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Estimation of Forestry Sector Competitiveness in Some European Countries

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Abstract. The competitiveness of forestry sector in some European countries including Bulgaria is estimated. From a statistical point of view, competitiveness is a complex indicator, characterized by numerous manifestations. It is composed of derived and one-dimensional indicators. The first expresses several sides of some phenomenon, while the second only individual side, a separate part of the phenomenon. The estimation of the level of the derived indicator, respectively, the complex indicator as a result of the transition from individual to the general, is based on the values of the simple indicators. Its practical calculation is done through aggregation of one-dimensional indicators, which are transformed from named to unnamed values [8, 14, 16]. In this study the competitiveness is characterized on the basis of the following derived indicators: total output; labour productivity; forest and other wooded land; growing stock in forest and other wooded land; net annual increment; gross fixed capital formation; net entrepreneurial income. Based on the above indicators complex criteria of the competitiveness of forestry sector is calculated. It is standardized from 0 to 1 [8, 11, 20]. The methodology is applied in forestry sector of some European countries. On the basis of results some conclusions concerning Bulgarian forestry sector competitiveness are done.

Keywords: competitiveness, indicators of competitiveness, forestry sector, complex indicator.

1 Introduction

The EU-28 has just over 180 million ha of forests, which provide multiple benefits to society as employment, food, fresh water, wood and non wood resources and so on. Prerequisite for these multiple benefits is competitiveness of the forestry sector. Its estimation is starting point for the right decisions of the policy makers from the sphere of forestry. Due to this the goal of current study is to offer complex index of forestry competitiveness and by means of it to measure competitiveness of forestry sector in Bulgaria and some European countries.

2 Literature review

Concerning the category competitiveness among the researchers there is not common understanding [15]. Initially competitiveness was considered as the firm's ability to provide products as or more effectively and efficiently in comparison to their competitors as well as to stay in business, to use the existing market opportunities and to create new markets. Due to this the

competitive firm are able to get positive results regarding profit, price, rate of return, products'quality and so on. The idea of firm competitiveness was developed by M. Porter to the national level. The author underlines that it is firm that competes on international market, but the task of the nation (country) is to help firms' business activities [17]. The national competitiveness reflects 'country's ability to create, produce, distribute and service products in the international trade while earning rising returns on its resources' [2]. National competitiveness in a long term is strongly determined by productivity. Nations with a higher productivity are wealthier and able to invest and reinforce their competitiveness in perspective [7]. In relations with the last one according to the World Economic Forum (WEF) competitiveness is 'the set of institutions, policies, and factors that determine the level of productivity of an economy, which in turn sets the level of prosperity that the economy can achieve' [19]. Another popular definition is on the Institute for Management Development (IMD). According to it competitiveness is the 'ability of a nation to create and maintain and environment that sustains more value creation for its enterprises and more prosperity for its people [6]. On the basis of these definitions WEF and IMD calculate respectively Global Competitiveness Index (GCI) and World Competitiveness Yearbook (WCY) index. Both indexes represent national competitiveness and are different from the competitiveness of forestry sectors. The main reasons for that are: firstly, nations possess different quantity of forest resources; secondly, countries have different level of development and investments in forestry sectors [17]. Due to this measuring the competitiveness of forestry sector on the basis of the indexes mentioned above is not reliable. Therefore it is necessary on the basis of literature review to offer indicators, which characterize accurately the different sides of forestry sector competitiveness. Here is the place to underline that there is difference between forestry and forest sector. Forest sector includes three main subsectors: forestry, which includes establishments primarily engaged in growing and timber harvesting; wood product manufacturing; and paper manufacturing [5]. In this paper is studied competitiveness only of forestry, which is subsector of forest sector

In the specialized leterature there are not commonly accepted indicators which characterize the competitiveness of forestry sector. D. Sasatani study national competitivenesss of wood products from natural forest in the Asia-pacific region on the basis of M. Porter's diamond using the following factors: natural forest area; natural forest area per capita; overall forest stock; accessible natural forest area; plantation-natural ratio; corruption perception index; environmental performance index; rural labor availability; gasoline price; productivity per worker; domestic consumption. These factors are weighted and through accumulation the national competitiveness of forestry was estimated [17]. The study of forest sector's competitiveness in Macedonia by N. Savic, M. Stojanovska and V. Stojanovski is also based on Porter's diamond model. The authors use four linked factors like: factor condition, demand factor, firm's strategy, rivalry and structure. Closely related with forestry competitiveness are factors conditions and demand factor. The first one is characterized by forest resources employment, investment in innovation, labor costs, geographical location and so on, while the second is characterized by local market and international markets [18]. Different approach to forestry sector competitiveness estimation is

offered by M. Kovalcik. The indicators used by him are: output of forestry, GDP of Forestry, contribution of forestry to GDP, Gross value added, Net value added. On the basis of these indicators the author compares competitiveness of forestry and profitability in selected European countries. He establishes that there are great differences in profitability and competitiveness among the particular countries as well as that the state of economy has a statistically significant influence on profitability and competitiveness of forestry [10]. The thesis of J. Korjonen about competitiveness also deserves attention. The author study competitiveness through the prism of factors driving investments in planted forests [9].

