

A COMPARISON OF THE IMPORTANCE OF THE FURNITURE MANUFACTURING IN EU COUNTRIES USING CLUSTER ANALYSIS AND HELLWIG'S METHOD

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ABSTRACT

The goal of the paper was to compare the importance of the furniture manufacturing industry in the European Union and indicate the groups of countries showing similarities in terms of the selected economic and production features. For this purpose, cluster analysis and multivariate linear ordering analysis were conducted. Italy, Poland and Germany were at the forefront of the list taking into account selected economic and production indicators of the furniture industry. The last places in the ranking were taken by small countries (Luxembourg, Cyprus, Malta, Greece) characterised by a low level of the furniture production and a relatively small number of enterprises. The conducted research allowed to determine the position of the furniture manufacturing industry of the EU countries as well as to identify the most relevant competitors within certain strategic groups. This may influence the national strategy of building a competitive advantage on the international market.

Keywords: furniture manufacturing, EU countries, cluster analysis, Hellwig's method.

INTRODUCTION

Furniture manufacturing with the wood and pulp and paper industries belong to the woodworking sector. These are based on processing wood, i.e. domestic ecological resource (POTKÁNY *et al.* 2018). Wood raw material obtained in forestry is the starting link in the chain of forestry and wood products. Value-added wood products are primary wood products that have been further processed into secondary products (FOREST PRODUCTS... 2017-2018). A significant part of them comprises furniture.

The furniture industry is an important component of the EU economy, and the EU plays a particularly significant role in the global furniture market. Approximately one-quarter of the world's furniture is manufactured within the European Union (BARBARITANO *et al.* 2019). The dominance of micro-firms and small medium-sized enterprises in the furniture industry is driving the furniture market growth in the region (ZION MARKET... 2018). The dynamic development of this industry has been observed over the years. In 2017, the value of global furniture production reached nearly USD 450 billion. For comparison, in 2003, it amounted to USD 223 billion, and in 2008, USD 278 billion. In just 15 years, furniture production doubled, and in the last 10 years, it has grown by over 60% (JIVKOV 2019). It is estimated that the size of the furniture market in 2019 was valued at approximately USD 609 billion (GLOBAL MARKET INSIGHT 2020). European and North American furniture manufacturing has lost considerable market share since the 1990s,

mostly to Asian countries. In Europe furniture manufacturing has grown most rapidly in the Czech Republic, Poland, Portugal and Romania (FOREST PRODUCTS...2017-2018).

The largest furniture manufacturers include China, USA, Germany, India, Italy and Poland (HAN *et al.* 2009, GRZEGORZEWSKA and STASIAK-BETLEJEWSKA 2014, JIVKOV 2019). Additionally, apart from China, Germany, Italy and Poland are the largest furniture exporters (GRZEGORZEWSKA *et al.* 2020). In the face of increasing competition, the international competitive ability of wood-based industries (including furniture production) is of growing importance, which has been the subject of research in relation to various countries (HAN *et al.* 2009, HAJDÚCHOVÁ and HLAVÁČKOVÁ 2014, HITKA *et al.* 2017, MILIĆEVIĆ *et al.* 2017, HITKA *et al.* 2019).

Many factors are used to determine the development of the furniture industry. Due to the close links with forestry, geographic and natural factors are taken into account, especially resources and availability of wood raw material. The development and competitiveness of the furniture industry is influenced by economic and market conditions, e.g. demand, economic situation, fluctuations in exchange rates, competition, changes in prices of wood raw materials and other materials. Market trends and demand are closely related to drivers. These include economic growth, urbanization, family incomes, and trends in housing and construction (FOREST PRODUCTS...2017-2018, TRACOGNA 2013, KAUFINGER 2014). Additionally, market tendencies in the furniture industry are determined by design, demographics, and changes in consumer preferences (PAKARINEN and ASIKAINEN 2001, KOZAK 2004).

