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FURNITURE INDUSTRY IN EASTERN EUROPE: CHALLENGES AND OPPORTUNITIES FOR SUSTAINABLE DEVELOPMENT

The paper presents results of research performed for furniture industry. The present researching is based on the comparison of the furniture industries for three ENP countries (Ukraine, Moldova and Georgia) in the one hand and furniture industries of Poland and Austria from the other. In the process of the researching authors of this paper: a) carried out analysis of the furniture industry development for the period from 2008 to 2012 in researching countries on the base of absolute indexes; b) presented comparative analysis for 2012 on the base of the main parameters for furniture industry of the mentioned above countries on the base of relative indexes; c) identified regression model which determines dependence of such very important value as turnover per capita in furniture industry from the following indexes - number of enterprises in furniture manufacturing per 1 mil inhabitants, average number of employees per enterprise in the national scale, GDP per capita, volume of the produced industrial round wood per capita, volume of the produced fiberboard per 1000 persons, volume of the produced particleboard per 1000 persons. As a result on the base of the carried out researching it has been identified main challenges and opportunities of the sustainable production for furniture industry in Eastern Europe.

Keywords: furniture industry, comparative analysis, regression model, ENP countries.

Introduction. Future sustainable development of the furniture industry in Eastern Neighborhood Partnership countries, especially in such countries as Ukraine, Georgia and Moldova is extremely important. There are at least a few reasons why it should consider furniture manufacturing in these countries as such that deserves especial attention and additional researching:

- furniture industry is one of the most important consumer of such unique resource as forest [Os-ses et al. 2013] and therefore development of this industry can offer a simple way to reduce the CO₂ emissions that is the main cause of Climate Change, through the carbon storage effect of wood products and substitution effect of carbon-intensive materials;
- Ukraine, Georgia and Moldova have signed trade agreement with EU and have announced their commitments to EU direction and nowadays economic development for these countries gains especially considerable value;
- there are some objective prerequisites in ENP countries for furniture industry development: they hold sufficient forest resources [Kiyko 2009, Kiyko, Kiyko I. 2012, Gayda 2011-2015]; current level of the furniture industry development is under average EU level and therefore needs considerable improving; there is constant internal demand for furniture pieces in these countries; comparing with some other sub industries furniture manufacturing needs investments but in no such scale as others (for instance automobile industry or infrastructure development); the wood-based industries, emerging anew in post-socialist economies, play a key role in regional development, as they could develop an even stronger impact on regional production, employment and value adding on the basis of regional natural resources simultaneously involving rich regional resource of highly qualified staff and using SMs potential;
- ENP countries hold considerable, yet less developed forest resources with a comparatively average lower land use pressure than in Western Europe [Kiyko O. 2009, Kiyko O., Kiyko I. 2012] and the main point in this regard is the following - a constantly growing demand for wood raw materials in European markets leads to higher raw material import and growing pressure on forests holding substantial, unexploited wood resources in neighbouring Eastern Europe. The main challenge here is to support the development of sustainable management regimes of the abundant resource.

As a rule, for furniture industry development and perspectives evaluation it is using benchmarking approach [Hitka, Sirotiakovà 2012, Smardzewski 2009] which allows to determine current place in some hierarchy (regional, continental or whole world), in-

dustrial network approach [Ratajczak-Mrozek, Herbeć 2014] or mathematical model creation which allows to forecast some future directions for industry or economic sector improving [Kiyko O., Kiyko I. 2012, Merková et al. 2012]. Each of these approaches has some advantages and we can assume that combining them will give some positive synergetic effect for any researching.

Research methodology. The presented researching comprises three successive stages.

1. Evaluation of the furniture industry dynamic for five-year period beginning from 2008 and finishing to 2012. Researching of the dynamics for the furniture industry development was carried out only for four countries: Ukraine, Moldova, Georgia and Poland. As the main parameters for any furniture industry identifying we used the following absolute indexes: overall turnover; number of enterprises; number of employees. Within the frameworks of the absolute indexes counting it was determine that level of the 2008 (the first year of the researching period) is equal to 100 %. The main aim of this stage was an evaluation of the five-year period in regard to furniture manufacturing development before and after world financial crises that was occurred in 2009-2010.

2. Comparative analysis of the furniture industry for five countries (Ukraine, Moldova, Georgia, Poland and Austria). Within the frameworks of this analysis it was used only the following relative indexes for 2012:

- turnover per enterprise in furniture manufacturing;
- turnover per employee in furniture manufacturing;
- number of furniture enterprises per 1 million inhabitants;
- average number of employees per furniture enterprise.