On the grounds of the lines above and the statement of M. Kovalcik that the indicators should be fully comparable internationally [10] in current article are offered the following indicators, which characterize competitiveness: total output at basic prices; labour productivity; forest and other wooded land; growing stock in forest and on other wooded land; net annual increment; gross fixed capital formation; net entrepreneurial income. The meaning of these indicators is shortly discussed below. Before that it should be underlined that when a complex indicator (like competitiveness) with multifaceted dimensions is quantified it is not possible to put terms for including all indicators as some parts of the studied phenomenon are not possible to be revealed [8, 14, 16].

Total output at basic prices. Output in forestry includes the value of all timber and non timber products and services created in forestry as of 2016. In this paper total output is accepted as an indicator for product competitiveness. The higher value of the indicator means that there is demand for the products of forestry, which generates revenues for the sector. On their basis it has an opportunity to invest in new technologies and to improve the qualification of its employees.

Labour productivity (gross added value per employee). Productivity of labor is a generalizing factor which reflects how effectively the forestry sector uses the available resources. Most authors believe that productivity of labor, taking into account the added value per one employee of the enterprise, is a basic indicator for estimation of the current competitiveness [3, 22].

Net entrepreneurial income. This indicator characterizes the quality of management of the sector's finances. It is an additional to other indicators because the achievement of a higher level of some indicators can be done on account of lower profit. For example, the higher competitiveness of marketed products can be achieved by increasing the quality considerably, which would reduce the financial performance, on condition that the market prices are steady [16, 24].

Forest and other wooded land (ha), **Growing stock in forest and on other wooded land (timber volume, m³)** and **Net annual increment (m³).** The first and second indicators are the main resources, which determine the current and future competitiveness of forestry sector. They are basis for production of timber and non timber products and services. The third indicator is of great significance for the annual timber harvested volume and the timber sales revenues. These three indicators determine to high extent the amount of added value, financial performance and opportunities for development of forestry sector.

Gross fixed capital formation. The investment accelerates firm's productivity gains and increases firm's competitiveness and stability [12, 23]. In this paper the gross fixed capital formation is used as an indicator for the amount of investments made in the forestry sector. The indicator includes the costs for acquiring the following types of long-term non-financial assets: buildings, equipments, vehicles, working animals, software products etc. In other words, these are investments used to buy assets that are used in production for more than one year.

The values of the indicators discussed above are presented in table 1 as of 2016 for fifteen countries members of EU. The data for the selected indicators for other 13 countries members of EU are missing in Eurostat and due to this they are not included in the research.

Table 1: Indicators Characterizing Forestry Sector Competitiveness in Some States Members of EU as of 2016

Country	Total Output, Million EUR	Forest Area and Wooded Land, thousand hectares	Growing Stock in Forest and on Other Wooded Land, thousand cubic metres	Net Annual Increment, thousand cubic metres	Gross Fixed Capital Formation, Million EUR	Labour Productivity, EUR per employee	Net entrepreneurial income, Million EUR
Austria	2255.11	4022.00	1129000	25136.00	156.94.	109369.70	571.71
Bulgaria	719.83	3845.00	645000	14361.00	4.90	8232.63	94.39
Croatia	307.05	2491.00	411980	8144.00	16.83	12505.10	38.12
Republic of Cyprus	3.90	386.19	10514.16	46.87	0.71	4016.67	-1.10
Czech Republic	2487.01	2667.41	754614	20462.97	115.66	37050.17	794.35
Finland	4855.00	23019.00	2327748	93379.17	433.00	197134.83	2584.00
France	6646.40	17579.00	2596749.14	82871.00	214.37	117163.86	2103.75
Germany	8576.33	11419.00	3617000	118589.60	268.91	94783.15	1943.49
Italy	2599.00	11110.00	1448300	32543.00	231.50	39591.25	869.59
Portugal	1216.93	4907.21	187800	19086.77	98.86	64108.89	643.30
Romania	1721.75	6951.00	1391460.73	29259.98	68.27	17104.22	360.40
Slovakia	1248.95	1940.00	514100	13465.00	78.40	20764.29	182.39
Slovenia	548.64	1271.00	407600	9165.00	18.07	68883.33	139.53
Sweden	4610.99	30505.00	2953100	79346.85	733.35	157735.83	2260.66
UK	1908.53	3164.00	380000	23113.00	161.08	38772.41	308.12

Source: Eurostat

3 Methodology for Estimation of Forestry Sector Competitiveness

There are various methods for estimation of competitiveness of national, industrial and firm level but neither of them is generally accepted [8, 11, 13]. The main shortcomings of most of these methods are the lack of complexity in assessment and inability to obtain summarization that is normalized within certain boundaries [13]. In this study these shortcomings are overcome by using the standardization (or z-scores) and linear ordering on national forestry sectors according

to coordinates of forestry sector-pattern in multidimensional space [8, 14, 16, 20]. The essence of methodology is presented in the lines below.