In studies concerning the development of the wood-based industry and the level of its competitiveness, the necessity to improve the production capacity, introduce innovations (CAO and HANSEN 2006, GRZEGORZEWSKA and WIĘCKOWSKA 2016, SEDLIÁČIKOVÁ *et al.* 2019, RATNASINGAM *et al.* 2018), enhance the quality of products (TOIVONEN 2012, LOUČANOVÁ *et al.* 2015) and take environmental issues into account (MALÁ *et al.* 2018, WIĘCKOWSKA, GRZEGORZEWSKA 2019) tends to be emphasised. CHOBANOVA and POPOVA (2015) identified the challenges before the furniture industry and characterised the state of the art and trends among others in the manufacture of the furniture, consumption, import/export, availability of raw materials and components. STASIAK-BETLEJEWSKA *et al.* (2020) analysed global macroeconomic trends affecting the furniture market and gave recommendations to furniture companies. OBLAK *et al.* (2020) analysed the European furniture market in terms of challenges, effective strategies, and key factors.

Considering variable circumstances, processes of economic globalisation and internationalisation of enterprises, particularly in export-oriented sectors, which in some European countries include the furniture industry, there is a necessity to constantly monitor the position of a given country in the European and global furniture market. This is of increasing importance because the group of countries eagerly aiming to develop this industry, and seek fresh sources of competitive advantage, are constantly growing. The goal of this paper is to compare the importance of the furniture industry in the European Union member states, indicate the groups of countries showing similarities in terms of the selected economic and production features associated with the production and operation of business entities as well as to specify the positions of particular countries in the EU market based on these variables.

METHODOLOGY

The main source of statistical data was Eurostat (2020). The research concerned the furniture industry, which in the NACE Rev. 2 classification is placed in section C31

Production of furniture. The analysis covers years 2010–2016, because complete and reliable statistical data were obtained during this period. However, Ireland was excluded from the analysis due to the significant volume of missing data. During the first stage of the study, k-means clustering was conducted to identify which of the analysed objects (EU member states) were the most related to each other in terms of the highlighted criteria. Indicators concerning the furniture production and economic entities functioning in the European furniture market were specified. These included furniture production value [million euro], number of enterprises [pcs.], furniture production value per 1 enterprise [thousand euro] which is the ratio of the furniture production value to the number of enterprises and the share of the production value of the furniture manufacturing in the GDP [%]. Similar economic and production indicators were also included in previous analyzes regarding the importance and position of the furniture industry (e.g. SMARDZEWSKI 2009, RATAJCZAK 2014, CHOBANOVA and POPOVA 2015, STASIAK-BETLEJEWSKA *et al.* 2020).

Cluster analysis is an approach used for studying similarities of observations with respect to the analysed phenomenon (FRĄTCZAK *et al.* 2009). It consists of finding homogeneous subsets in a heterogeneous set of objects, i.e. determining objects, which are more similar to objects forming a particular group (cluster) than to objects from outside of this group (BALICKI 2009, KISIELIŃSKA 2009). Hence, the aim of the cluster analysis was to identify the groups of EU member states, which were similar to each other in terms of particular aspects of activity in the furniture industry. Due to the diversified measuring scales of the variables, the procedure of their standardisation was implemented in order to normalise the measurement units as well as to eliminate the diversification of variables in terms of the location and variability of the studied population (BALICKI 2009). The factorial k-means analysis started with determining the number K of classes (clusters), into which the set of observations should be divided. Subsequently, the average vectors, also known as the centres of gravity, were calculated in each iteration. These were the points determining the value, within which the points included in the cluster were located. The determination of these median values enabled the classification of the objects into clusters. Every object O_i ($i = 1, \dots, n$) was assigned into a group with the closest centre of gravity, i.e. $O_i \in S_j$ where $d(O_i, M_j) = \min_k d(O_i, M_k)$, where d refers to the Euclidean distance. A given object (country) was assigned to the cluster whose centre was the closest. In subsequent iterations, attempts were made to enhance the assignment of the objects. This was possible because the hierarchy of clusters was not previously specified, and the objects could move between groups. This means that for S_j ($j = 1, \dots, k$), new gravity centres were calculated as arithmetic averages of all objects belonging in a particular group (FRĄTCZAK *et al.* 2009).