The main aim of this comparison was to identify some disadvantages of the furniture industry in ENP countries.

3. Creation of the mathematical regression model for forecast making in regard to furniture industry development. This stage included sample coefficient of the correlation determining and regression equation receiving.

Sample coefficient of the correlation r was counted as shown in (1):

$$r = \frac{\sum_{i=1}^N (x_i - \bar{x}) \cdot (y_i - \bar{y})}{(N - 1) \cdot S_x \cdot S_y} \quad (1)$$

where: x and y are two random values between which sample coefficient of the correlation was counted; $\bar{x}$ and $\bar{y}$ - two average samples; S_x and S_y - two standard deviations.

As a regression equation it was used the first and the second degree polynomials. Linear dependence it was presented as shown in (2):

$$y = b_0 + \sum_{i=1}^k b_i x_i + \sum_{i,u=1}^k b_{iu} x_i x_u, \quad (2)$$

where: b_0 - free member; b_i - factor's coefficients; b_{iu} - coefficients for factor's interactions, moreover - $i \neq u$.

Quadratic dependence it was presented as shown in (3)

$$y = b_0 + \sum_{i=1}^k b_i x_i + \sum_{i,u=1}^k b_{iu} x_i x_u + \sum_{i=1}^k b_{ii} x_i^2 \quad (3)$$

where: b_{ii} - coefficients for factors in the second degree.

After verification of these two models linear dependence was chosen as an adequate and more precise one. The accuracy of the model was determined by means of such parameter as the sum of squared deviations of differences. In the case of linear model

this sum was $1,4 \cdot 10^{-19}$ and in the case of quadratic model this value was equal to $4 \cdot 10^{-3}$. The presented researching is based on the comparison of the furniture manufacturing in three ENP countries (Ukraine, Moldova and Georgia) in the one hand and Polish and Austrian furniture industries from the other. This “country choice” was motivated by the following reasons:

- Ukraine, Moldova and Georgia are ones of the most important in economic terms representatives of Eastern Partnership;
- Ukraine, Moldova and Georgia declare their commitments to the European way of development and it is important to evaluate their “forest possibilities” at the beginning of this way;
- Austria has one of the most powerful forest sector in the Europe;
- Poland is a country which has passed the way from country of socialist camp to the one of the EU leader;
- there are a lot of similarities between furniture sectors of Ukraine and Poland;
- there are some similarities between forest sectors of Moldova and Georgia.

Results and discussion. Analysis of the furniture industry development carried out on the base of absolute indexes. The main indexes of the furniture industry development for researching countries are presented in table 1.

Table1. Furniture industry development in Ukraine, Georgia, Moldova and Poland for period from 2008 to 2012

Parameters/ Years	2008	2009	2010	2011	2012
Ukraine					
Turnover, bil. UAH	5,4	3,9	4,9	6,2	7,2
Number of enterprises, units	1676	1700	5539	1512	1548
Number of employees, ths. persons	51,3	39,8	38,7	37,1	38,5
Moldova					
Turnover, bil. MDL	0,64	0,55	0,61	0,72	0,69
Number of enterprises, units	225	275	327	362	370
Number of employees, ths. persons	3,6	3,3	3,5	2,5	2,7
Georgia					
Turnover, mil. EUR	9,82	7,56	23,52	38,82	42,76
Number of enterprises, units	193	434	418	401	387
Number of employees, persons	885	1166	1513	2325	2650
Poland					
Turnover, mil. PLN	26419	27724	25728	30182	28788
Number of enterprises, units	24980	24806	26488	26488	27047
Number of employees, ths. persons	153,1	151,0	144,9	144,3	138,6

The main goal of the comparison regarding furniture industry development for four countries was evaluation of the post crises situation in these countries. In order to analyze overall situation in furniture manufacturing it has been used such three parameters as turnover (fig. 1), number of enterprises (fig. 2) and number of employees (fig. 3).