Statistically speaking, competitiveness is a complex indicator characterized by multifaceted dimensions. It consists of derived and one-dimensional indicators. The former reflect several features of certain phenomenon while the latter reflect only one separate feature of it. The assessment of the derived, or complex, indicator as a result of the transition from singular to general is based on the significance of one-dimensional indicators. The very calculation of the assessment can be done through aggregation of the values of one-dimensional indicators, which in their unity characterize the complex indicator that is studied.

The indicators used to estimate the competitiveness in this study are discussed in point 2 It should be noted that the quantification of a multivariate indicator – which in this case is the competitiveness – cannot claim to be exhaustive because there is always something elusive within the set of one-dimensional indicators. They refer to certain features of the phenomenon being studied and are subject to quantification. In their unity as a single system they characterize the wholeness, i.e. the multivariate indicator that is studied [8, 14, 16].

Each one derived indicator is determined by several one-dimensional indicators expressed in various measuring units (currency, ha, m3, etc.). Their aggregation requires the one-dimensional indicators to be transformed from named to unnamed values. For this purpose the classic standardization formula is applied [8, 11, 20]:

$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{\sigma_j} , \qquad (1)$$

where z_{ij} is the standardized value of the j-th indicator at the i-th forestry sector;
x_{ij} is the value of the j-th indicator at the i-th forest administration unit;
$\bar{x}_j$ – the average for the relevant j-th indicator. It is calculated through the formula (2):

$$\bar{x}_j = \frac{\sum_{i=1}^{n} x_{ij}}{n} , \qquad (2)$$

where n is the number of units in the relevant aggregation;

σ_j – the standard deviation of the j-th indicator. It is calculated through the following formula:

$$\sigma_j = \sqrt{\frac{\sum_{i=1}^{n} (x_{ij} - \bar{x}_j)^2}{n}} \qquad (3)$$

Linear ordering and comparative analysis in regard to complex indicator competitiveness is done on the basis of point-pattern in multidimensional space and establishment of location of the fifteen forestry sectors towards this point. This is used to calculate

multidimensional indicators (quantifications) normalized within boundaries from 0 to 1. Linear ordering should be applied on the basis of the indicators presented in point 2. For this purpose, their standardized values are used and the coordinates of the pattern point in m-dimensional space are determined. Such are the extremal values of the standardized indicators in 2016. They are categorized as stimulators and suppressors. As regards the former, the higher value is related to the increase of the quantitative assessment of the level of the multivariate indicator (competitiveness), while regarding the latter, it is related to its decrease. In formula (4) the stimulating indicators are taken at their maximum values and the suppressing indicators are taken at their minimum values [8, 11, 20]:

$$k_{ie} = \sqrt{\sum (z_{ij} - z_{ej})^2} \, , \qquad\qquad\qquad (4)$$

where k_{ie} is the Euclidean distance between the competitiveness of the i-th forestry sector and the pattern point;
z_{ij} – the standardized value of the j-th indicator of the competitiveness of the i-th forestsry sector;
z_{ej} – the standardized value of the j-th indicator at the pattern point.

The quantitative estimation (multivariate indicator) of the level of competitiveness of the i-th forestry sector is determined through the formula (5):

$$K_i = 1 - \frac{k_{ie}}{k_e} \, , \qquad\qquad\qquad (5)$$

where K_i is the multivariate indicator (quantitative estimation) of the level of competitiveness of the i-th forest enterprise;
k_e – sum of the mean value of the fifteen Euclidean distances determined through formula (5) and their doubled standard deviation.

4   Estimation of the Level of Competitiveness of the Forestry Sectors in 15 States Members of EU

The standardized values of the indicators characterizing the competitiveness of the forestry sectors in 15 states members of EU as of 2016, and the coordinates of the pattern point are calculated on the basis of the data in table 1 and formula 1. They are presented in table 2.