The cluster analysis was complemented by multivariate data analysis utilising linear classification methods. Considering its wide range of applications and universality in studying economic and social phenomena, the Hellwig's method was also introduced in the analysis. Initially, the degree of differentiation of the studied features was specified using the coefficient of variation. Features for which the coefficient of variation exceeded the value of 0.1 were adopted for subsequent analyses. All analysed variables met the variability criterion. Additionally, uncorrelated features were taken into account, i.e. those below the value of 0.7 (KISIELIŃSKA 2012). In the conducted analyses, the calculated coefficient of variation confirmed the required level of differentiation in the case of all features constituting the base for the synthetic measure.

Hellwig's method requires finding a potential influence of variables on the examined phenomenon.

The calculation scheme of Hellwig's method is as follows:

1. Determining the stimulant and destimulant among the studied variables.
2. Performing zero unitarisation for stimulants and destimulants (eq. 1 and 2).

3. Finding an abstract development pattern - for stimulants, the pattern is the maximum value of a feature from a given set of objects/countries (eq. 3), and for destimulants, the pattern of development is the minimum value of a feature from a given set of objects/countries (eq. 4).
4. Calculating the Euclidean distance of the feature value of each object/country from the adopted development pattern (eq. 5).
5. Determining a development measure that takes into account all the examined features (eq. 6 and 7).
6. Assigning individual objects/countries an appropriate natural number, following the criterion of the decreasing value of the development measure each year.
7. Calculating of the arithmetic mean of Hellwig's development measure in the whole analysed period.
8. Calculating of the final position of objects/countries in the analysed period on the basis of the calculated arithmetic mean.

Stimulants are specific features, the high values of which are desired from the viewpoint of this phenomenon, whereas low values are considered undesirable. In the case of destimulants, the opposite is true. In the conducted research, all features were stimulants. Subsequently, the specified features were normalised, which involved assigning appropriately processed (transformed) variables to the original variables. To this end, reset unitisation was used, as it fulfils all the requirements for data normalisation. The transformations of the variables were performed according to the following formulas (KUKUŁA 2014):

– for stimulants:

$$Z_{ij} = \frac{x_{ij} - \min_i x_{ij}}{\max_i x_{ij} - \min_i x_{ij}} \quad (1)$$

– for destimulants:

$$Z_{ij} = \frac{\max_i x_{ij} - x_{ij}}{\max_i x_{ij} - \min_i x_{ij}} \quad (2)$$

Subsequently, an abstract object, i.e. a so-called development model z_{0j} with the most optimal values for each variable as well as an anti-model $z_{_0j}$ with the worst values for each variable were specified. These were determined according to the following relationships (STEC 2011):

$$\begin{cases} z_{0j} = \max z_{ij} , & \text{when } x_j \text{ is a stimulant} \\ \quad \text{lub} & j = 1, 2, L, m \\ z_{0j} = \min z_{ij} , & \text{when } x_j \text{ is a destimulant} \end{cases} \quad (3)$$

$$\begin{cases} z_{_0j} = \min z_{ij} , & \text{when } x_j \text{ is a stimulant} \\ \quad \text{lub} & j = 1, 2, L, m \\ z_{_0j} = \max z_{ij} , & \text{when } x_j \text{ is a destimulant} \end{cases} \quad (4)$$

In the subsequent step, the similarities of the objects with respect to the best abstract object were analysed by calculating the Euclidean distance of each object from the development model (BALICKI 2009):

$$d_{i0} = \sqrt{\sum_{j=1}^p (z_{ij} - z_{0j})^2} \quad (5)$$

In the next step, the so-called measures of development were determined for each object (country) according to the following formula:

$$m_i = 1 - \frac{d_{i0}}{d_0} \quad (6)$$

where:

$$d_0 = \sqrt{\sum_{j=1}^p (z_{0j} - z_{0j})^2} \quad (7)$$

m_i – development measure for the i th object,

d_0 – distance between the model of development and the anti-model.