Considering 2008 level as 100 % it is interesting that in 2012 the largest increasing of the turnover for furniture industry we had in Georgia (335 %) but for other countries –much less (33 % in Ukraine, 8 % in Moldova and 9 % in Poland (fig. 1)). As it is presented in fig. 2, considerable changes in regard to number of the furniture enterprises for five years period was identified in Moldova (+ 64%) and in Georgia (+100%) while in Ukraine and in Poland we cannot call these changes as considerable ones (+8% and - 8% respectively). Analyzing such very important for any industry index as number of employees it can point out that excluding Georgia (+199 %) it can observe decreasing

of this number in all other countries (- 25% in Ukraine; -25 % in Moldova; -10 % in Moldova).

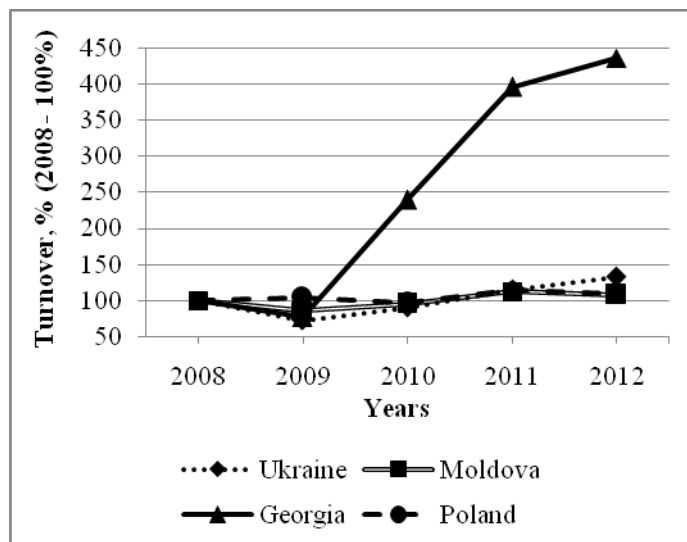


Fig. 1. Changes of the turnover for furniture industry

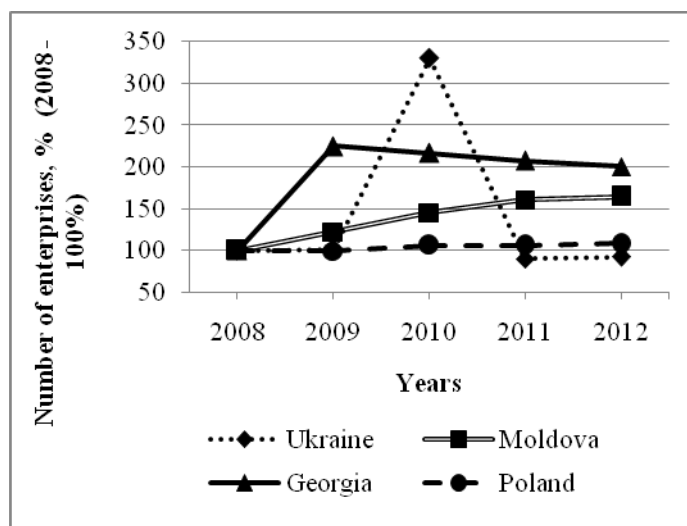


Fig 2. Changes of the number of enterprises for furniture industry

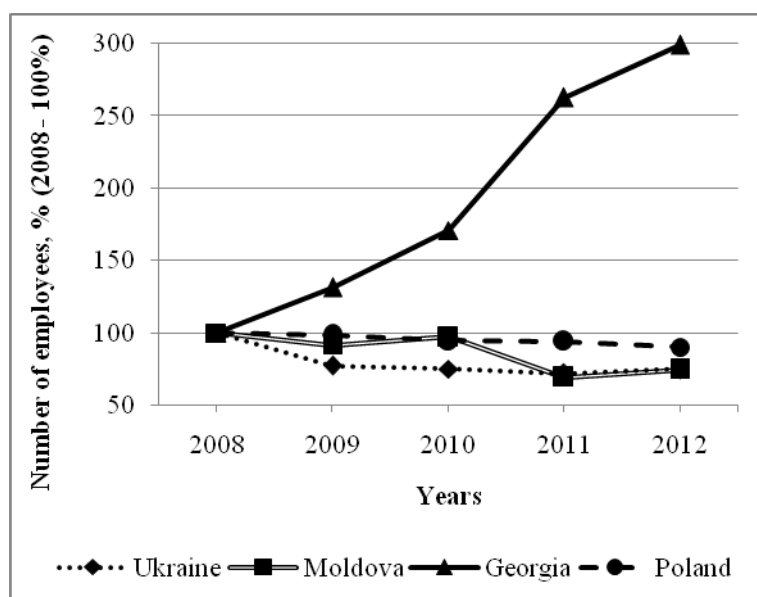


Fig. 3. Changes of the number of employees for furniture industry

Previous comparison carried out on the base of analysis of the dynamics of furniture manufacturing for ENP countries (Ukraine, Moldova and Georgia) and EU member (Poland) shows that:

