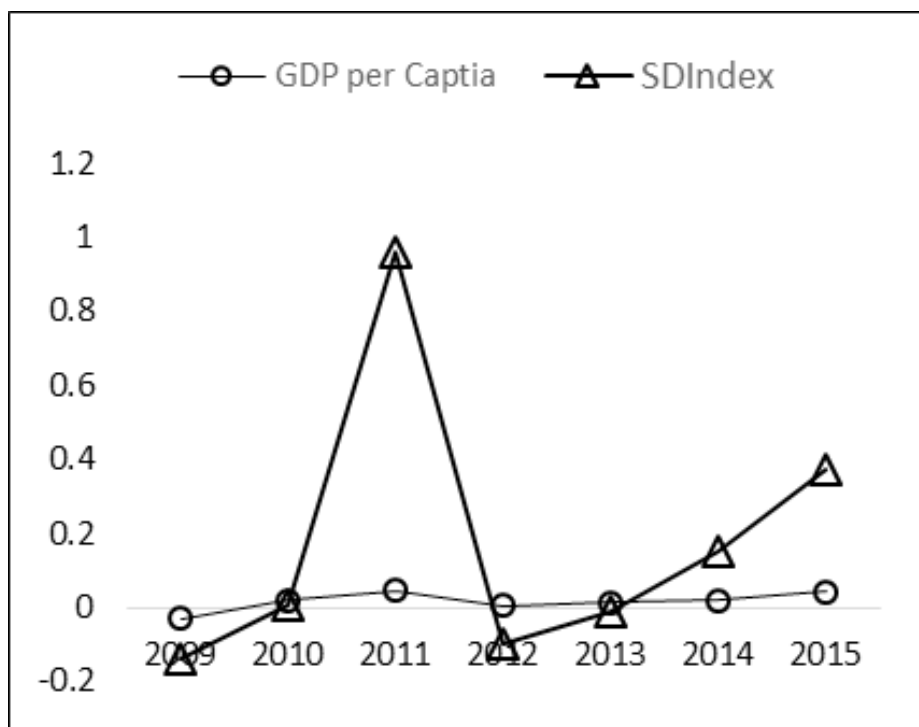

Fig.2. SD Index of the Bulgarian forest-based industries compared to GDP per capita (Eurostat, 2018)

SD of forest-based industries increases the GDP due to the expenditures included like second level indicators. Booms move the overall SD of Bulgaria upwards and compensation downwards. The main factor that influences the country SD since 2001 are the expenditures incurred in relation to environmental issues. In comparison, the SDG index of Bulgaria (Sachs et al., 2017) reveals the same problems, i.e. in the infrastructure and wellbeing. The answer about the influence of sustainable development of the forest-based industries to the economy is given by the regression analysis conducted here. The results are presented in Table 2.

Table 2. Linear regression between SD index of forest based industries and real GDP per capita

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	DW	dU
1	.767	.588	.506	.0179	1.766	1.036

Coefficients

Model B		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		Std. Error	Beta			
1	(Constant)	.008	.008		1.005	.361
	SDI	.051	.019	.767	2.672	.044

The regression output derived in SPSS confirms the results discussed above. SD index barely but statistically significantly influence the real GDP per capita with 5,1% per year with probability of that in about 60%. This means that the SD of the forest based industries should remain stable in order to avoid booms and consequent compensations in GDP. The study confirmed that if the boom and the bottom of the index are removed, arise clear linear trend for sustainable development for all the period investigated:

$$Y = 0,117t - 0,275; R2 = 0,895; \tag{4}$$

$$p - value = 0,014$$

If the significant changes of SD index in 2011 (boom) and 2012 (compensation) did not appear, the SD would gain a stable annual increment of about 11% with a probability of 89,5%. This confirms that stress movements make the improvement of SD of the particular economic system slower than it has capabilities to do.

5 Conclusions

The results show that forestry in Bulgaria contributes to sustainable development in two of its directions. Sustainable development in the research sectors has been identified. At the same time, the weak social perspective raises questions about the future stability of the sector's development and the extent to which it will be sustainable. The economic instruments for sustainable development are the continuous investment in infrastructure and the cost of environmental protection. Social indicators should be significantly improved due to remain the speed of development after 2011. Wages, salaries and investments in personnel skills can be vital over the next five to ten years, not only to the sectors studied but the overall Bulgarian economy. The main policy measures should include the following:

- Encourage the enterprises from the forest-based industry to invest in industrial infrastructure permanently not incrementally.
- Encourage the enterprises from the forest-based industry to invest permanently in personnel qualification development and training, including necessary further training of workers.
- Stable course towards labour productivity improvement at every level and workplace.

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