The values of the Hellwig's development measure were in the range from 0 to 1, whereby the measure of development calculated for the model was equal to one, and for the anti-model – zero. A higher value of the development measure indicated a higher level of the studied complex phenomenon. Based on the obtained values of the development measure, rankings were built separately for each year (2010–2016). Then, using the arithmetic mean, the average value of Hellwig's development measure over the entire period was calculated. All analyses were performed using the MS Excel Office 2016 and SPSS Statistics 24.0 package. In the case of studying the significance of the diagnostic variables in the cluster analysis, the inference was made at the significance level of $\alpha = 0.05$.

RESULTS AND DISCUSSION

The preliminary k-means clustering conducted for the EU countries showed that with three cluster centres, the convergence in the cluster centres was achieved after three iterations. The addition of one more cluster centre allowed for the convergence to be achieved after two iterations. Finally, the data were analysed and grouped into four cluster centres. There was one country in the first centre (i.e. Lithuania), 19 countries in the second centre (Austria, Belgium, Finland, France, Greece, Spain, Netherlands, Luxembourg, Portugal, Sweden, United Kingdom, Bulgaria, Croatia, Cyprus, Czech Republic, Malta, Slovakia, Slovenia, Hungary), 2 countries (Denmark, Germany) in the third and 5 countries (Italy, Estonia, Latvia, Poland, Romania) in the fourth. The summary of the affiliation of particular countries to the centres is presented in Table 1.

Tab. 1 Affiliation of EU countries to various cluster centres due to the importance of the furniture industry

Country	Cluster	Distance	Country	Cluster	Distance	Country	Cluster	Distance
Lithuania	1	0.000	Portugal	2	0.604	Slovenia	2	0.804
Austria	2	0.767	Sweden	2	0.812	Hungary	2	0.701
Belgium	2	0.792	United Kingdom	2	1.133	Denmark	3	1.368
Finland	2	0.725	Bulgaria	2	0.822	Germany	3	1.368
France	2	0.694	Croatia	2	0.910	Italy	4	1.220
Greece	2	0.745	Cyprus	2	0.862	Estonia	4	1.590
Spain	2	0.476	Czech Republic	2	0.661	Latvia	4	1.108
Netherlands	2	0.302	Malta	2	0.718	Poland	4	0.745
Luxembourg	2	1.345	Slovakia	2	0.698	Romania	4	0.710

Due to the diversified measuring scales of the variables, the procedure of their standardisation was implemented in order to normalise the measurement units as well as to eliminate the diversification of variables in terms of the location and variability of the studied population. The conducted analysis of variance revealed that the strongest diagnostic variable was the share of the furniture production value in the GDP [%]. The second strongest variable was the furniture production value per 1 enterprise [thousand euro] and the third variable was the furniture production value production [million euro]. The number of enterprises [pcs] was determined as an unsuitable diagnostic variable differentiating particular clusters. The summary of the analysis of variance is presented in Table 2.

Tab. 2 The analysis of variance of diagnostic variables related to the furniture industry.

Itemisation	Cluster		Error		F test	Significance
	Mean square	df	Mean square	df		
Furniture production value [million euro]	0.140	3	0.056	23	3.501	0.009
Number of furniture enterprises [pcs.]	0.034	3	0.037	23	0.909	0.452
Furniture production value per enterprises [thousand euro]	6.819	3	0.361	23	18.894	0.000
Share of the furniture production value in GPD [%]	7.228	3	0.282	23	25.597	0.000

Table 3 shows the intra-class mean values (average values per country) of selected diagnostic variables indicating the importance of the furniture industry in those countries. The first cluster included only Lithuania. This cluster was characterised by the lowest number of enterprises and a relatively low total production value. However, attention should be paid to the value of this production per enterprise, which was on average twice as high as the average in the EU13 countries. Moreover, Lithuania stood out as the country with the highest importance of the furniture industry for the national economy, which was confirmed by the large share of the furniture production in the GDP value. It is a relatively small country, which in terms of the production value was in the 15th place at the end of the studied period. However, the country showed the highest dynamics of the production growth in terms of value.

