

Analysis of performance of the forestry sector in the Czech and Slovak Republics

ANDREA SUJOVÁ*, JAKUB MICHAL

*Department of Forest and Wood Products Economics and Policy,
Faculty of Forestry and Wood Sciences, Mendel University in Brno, Brno, Czech Republic*

**Corresponding author: andrea.sujova@mendelu.cz*

Abstract

Sujová A., Michal J. (2017): Analysis of performance of the forestry sector in the Czech and Slovak Republics. *J. For. Sci.*, 63: 293–299.

The forestry sector provides several social and economic benefits to the whole economy. It is based on the sustainable management of renewable natural resources and production of raw wood. It is therefore able of sustainable growth. The interest of the European Union is to build economy based on renewable natural resources, resulting in the need to pay increased attention to the development and support of the forestry. The aim of the paper is to evaluate the performance of forestry sector in the Czech and Slovak Republics for a period of five years. System of indicators measuring sectorial performance was set up to reach the goal. Obtained results in indicators have shown that the profitability and value added rate of Slovak and Czech forestry are at a high level and the performance is affected by high investment efficiency.

Keywords: economy; profitability; ratio indicators; value added; forest industry

The mission of the forestry sector is sustainable forest management consisting in keeping the sustainable stock and production of raw wood. The contribution of the forestry sector to national economies is one dimension of sustainable forest management. However, for all that, it has to keep financial health and endeavour to reach the high economic effectiveness by utilization of inputs as other industrial sectors do.

The paper deals with the analysis of performance in the forestry economy and its comparison in Slovakia and in the Czech Republic. Both countries dispose of the above-average stock of raw wood material. In Slovakia, forests cover approximately 2.0 million ha, i.e. 41% of its territory. There is a relatively good composition of tree species consisting roughly of 50% coniferous and 50% broadleaved tree species and the total growing stock is approximately 452 mill. m³ (PALUŠ, PAROBEK 2013). In the Czech Republic, forests cover 34% of the territory, i.e. 2.66 mill. ha. There are relatively good recover-

ing forests mostly represented by commercial coniferous tree species (ŠMÍDA, DUDÍK 2014).

The performance as a term is defined by the European Foundation for Quality Management as a measure of reached results by individuals, groups, organizations and processes. The performance is an ability to reach required outputs or effects in measurable units. However, there exist different approaches to performance evaluation at microeconomic and macroeconomic levels. Macroeconomic performance is regarded according to the size of production expressed in monetary units. Aggregate indicators for performance evaluation based on value added are gross national product or national income (SUJOVÁ 2005a). Corporate performance is defined as an ability to valorise resources and create a profit (DRÁBEK, POTKÁNY 2008). Indicators for corporate performance measurement come out from the financial analysis of the enterprise: profitability, activity, solidity, indebtedness and market value, which are presented by several economists

(KISLINGEROVÁ, HNILICA 2005; VLACHYNSKÝ 2006). Among modern performance indicators of the enterprise belong indicators based on value added: economic value added, market value added, stakeholder value added (WAGNER 2009).

Performance evaluation of the sector is based on an interconnection of macro and microeconomic evaluation on the sectorial principle. The resource base is the scale of economic indicators of the sector. In official structural statistics the Eurostat International statistical databases present some indicators of the sectors related to labour productivity, profitability, value added rate, investment rate on output. In the study of FAO (2014), the economic contribution of the forestry sector is measured by the following three indicators: employment in the sector; value-added (i.e. the forestry sector's contribution to GDP); and the value of forest product exports and imports (i.e. the sector's contribution to trade balances).

The performance of a forest-based sector from the view of investment effectiveness and investment rate is analysed in several scientific studies by MERKOVÁ et al. (2012), YANG et al. (2014), when the influence of investment on the growth of value added and labour productivity was proved. The issue of investment effectiveness in the forest-based industry was presented also in the study of experts from Croatia and Slovenia (OJUROVIĆ et al. 2013). The study of KOEBEL et al. (2016) dealing with the trade performance of the wood product sector considers the total factor productivity and average labour cost as the indicators reflecting industrial performance. According to YANG et al. (2016), the total factor productivity is an important means to evaluate the efficiency of technical elements in forestry enterprises.

The analysis of input-output efficiency of forestry based on a Data Envelopment Analysis model provided by ZHANG et al. (2016) includes six forestry input-output indices: forestry investment in fixed assets, number of employees at the end of the year in forestry sectors, planting area, proportion of forestry industrial structure, output value of forestry industry and the rate of woody plant cover.