By using formulas (4-5) and the extremal values of the above indicators, the quantitative estimation of the level of competitiveness of the fifteen forestry sectors can be found. They are presented in table 3, along with the relevant positions in the linear ordering for 2016. From the results in table 3 is clear that Sweden and Finland foresty sectors are with the highest competitiveness from the studied fifteen. They are with leading positions in all indicators with

exception of the indicator *total output* where the leadership is held by Germany and France (see table 1 and table 2).

Table 2: Standardized Values of Indicators Characterizing Forestry Sector Competitiveness in Some States Members of EU as of 2016

Country	Total Output	Forest Area and Wooded Land	Growing Stock in Forest and on Other Wooded Land	Net Annual Increment	Gross Fixed Capital Formation	Labour Productivity	Net entrepreneurial income
Austria	-0.1636	-0.5035	-0.1134	-0.3617	-0.0874	0.7723	-0.3312
Bulgaria	-0.8047	-0.5241	-0.5610	-0.6664	-0.8952	-1.0211	-0.8806
Croatia	-0.9770	-0.6815	-0.7765	-0.8421	-0.8318	-0.9453	-0.9453
Republic of Cyprus	-1.1036	-0.9263	-1.1478	-1.0710	-0.9175	-1.0958	-0.9905
Czech Republic	-0.0668	-0.6610	-0.4597	-0.4939	-0.3067	-0.5101	-0.0750
Finland	0.9219	1.7056	0.9952	1.5676	1.3793	2.3286	1.9847
France	1.6698	1.0730	1.2439	1.2705	0.2177	0.9105	1.4320
Germany	2.4756	0.3567	2.1874	2.2803	0.5075	0.5137	1.2475
Italy	-0.0201	0.3208	0.1818	-0.1523	0.3087	-0.4650	0.0116
Portugal	-0.5971	-0.4006	-0.9839	-0.5328	-0.3960	-0.0302	-0.2488
Romania	-0.3863	-0.1629	0.1293	-0.2452	-0.5585	-0.8637	-0.5744
Slovakia	-0.5837	-0.7456	-0.6821	-0.6917	-0.5047	-0.7988	-0.7793
Slovenia	-0.8761	-0.8234	-0.7806	-0.8133	-0.8252	0.0544	-0.8286
Sweden	0.8200	2.5762	1.5735	1.1709	2.9752	1.6300	1.6125
UK	-0.3083	-0.6033	-0.8061	-0.4189	-0.0654	-0.4795	-0.6346
Coordinates of the pattern point	**2.4756**	**2.5762**	**2.1874**	**2.2803**	**2.9752**	**2.3286**	**1.9847**

At the bottom of the ranking are forestry sectors of Bulgaria, Croatia and Republic of Cyprus respectively on 13, 14 and 15 place (see table 3). Concerning Bulgarian forestry sector the indicators, which contribute to high extent for this unsatisfactory estimation are: firstly, Bulgarian forestry sector is on the fourteenth place by the indicator *gross fixed capital formation* with 4.9 million EUR; secondly, Bulgarian forestry sector is on fourteenth place by the indicator *labour productivity* with 8232.63 EUR per employee; thirdly, Bulgarian forestry sector is on the thirteenth place by the indicator *net entrepreneurial income* with 94.39 million EUR (see table 1).

5 Conclusions

On the grounds of the forestry sector competitiveness estimation in 15 states members of EU the following conclusions concerning Bulgarian forestry sector can be done:

- Bulgarian forestry sector possess forest resources, which permit it a higher place in the competitiveness ranking. In this relation should be mentioned that Bulgarian *forest area and wooded land* is 3845 thousand hectares and ranked Bulgaria on ninth place by this indicator. The

Bulgarian foresty sector is on the same place by the indicator *growing stock in forest and on other wooded land* with 645 000 thousand cubic metres.

- The low competitiveness of Bulgarian forestry sector is mainly due to low labour productivity, low net entrepreneurial income and insuffisient investment;

The insufficient investment in forest roads and equipment lead to poor condition of forest network density (7.9 m/ha) and inaccessibility of certain forest areas. Because of that timber harvesting in them is not possible to be performed, which leads to low labour productivity, low entrepreneurial income and significant difference between timber harvesting and net annual increment.

Table 3: Quantitative Estimation of the Level of Forestry Sector Competitiveness in Some States Members of EU as of 2016

№	National Forestry Sector	Competitiveness Estimation
1	Sweden	0.7962
2	Finland	0.7473
3	France	0.6493
4	Germany	0.6479
5	Italy	0.4217
6	Austria	0.3811
7	Czech Republic	0.3242
8	Romania	0.3192
9	UK	0.3037
10	Portugal	0.3031
11	Slovakia	0.2523
12	Slovenia	0.2428
13	Bulgaria	0.2301
14	Croatia	0.2095
15	Republic of Cyprus	0.1669

6   Acknowledgements

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