Tab. 3 Intra-class means of selected variables characterising the furniture industry in the EU countries

Itemisation	Cluster			
	1	2	3	4
Furniture production value [million euro]	1065.3	2013.4	10651.1	5974.7
Number of furniture enterprises [pcs.]	1468.0	4000.1	4825.5	9057.2
Furniture production value per enterprises [thousand euro]	725.4	538.2	3103.1	585.5
Share of the furniture production value in GPD [%]	3.21	0.51	0.72	1.50

The second cluster comprised as many as 19 EU countries, including those classified as new and old member states. These countries showed on average the lowest share of the furniture industry in creating GDP – lower than the EU average in the studied period. Furthermore, the cluster was characterised by a relatively low production value per enterprise. It should be noted that this cluster included countries with a low as well as a relatively high level of economic development.

The third cluster included two countries – Denmark and Germany, which demonstrated the highest total value of the furniture industry production as well as per enterprise. In addition, these countries are characterised by high labour productivity. In contrast, the furniture industry was less important for the national economies of these countries than in the case of Lithuania and the countries belonging to the last cluster. Moreover, Germany is one of the world's largest producers of furniture and wood-based panels.

Five countries were included in the fourth cluster, which was characterised by a relatively high share of the value of the furniture production in generating GDP. This indicated that the furniture industry in these countries was very important to their national economies. This cluster was also distinguished by the significant furniture production value. However, due to the large number of economic entities operating in the industry, the furniture production value per enterprise placed the countries below the EU average.

Thanks to the cluster analysis, countries were identified that are similar to each other in terms of selected economic and production factors. This means that it is possible to identify countries that may be the biggest competitors in the European furniture market. Countries with similar production capacities and a similar number of enterprises should first look for sources of advantage within their own strategic group. Small countries, where the furniture industry is not strongly developed, have limited opportunities to compete with the largest furniture manufacturers.

Cluster analysis showed which countries are in clusters and therefore are similar to each other. However, this method did not provide information on the position of individual countries. Hence, it was important to develop a ranking of countries taking into account the importance of their furniture sector on the EU market.

Tables 4 and 5 show that Italy is the leader in the ranking of the EU member states, which was developed using the Hellwig's method based on the indicators concerning the production activity of enterprises. The position of this country did not change in the analysed period. However, the measure of Hellwig's development pattern slightly decreased from 0.519 to 0.459. The Italian economy recorded the highest values of the furniture production and the largest number of economic entities. Considering the level of production per enterprise, Italy was also at the top of the list, and the importance of this industry for the national economy was twice as high as the EU average.

In the list of key production indicators, Poland ranked a high, second place. The measure of Hellwig's development pattern was at a similar level in years 2010-2016 (coefficient of variation $V = 4.23\%$) and at the end of the analysed period, it was equal to 0.426. Poland moved up from the 6th to the 4th place in terms of the furniture production value. At the same time, similarly to the case of Italy, a relatively large number of economic entities actively operating in the market caused a decrease in production per enterprise. In turn, the importance of the furniture production for the national economy was confirmed by the relatively large share of the value of this production in generating the GDP. This indicator was three times higher than the average in the EU countries.

Somewhat different trends were noted in the case of Germany in 2016, where a slight increase in the value of the Hellwig's index was observed (i.e. to a level of 0.387). Furthermore, a relatively high value of the furniture industry production and the value of that production per enterprise were observed. In addition, the importance of the furniture industry for the national economy was not as evident as in the case of the previous countries, which was confirmed by the share of furniture production in the aggregate value of goods and services, which was at the level of approx. 0.7%.