Economic results of the Slovak and Czech forestry are annually published in so called "Green Reports". Economic analysis and competitiveness of the Slovak forest-based sector were dealt with by Sujová, who published the results in several scientific papers and monographs (SUJOVÁ 2005b; SUJOVÁ et al. 2015a, b), and by HAJDÚCHOVÁ and HLAVÁČKOVÁ (2014). An economic analysis of the Czech forestry, focused on traditional indicators of profitability, was provided by Kupčák in several publications (KUPČÁK 2004, 2008; KUPČÁK, PEK 2015).

The aim of the present paper is to determine suitable indicators of the sector's performance and to evaluate the performance of forestry in Slovakia and in the Czech Republic by the analysis of obtained values of the indicators for the period 2010–2014.

MATERIAL AND METHODS

The material necessary for obtaining relevant outputs was gathered by secondary research based on the review and analysis of the available scientific literature which deals with the topic and by processing statistical data on economic indicators in forestry sectors in the Czech and Slovak Republics. The analysis of knowledge in the literature has shown that performance is evaluated by different indicators at the micro and macro level. On that basis, a system of ratio indicators suitable for the sector's performance evaluation was created by the authors.

The first group of indicators is focused on profitability of the sector. The indicators are based on a comparison of economic result (ER) with the amount of resources used for its creation [return on sales, return on investment (ROI), return on costs]. The positive results are considered plus values with upward trend. The profitability (R) is calculated in Eq. 1:

$$R = \frac{\text{ER}}{\text{resource}} \times 100 (\%) \quad (1)$$

Another indicator of profitability is the rate of profitability (RR) which expresses the rate of covering the costs by sales and is calculated in Eq. 2:

$$\text{RR} = \frac{\text{sales}}{\text{costs}} (\text{EUR}) \quad (2)$$

The second group of indicators is based on the creation of value added: value added per employee, per one enterprise in the sector and the rate of value added (RVA) which indicates the percentage rate of value added (VA) in sales (S) and is calculated in Eq. 3:

$$\text{RVA}_s = \frac{\text{VA}}{\text{sales}} \times 100 (\%) \quad (3)$$

The third group of indicators concerns the evaluation of effectiveness in labour utilization:

(i) Labour productivity (LP), calculated in Eq. 4, has several modifications, it expresses rate of sales, production, profit, costs or value added per one employee of the sector:

$$LP = \frac{\text{economic output}}{\text{number of employees}} (\text{EUR}) \quad (4)$$

(ii) The rate of labour productivity (RLP) indicates the number of employees per one monetary unit of sales and it is calculated in Eq. 5:

$$RLP_s = \frac{\text{number of employees}}{\text{sales}} (\text{No. of persons per EUR of sales}) \quad (5)$$

(iii) Marginal labour productivity (MLP) indicates the accrual of financial value of the sector (sales, production, profit, value added) by increasing the employment by one employee, calculated in Eq. 6:

$$MLP = \frac{\Delta \text{ economic indicator}}{\Delta \text{ number of employees}} (\text{EUR}) \quad (6)$$

The results of the MLP indicator mean that if $MLP > 0$, an increase in the number of employees brings about an increase in economic indicators of the sector and if $MLP < 0$, an increase in the number of employees results in a decrease in economic indicators of the sector.

The fourth group of ratio indicators of the sector's performance is represented by indicators of investment effectiveness:

(i) Investment rate (IR) shows what proportion of the generated resources is invested. It can be calculated as a share of investment (I) in revenues (R) and profit (P), as Eqs. 7 and 8:

$$IR_s = \frac{\text{investment}}{\text{sales}} (\text{EUR}) \quad (7)$$

$$IR_p = \frac{\text{investment}}{\text{profit}} (\text{EUR}) \quad (8)$$

(ii) Efficiency of investment (EI) presents the effectiveness of capital utilization. It indicates what value of economic output (sales, production, value added) is created by one invested monetary unit, as Eq. 9:

$$EI = \frac{\text{output of a sector}}{\text{investment}} (\text{EUR}) \quad (9)$$

(iii) Marginal efficiency of investment represents the impact of investment on changes in the economic output of the sector. It expresses the additional output value of the industry (sales, production, value added, profit, equity) generated by unit of investment. It is calculated as Eq. 10:

$$MEI = \frac{\Delta \text{ output of a sector}}{\text{investment in } t-1} (\text{EUR}) \quad (10)$$

where:

t – year,

$t - 1$ – previous year.

The results of the MEI indicator mean that if $MEI > 0$, the investment causes an increase of the economic indicator of the sector and if $MEI < 0$, the investment causes a decrease of the economic indicator of the sector. If $|MEI| > 1$, we speak about the multiplier effect of investment.