- furniture industry of Georgia is the most dynamic manufacturing since for the five years period from 2008 to 2012 increasing here was the following: 335 % in turnover terms; 100 % in number of enterprises terms; 199 % in number of employee terms. It will be reasonable to explain such considerable and fast development by vital economic reforms in this country;
- furniture industry of Ukraine regarding its dynamics for five years period can be characterized by the following features: 33% of the turnover increasing presents very weak growing, that can be considered as an increasing within the frameworks of current inflation level; 18 % decreasing of the number of enterprises and 25 % reducing of the number of employees indicate that furniture industry of Ukraine is very weak branch of national economy and maybe the most suitable characteristic in this regard is “unsustainable industry”;
- furniture industry of Moldova has a lot of similarities with furniture industry of Ukraine mentioned in previous point but in reference to Moldova it is necessary to take into consideration poor forest resources of Moldova that exercises significant influence over the development of the furniture industry (0,05 billion m³ of overall timber stock in Moldova against 2 billion m³ of overall timber stock in Ukraine);
- relatively constant parameters characterizing the Polish furniture industry, show that this industry, in contradistinction to ENP countries, it can be considered as more sustainable since even during the financial crisis of 2008 it had no some sudden considerable reducing and negative changes.

In order to formulate final conclusion in regard to state of the furniture industry we need to carry out some additional researching: to analyze for instance some other indexes and factors and then to determine some mathematical relations.

Analysis of the furniture industry development carried out on the base of relative indexes. As we can see in fig. 4, furniture enterprises in ENP countries and in some EU countries are comparable since, for instance in Ukraine, turnover for average company makes up 0,45 million EUR while in Poland this index is equal to 0,26 million EUR per enterprise. At the first view it means that Ukrainian enterprise is more powerful than Polish one but considering such index as turnover per one employee it turns out that in average in ENP countries every employee produces much less furniture pieces in money terms than in Poland and in Austria. This very interesting situation obviously has some reason. In our opinion nowadays in Ukraine there are not so many furniture enterprises as in Poland (fig. 5). If to count number of the furniture enterprises per 1 million of inhabitants it can be observed that in Ukraine such number is 20 times less than in Poland. Additionally to previous information regarding turnover it is very useful to determine number of employees for average furniture enterprise in Ukraine, Moldova, Georgia, Poland and Austria. As it is shown in fig. 6, average Ukrainian furniture enterprise employs 25 persons while in Moldova and Georgia this number makes up 7, in Austria – 9 and in Poland – 5.

There are two main ways of the furniture industry development – so-called German and Italian ways. According to the first of them it is necessary for succeeding in furniture industry to develop this industry having not much but quite powerful furniture enterprises. The main advantage of such way is existence of medium-scale and large-scale enterprises with possibility of expenditure reducing for providing of the competitive price for furniture pieces. According to so-called Italian way of development in furniture industry is provided by a lot of small and medium scale enterprises (sometimes even it means micro scale enterprises) taking into consideration such positive factors as strong competition and a wide variety of different furniture enterprises. According to our analysis such EU countries as Poland and Austria and such ENP countries as Geor-

gia and Moldova are moving considering their furniture industries in Italian direction while Ukraine obviously has not defined its development path since there is not such number like in Italy and such capacity like in Germany. In our opinion this is very threatening economic situation.

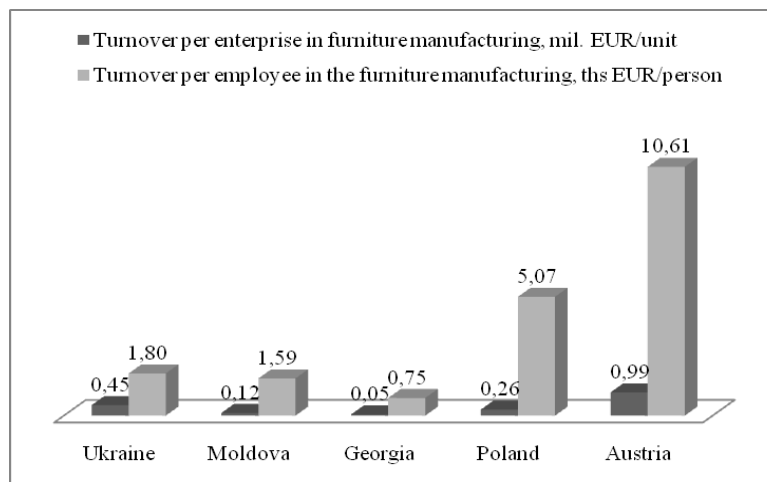


Fig. 4. Turnover for furniture industry (2012)