In 2010–2016, Italy, Poland and Germany were at the top of the ranking, and the positions of these countries remained unchanged. The distinctive role of these countries in the furniture market was emphasised, among others, by HAN *et al.* (2009), ZHELEV (2013),

GRZEGORZEWSKA and STASIAK-BETLEJEWSKA (2014), VU *et al.* (2019) and STASIAK-BETLEJEWSKA *et al.* (2020). These countries show the highest production value among the EU states, and for years have been in the group of the largest furniture exporters, behind the leader, China. However, it should be pointed out that Poland and Italy are relevant net exporters of the wood-based industry, while in the case of Germany, for years there has been a surplus in the value of furniture imports over exports (DIETER and ENGLERT 2007, VU *et al.* 2019). Additionally, the Polish furniture manufacturers and exporters exhibited a relatively large international competitiveness in the foreign trade in relation to Italy and Germany (GRZEGORZEWSKA *et al.* 2020). This is also due to the fact that in Poland furniture is wood products of special importance because of its high value added and huge share within foreign trade. The Polish furniture industry generated the highest value added amongst the wood industries (RATAJCZAK 2014). The most important challenges for the Polish furniture industry include maintaining the current level and dynamics of furniture sales to Western European countries and the development of the potential of Eastern markets, as well as the sale of furniture under own brands. According to STASIAK-BETLEJEWSKA *et al.* 2020, this requires greater control in the distribution of products to the end customer and much greater involvement in marketing activities on foreign markets.

Tab. 4 Measure of the Hellwig's development pattern for EU countries according to selected criteria in 2010–2016

Country	2010	2011	2012	2013	2014	2015	2016	Mean	SD*	V**
Italy	0.519	0.517	0.497	0.465	0.472	0.460	0.459	0.484	0.026	5.46
Poland	0.434	0.409	0.432	0.382	0.414	0.416	0.426	0.416	0.018	4.23
Germany	0.386	0.404	0.405	0.403	0.392	0.385	0.387	0.394	0.009	2.28
Lithuania	0.273	0.285	0.299	0.307	0.306	0.315	0.313	0.300	0.016	5.18
United Kingdom	0.249	0.270	0.249	0.250	0.256	0.276	0.295	0.263	0.017	6.62
Estonia	0.247	0.259	0.258	0.244	0.245	0.226	0.238	0.245	0.012	4.70
Spain	0.298	0.294	0.268	0.235	0.218	0.211	0.208	0.248	0.039	15.63
Denmark	0.285	0.262	0.254	0.235	0.232	0.214	0.216	0.243	0.026	10.54
France	0.232	0.240	0.243	0.229	0.234	0.228	0.221	0.232	0.008	3.23
Austria	0.228	0.224	0.225	0.207	0.206	0.193	0.187	0.210	0.016	7.73
Romania	0.227	0.224	0.214	0.203	0.209	0.203	0.203	0.212	0.010	4.79
Sweden	0.197	0.195	0.207	0.193	0.190	0.170	0.167	0.186	0.014	7.59
Netherlands	0.179	0.186	0.180	0.172	0.174	0.167	0.173	0.176	0.006	3.60
Portugal	0.192	0.193	0.178	0.157	0.161	0.157	0.163	0.172	0.016	9.37
Czech Republic	0.181	0.167	0.171	0.159	0.152	0.143	0.140	0.157	0.012	7.56
Belgium	0.156	0.161	0.160	0.143	0.150	0.140	0.148	0.151	0.008	5.48
Latvia	0.158	0.148	0.140	0.136	0.145	0.142	0.140	0.144	0.007	5.02
Slovakia	0.164	0.145	0.139	0.124	0.126	0.136	0.137	0.143	0.025	17.24
Croatia	0.156	0.150	0.148	0.139	0.133	0.117	0.124	0.138	0.014	10.32
Slovenia	0.182	0.171	0.150	0.124	0.113	0.111	0.105	0.136	0.031	22.76
Bulgaria	0.152	0.144	0.140	0.134	0.132	0.126	0.124	0.136	0.010	7.37
Finland	0.125	0.129	0.135	0.127	0.124	0.117	0.114	0.124	0.007	5.61
Greece	0.161	0.154	0.138	0.093	0.067	0.066	0.074	0.108	0.042	39.20
Hungary	0.099	0.093	0.093	0.085	0.084	0.081	0.084	0.089	0.007	7.67
Malta	0.140	0.104	0.087	0.068	0.078	0.073	0.073	0.089	0.026	28.98
Cyprus	0.107	0.106	0.087	0.072	0.067	0.055	0.049	0.078	0.023	29.70
Luxembourg	0.015	0.018	0.021	0.023	0.025	0.028	0.027	0.023	0.005	21.21