The calculation of the individual indicators was applied to the forestry industry in the Czech and Slovak Republics. Input data were annual economic indicators of the forestry industry: sales, costs, value added, economic result before taxation, number of employees, investment. The data source was information from Green Reports published by Ministry of Agriculture and Rural Development of the Slovak Republic (2013, 2015) and Information on Forests and Forestry in the Czech Republic published by Ministry of Agriculture of the Czech Republic (2015). Economic indicators in the Czech Republic were converted to euro by the average rate of the European Central Bank.

RESULTS

When evaluating the performance of a sector it is necessary to use not only absolute economic indicators but also ratio indicators. The values of ratio indicators measuring the performance of the forestry sector in Slovakia and in the Czech Republic for the five-year period from 2010 to 2014 are presented in Table 1.

Positive values of profitability in Table 1 show a positive result. Markedly higher profitability is reached in the forestry of the Czech Republic, it is fivefold higher than in Slovakia, while the development trend is also positive, an upward trend. The profitability was doubled during the five-year period. The best results are reached in return on investment; it is at the level of 230–635%. The sales cover a doubled amount of costs. The profitability in the Slovak forestry is also growing, but a maximal value is 9.7% by return on sales and 10.7% by return on costs. Return on investment is over 100%, however after a marked triple increase in 2011 from 57.4 to 156%, there was a fall to 129% during the next two years. Costs are covered by sales at a lower rate, only by 10%.

The rate of value added in the Czech Republic is double in comparison with the Slovak forestry. The rate of value added in relation to sales in the Czech Republic after an increase from 70 to 81% in 2010 was maintained at the level 83% of sales. The value added is higher than the sales represented by the sale of raw wood and has a positive upward trend.

Table 1. Performance indicators of the forestry sector in the Slovak and Czech Republics

Indicator	Slovakia					Czech Republic				
	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
Profitability										
ROS (%)	3.8	8.9	8.1	6.7	9.7	15.2	21.0	22.9	20.6	30.2
ROI (%)	57.4	156.3	145.1	129.0	140.5	230.5	322.6	325.8	340.9	634.6
ROC (%)	3.9	9.8	8.8	7.2	10.7	24.2	38.1	41.2	38.9	68.0
RR (EUR)	1.04	1.10	1.09	1.07	1.11	1.59	1.82	1.80	1.89	2.25
RVA _S (%)	38.1	41.0	48.8	51.3	50.2	70.3	81.1	84.6	83.0	82.9
Labour productivity										
LP _S (mill. EUR)	51.8	62.8	55.7	58.0	68.7	78.9	90.8	95.1	95.2	98.3
LP _Q (mill. EUR)	40.7	50.0	44.2	47.4	55.4	53.2	61.9	65.7	60.9	65.9
LP _P (mill. EUR)	2.0	5.6	4.5	3.9	6.7	12.0	19.1	21.8	19.6	29.7
LP _{VA} (mill. EUR)	19.7	25.8	27.2	29.8	34.5	55.5	73.6	80.5	79.0	81.5
LP _C (mill. EUR)	49.8	57.2	51.2	54.1	62.0	49.6	50.0	52.9	50.4	43.7
RLP _S (No. of persons per mill. EUR of sales)	19	16	18	17	15	13	11	11	11	10
MLP _S (mill. EUR)	-0.15	-0.11	-0.24	0.03	-0.18	-0.25	-0.09	-0.08	0.09	-2.09
MLP _P (mill. EUR)	-0.01	-0.05	-0.04	0.01	-0.06	-0.15	-0.09	-0.09	0.09	-7.08
Investment rate										
IR _S (EUR)	0.07	0.06	0.056	0.05	0.07	0.07	0.07	0.07	0.06	0.05
IR _P (EUR)	1.74	0.64	0.69	0.78	0.71	0.43	0.31	0.31	0.29	0.16
Investment efficiency										
EI _{VA} (EUR)	5.78	7.22	8.72	9.89	7.28	10.66	12.45	12.02	13.74	17.40
EI _S (EUR)	15.19	17.58	17.87	19.27	14.51	15.15	15.35	14.21	16.56	20.99
MEI _P (EUR)	0.20	-53.1	2.50	2.67	1.63	19.29	18.62	3.56	2.51	-9.41
MEI _S (EUR)	4.06	-115	15.14	7.28	5.04	31.74	18.70	3.23	2.69	-2.78
MEI _{VA} (EUR)	-0.24	-72.3	-5.41	-0.19	2.09	22.73	42.38	7.89	3.56	-2.22