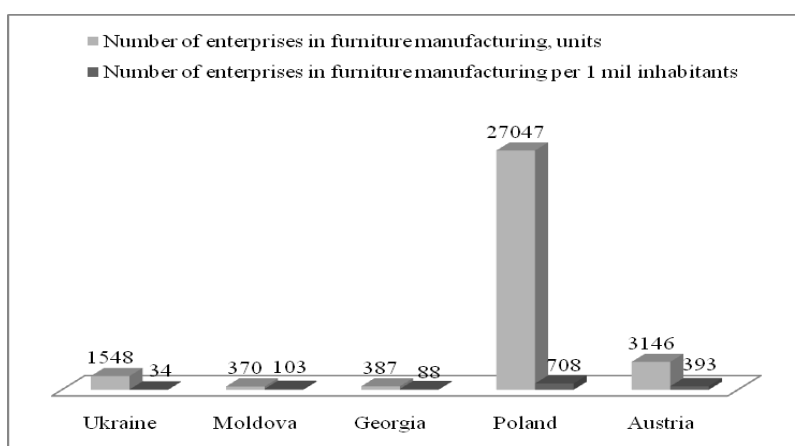


Fig. 5. Number of enterprises in furniture industry (2012)

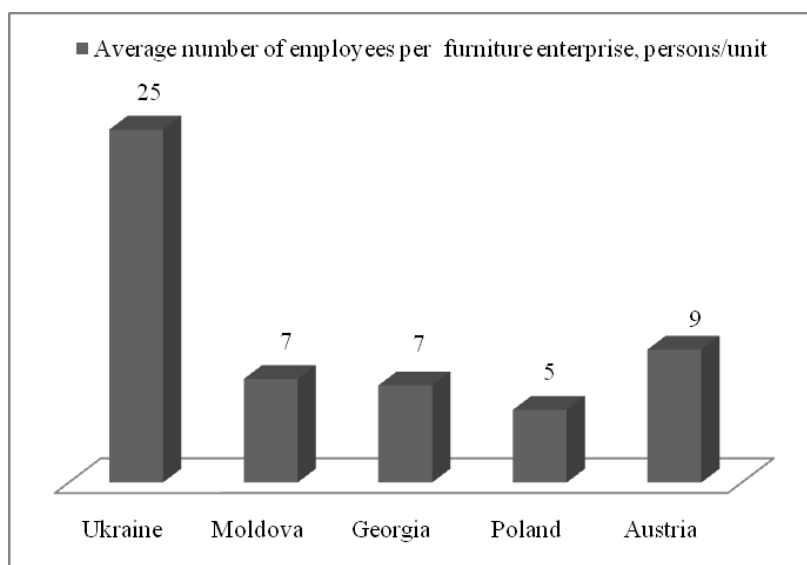


Fig. 6. Number of employees of the furniture enterprise (2012)

Regression model. As input values for the regression model creation we used indexes according to our reckoning mainly determine future development of the furniture manufacturing (tables 2, 3).

Table 2. The main indexes (2012) that impact on the furniture industry development

Country / indexes	Number of enterprises in furniture manufact. per 1 mil inhabitants	Average number of empl. per furniture enterprise pers/unit	GDP per capita (US\$)	Industrial roundwood per capita, m ³ /person	Fiberbord per 1000 person, m ³ /1000 persons	Particle board per 1000 person, m ³ /1000 persons	Annual turnover of the furniture manufact. per person, EUR/pers.
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	Y
	N _{en}	N _{emp}	G _c	I _r	F _b	P _b	T _f
Ukraine	34	25	3873	0,17	6,61	35,18	15
Moldova	103	7	2046	0,01	0,00	0,01	12
Georgia	88	7	3528	0,02	0,00	0,23	5
Poland	708	5	12876	0,86	83,01	127,49	184
Austria	393	9	48342	1,60	93,75	281,25	391