*SD- standard deviation

**V- coefficient of variation

In the analysed period, Lithuania was also ranked high in the ranking of the Hellwig's development pattern. The measure of the development pattern in the considered period increased from 0.273 to 0.313. It should be emphasised that Lithuania advanced by two

places compared to 2010. It is the only country among the EU member states that was alone in a cluster. Although Lithuania was characterised by a relatively low furniture production value, the level of this production per enterprise placed the country high in the ranking. In addition, it should be emphasised that the Lithuanian furniture industry is of great importance for the domestic economy. During the studied period, this indicator increased from 2.4% to 3.8%. Moreover, the share of the furniture industry in the total industrial production value increased from 5.8% to 7.9%. These were the highest values among the group of EU member states. As mentioned by KALĖDIENĖ *et al.* (2010), in Lithuania, the wood manufacturing and furniture industry are very old and traditional industries. This is because the processing of wood in Lithuania has favourable conditions, nearly a third of Lithuania's territory is covered with forests. Quite cheap labour force and high qualifications are big competitive advantages for Lithuania in foreign markets.

Tab. 5 Positions of EU countries in the Hellwig's ranking in 2010–2016.

Country	2010	2011	2012	2013	2014	2015	2016	Mean	Change
Italy	1	1	1	1	1	1	1	1	0
Poland	2	2	2	3	2	2	2	2	0
Germany	3	3	3	2	3	3	3	3	0
Lithuania	6	5	4	4	4	4	4	4	2
United Kingdom	7	6	8	5	5	5	5	5	2
Estonia	8	8	6	6	6	7	6	6	2
Spain	4	4	5	7	9	9	9	7	-5
Denmark	5	7	7	8	8	8	8	8	-3
France	9	9	9	9	7	6	7	9	2
Austria	10	10	10	10	11	11	11	10	-1
Romania	11	11	11	11	10	10	10	11	1
Sweden	12	12	12	12	12	12	13	12	0
Netherlands	16	14	13	13	13	13	12	13	4
Portugal	13	13	14	15	14	14	14	14	-1
Czech Republic	15	16	15	14	15	15	16	15	0
Belgium	20	17	16	16	16	17	15	16	5
Latvia	19	20	20	18	17	16	17	17	2
Slovakia	17	21	21	21	20	18	18	18	-1
Croatia	21	19	18	17	18	20	19	19	2
Slovenia	14	15	17	22	22	22	22	20	-8
Bulgaria	22	22	19	19	19	19	20	21	2
Finland	24	23	23	20	21	21	21	22	3
Greece	18	18	22	23	26	25	24	23	-6
Hungary	26	26	24	24	23	23	23	24	3
Malta	23	25	26	26	24	24	25	25	-2
Cyprus	25	24	25	25	25	26	26	26	-1
Luxembourg	27	27	27	27	27	27	27	27	0

The top ten countries in the ranking included both old and new member states, i.e. United Kingdom, Estonia, Spain, Denmark, France, Austria and Romania. In this group, it is possible to identify countries belonging to EU-15 (United Kingdom and France), which are characterised by a significant production of furniture and a relatively high number of enterprises; however, their furniture industries are two times less important for the national economies than the EU average. Nevertheless, the top ten also included smaller EU-13 countries, such as Estonia or Romania, where the share of the furniture industry in generating GDP was twice as high as the EU average. In recent years, the furniture production and export in Romania have increased significantly, primarily due to industry restructuring and large investments in new technologies (BURJA and MĂRGINEAN 2013). The furniture industry also plays a relevant role in the Romanian economy, due to its great impact on the

commercial balance through the generated financial flows. However, producers from Romania have to still invest to become more competitive, so that they can increase their profits and raise the exports (PUIU *et al.* 2012). Research, innovation, and development are neglected in a Romanian furniture sector that is activity-dependent on creation, development, and innovation, as these elements may improve performance (MARINESCU 2008).

During the considered period, as many as 12 countries improved their position in the ranking, which was prepared based on the Hellwig's method. The largest improvements were observed in the case of Belgium (5 places higher) and the Netherlands (4 places higher); however, these countries were still placed in the middle of the ranking, taking the 13th and 16th place, respectively. On the other hand, a decrease in the importance of selected features concerning the production activity of furniture enterprises was recorded for Slovenia (by 8 places) and Greece (by 6 places). The last places in the ranking were occupied by small countries (i.e. Luxembourg, Cyprus, Malta), which showed a low level in the case of all examined diagnostic variables. These are the countries characterised by a low level of production in the furniture industry, which is accompanied by a relatively small number of enterprises. The furniture production does not play a significant role in the economies of these countries, which was confirmed by the low share of the furniture industry in creating the value of industrial production and GDP. This group also showed the highest variability of the Hellwig index in the studied period ($V > 20\%$).

The methods used in the research have some limitations. K-means cluster analysis requires the number of groups to be defined, although it is usually not known how many groups there are in the set being processed. Moreover, the starting centroids are chosen at random while their selection has a decisive influence on the quality of the resulting clustering. Despite many disadvantages, it is still one of the most used iterative methods since it is easy to implement. Likewise, among the methods of linear ordering, Hellwig's method is one of the most used. However, this method may turn out to be not very objective due to the relative nature of many variables and the need to select variables for analysis. In futures studies, an attempt can be made to use non-hierarchical iterative methods, as well as the method of standardised sums and sum (or mean) ranks. However, in the latter, the use of continuous variables in the research means that the natural numbers assigned to the objects do not reflect the real differences between the objects.

CONCLUSION

The furniture industry is an important component of the EU economy, and the EU plays a special role in the global furniture market. The EU largest furniture manufacturers include Germany, Italy and Poland. However, the importance of the furniture industry for the national economies of individual countries as well as their role in the EU and global markets is diversified. Competition in the furniture market also comes from smaller EU 13 countries, where the furniture industry is of great importance to the national economy.

The conducted research allowed to determine the position and economic and production importance of the furniture manufacturing industry in the EU countries, as well as to identify the most relevant competitors within certain strategic groups. This is important information for representatives of the furniture manufacturing industry and government that may influence the national strategy of building a competitive advantage on the international market.

Knowledge of the most important competitors in the EU and global market helps in the search for sources of competitive advantage. One of the major challenges of most EU countries is to increase their role in the global furniture market. It is not only about

maintaining the current level and dynamics of furniture sales. In the case of the EU13 countries, it is also important to develop the sale of furniture under producers of private labels, which requires a greater involvement in marketing activities. It is also important to emphasise strong traditions, use of modern design, and emphasise ecology and sustainable development. In this regard, it is worth following good practices applied, inter alia, by Italian furniture manufacturers. Hence, it is important to build a development path for the furniture industry and prepare a development strategy at the national level.

European countries, especially EU13, should strengthen their business model based on added value for the consumer. It is important to assess the market opportunities of individual countries and anticipate potential threats, and consequently, reduce the risk of wrong decisions in order to cope better in highly competitive markets. However, the effective implementation of the strategy at the national economic level requires a thorough knowledge of internal and external factors that determine the development opportunities of the industry. The conducted research makes it possible to determine the patterns of competition in the sector and to further analyse the environment, including actual competitors.

In subsequent research stages, it is also essential to take into account the labour productivity, labour costs as well as foreign trade as important sources of building a competitive advantage in the global and European furniture manufacturing market.

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