Table 3. The Value of the coefficient of the sample correlation

Indexes	Number of enterprises in furniture manufact. per 1 mil inhabitants	Average number of empl. per furniture enterprise pers/unit	GDP per capita (US\$)	Industrial roundwood per capita, m ³ /person	Fiberbord per 1000 person, m ³ /1000 persons	Particle board per 1000 person, m ³ /1000 persons
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆
	N _{en}	N _{emp}	G _c	I _r	F _b	P _b
Value of the coefficient of the sample correlation between input value and annual turnover of the furniture manufacturing	0,65	-0,26	0,97	1,00	0,93	0,99

As a result of the data treatment, have been received equation of the regression (1) for output value (annual turnover of the furniture manufacturing per person) determining depending on the six independent input values (table 2):

$$\begin{aligned}
 T_f = & 2,4 \cdot 10^{-5} + 0,003 \cdot N_{en} + 0,0002 \cdot N_{emp} - 0,0022 \cdot G_c + 236,17 \cdot I_r + 7,8 \cdot 10^{-7} \cdot F_b + \\
 & + 3,44 \cdot 10^{-6} \cdot P_b + 0,025 \cdot N_{en} \cdot N_{emp} + 1,04 \cdot 10^{-5} \cdot N_{en} \cdot G_c - 2,06 \cdot 10^{-6} \cdot N_{en} \cdot I_r + \\
 & + 6,27 \cdot 10^{-5} \cdot N_{en} \cdot F_b + 4,71 \cdot 10^{-5} \cdot N_{en} \cdot P_b - 0,0004 \cdot N_{emp} \cdot G_c + 9,38 \cdot 10^{-7} \cdot N_{emp} \cdot I_r + \\
 & + 5,76 \cdot 10^{-5} \cdot N_{emp} \cdot F_b + 0,0002 \cdot N_{emp} \cdot P_b - 0,0002 \cdot G_c \cdot I_r - 0,0003 \cdot G_c \cdot F_b + \\
 & + 0,0001 \cdot G_c \cdot P_b + 2,27 \cdot 10^{-7} \cdot I_r \cdot F_b + 1,08 \cdot 10^{-5} \cdot I_r \cdot P_b + 1,34 \cdot 10^{-5} \cdot F_b \cdot P_b \quad (4)
 \end{aligned}$$

Using this equation it is very easy to forecast or to count possible turnover of the furniture manufacturing per person in curtain country changing some of the input values. Changing values of these indexes for our regression model we should take into account real economic conditions, real economic prerequisites. Since today's output index is too law, for instance, it will be very interesting to forecast furniture turnover in Ukraine (table 4). As it presented in table 4, there are three input indexes increasing of which leads to increasing of the output value.

These are industrial round wood per capita (increasing of this index on 10 % leads to increasing of the annual furniture turnover per capita on 31 % - the biggest change), number of enterprises in furniture industry and particle board manufacturing. Nature of these relations is an obvious and there is

no doubt about it since actually furniture turnover depends first of all on quantity of wood resources, furniture capacity (number of the furniture enterprises) and quantity of the main construction material – particle board. At the same time, according our regression model, increasing of the number of employees at the average furniture enterprise in Ukraine we can consider as ineffective in economic terms and therefore such that leads to possible reducing of furniture turnover.

Table 4. Change (the forecasted, according regression model, value) of the furniture turnover per capita for Ukraine after increasing of the input parameter on 10 %

Name of index	Existent value of the input index (2012)	Increased on 10 % value of the input value	Existent value of the output parametr - turnover per capita (2012)	Forecasted value of the output parametr - turnover per capita	Increasing of the output parametr, %
Number of enterprises in furniture manufacturing per 1 mil inhabitants	33,6	37,4	15,0	17,6	17
Average number of employees per enterprise in the national scale, persons/unit	24,9	27,4	15,0	12,5	-17
Industrial round-wood per capita, m ³ /person	0,17	0,19	15,0	19,6	31
Particle board per 1000 person, m ³ /1000·persons	35,2	38,7	15,0	16,5	10

In reference to influence of the GDP per capita in Ukraine there is some contradiction since on the one hand – the richer person the more possibility for internal furniture producing but on the other hand GDP increasing in such poor country as Ukraine not always leads to improving of the furniture manufacturing because existents of a lot of other demands beside furniture buying in this case. Taking into account this contradiction, determining of the GDP impact on the annual furniture turnover needs supplementary, circumstantial researching. And finally, in regard to influence of the MDF producing – according our model, furniture turnover dose not considerably depends on this input index maybe because fiber board, especially in Ukraine, we cannot consider as a main furniture construction material like particle board for instance.

We can accept that in Ukraine will be possible, will be real to increase such three indexes as volume of the harvested industrial round wood per capita, volume of the produced particle board per 1000 person and number of enterprises in furniture manufacturing per 1 million inhabitants. Concerning industrial wood – we can increase this value on at least to 40 % since now in Ukraine harvests approximately 17 million m³ of the wood resources per year using only 50 % from annual increment and therefore 40 % increasing in this case will mean only 70 % usage of annual increment that agrees with international rules. There are a few quite powerful enterprises in Ukraine that all together produce annually 1,6 million m³ of particleboards and what is more there is some possibility for increasing of existing volume in regard to particleboards manufacturing at least on 30 %.

Taking into account such two factors as new law in Ukraine according which it will be gradually implement prohibition of the round timber export (it can forecast some reactivation in furniture sector) and existing so-called “shadow” sector in furniture manufacturing which must be eliminate we can assume there is real future prerequisite for number of the furniture enterprises increasing. According our model (1) possible such future changing grounded in real economic prerequisites – increasing of the volume of the harvested industrial roundwood per capita on 40% (from existing 0,17 m³ to forecasting 0,25m³), increasing of the volume of the produced particle board per 1000 person on 30% (from existing 35 m³ to forecasting 45 m³) and increasing of the number of enterprises in furniture manufacturing per 1 million inhabitants on 100 % (from existing 34 units to forecasting 68 units) will lead to final increasing of furniture turnover approximately in 4 times (from existing 15 EUR/person to fore-

casting 61 EUR/person). In our Ukrainian example values of such factors as average number of employees per enterprise in the national scale, GDP per capita and volume of the produced fibreboards per 1000 person were unchangeable because of economic difficulties of such changing providing.

Conclusions. Based on the results given in article it is possible to formulate the following conclusions. Furniture industry of Georgia is the most dynamic manufacturing that we can explain by vital economic reforms in this country. In return it can consider furniture industries of Ukraine and Moldova as very weak and such that need considerable improving.

1. In contradistinction to ENP countries, it can characterize furniture industry of Poland as more sustainable and more advanced branch (taking into account labor productivity, number of enterprises).

2. Number of the furniture enterprises per 1 million of inhabitants in ENP countries is much less than in Poland and in order to change this unfavourable situation it is necessary to carry out considerable improving in regard to availability of forest resources and ease of doing business.

3. It will be reasonable to consider furniture manufacturing in ENP countries as very perspective ones taking into account all favourable factors such as forest resources, economic feasibility, regional importance etc. and there are some indexes increasing which it is possible to step up development of the furniture industry (timber harvesting, particle boards manufacturing, fiber boards manufacturing).

4. Economic growing of furniture manufacturing in ENP countries has some challenges in regard to sustainable development since it does not into consideration environmental factors.

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Меблева промисловість в країнах Східної Європи: виклики і можливості для сталого розвитку

Представлено результати досліджень, які проведені для меблевої промисловості. Дослідження базується на порівнянні меблевої промисловості для трьох країн Східного Партнерства (Україна, Молдова і Грузія) з однієї сторони і меблевої промисловості Польщі та Австрії з іншої. В процесі дослідження автори даної статті: а) провели аналіз розвитку меблевої промисловості за період з 2008 по 2012 рік в країнах, що досліджуються, на основі абсолютних показників; б) провели порівняльний аналіз за 2012 рік на основі основних параметрів для меблевої промисловості перерахованих вище країн на основі відносних показників; в) розробили регресійну, яка визначає залежність такого дуже важливого параметра, як оборот на душу населення в меблевій промисловості від таких показників - кількість підприємств у виробництві меблів на 1 мільйон жителів, середнє число працівників на підприємстві в національному масштабі, ВВП на душу населення, обсяг виробництва круглих лісоматеріалів на душу населення, обсяг виробництва волокнистих плит середньої щільності на 1000 осіб, обсяг виробництва стружкових плит на 1000 осіб. В результаті проведених досліджень ідентифіковано основні проблеми та можливості сталого виробництва для меблевої промисловості в Східній Європі.

Ключові слова: меблева промисловість, порівняльний аналіз, модель регресії, країни ССП.