ROS – return on sales, ROI – return on investment, ROC – return on costs, RR – rate of profitability, RVA – rate of value added, S – sales, LP_S – rate of sales, LP_Q – rate of production, LP_P – rate of profit, LP_{VA} – rate of value added, LP_C – rate of costs, RLP – rate of labour productivity, MLP_S – marginal labour productivity on sales, MLP_P – marginal labour productivity on profit, IR_S – investment rate on sales, IR_P – investment rate on profit, EI_{VA} – efficiency of investment by value added, EI_S – efficiency of investment by sales, MEI_P – marginal efficiency of investment by profit, MEI_S – marginal efficiency of investment by sales, MEI_{VA} – marginal efficiency of investment by value added

The share of value added in sales in Slovakia was slightly increasing from 38 to 50%, while the net value added was by 5% lower than the gross one.

The number of employees was decreasing in both countries in the monitored period. The labour productivity was therefore increasing, in the Czech Republic it was higher than in Slovakia. In the Czech forestry, labour productivity is the highest in relation to sales, it was gradually increasing from 79 to 98 mill. EUR and stagnation occurred in 2013 due to a decrease of sales. A noticeable increase of labour productivity was observed in relation to profit, when profit per employee rose during five years by 18 mill. EUR to the level of 29.7 mill. EUR. The highest increase of labour productivity, by 36 mill. EUR, was noticed in relation to value added. The results of marginal labour productivity showed that a decrease of the number of employees affected an increase of sales and a small rise of

profit. The exception was the year 2013, when a decrease of the number of employees was followed by a decrease in the performance of the forestry sector, however in the next year a noticeable performance increase was registered. Costs per employee were gradually increasing from 49.6 mill. EUR in 2010 to 52.9 mill. EUR in 2012, however in the last two years costs markedly fell to 43.7 mill. EUR. The number of employees for the creation of 1 mill. EUR of sales is stable at the level of 10–11 employees. In the Slovak forestry, costs per employee were increasing from 49.8 to 62 mill. EUR. The number of employees for the creation of 1 mill. EUR of sales is 17 persons on average. These higher values were caused by much lower labour productivity than in the Czech Republic. Labour productivity in relation to sales gradually increased from 51.8 to 68.7 mill. EUR in 2014, i.e. by 17 mill. EUR except the year 2012, when the number of employees increased. In

relation to value added, the labour productivity was gradually increasing, by 15 mill. EUR during the five-year period and reached the level of 34 mill. EUR. The effect of a change in the number of employees on the sector performance is also opposite in Slovakia, however, the intensity of the influence is smaller. The influence of an increase in the number of employees on a decrease in sales was more pronounced. The decline in sales continued in 2013 in spite of a decrease in the number of employees.

The last group of indicators concerns investment effectiveness. In the Czech forestry 7% of sales is invested, however, in 2013 and 2014 there was a decline by 2%. A marked decline was in the investment rate in relation to profit, which fell from 43 to 16% despite the gradual profit increase. In Slovakia, an investment rate in relation to sales is comparable with the Czech Republic. The difference is in a much higher investment rate in relation to profit which is at a level of 70% of the profit. As for results of investment efficiency in the Czech forestry, one invested euro created 10.6–17.4 EUR in value added and 15–21 EUR in sales. In Slovakia, investment efficiency in relation to value added is lower, at a level of 5.78–7.28 EUR. After the positive generation of sales from 15 to 19.3 EUR, there was a marked decrease to 14.5 EUR in 2014. Results of marginal investment efficiency showed that investment in the Czech Republic had a multiplier effect on an increase in the forestry sector performance in 2010 and 2011. However, despite the marked investment increase in 2012, there was a decline in the sector performance in 2013. In Slovakia, the investment had a multiplier effect on an increase in sales and slightly on value added. A noticeable increase of investment in 2011 and its lower amount in the next years caused a decrease of sales and profit in 2013 and 2014.

DISCUSSION

Development of the analysed economic indicators in the forestry sector showed comparable trends in the Czech Republic and in Slovakia. The decrease of the sector performance was noticed in 2012 and 2013 in Slovakia and only in 2013 in the Czech Republic. The decrease was periodical, in a three-year cycle, which was proved also in China forestry as reported by YANG et al. (2014).

The profitability of Czech forestry companies analysed by LEVÁ et al. (2016) comes out from the Amadeus database including 55 entities. It was based on the indicator return on equity (ROE) and showed an average value of 12.6%. Compared to the analysis of

state forest enterprises provided by KUPČÁK (2004), the results of ROE indicate higher values than in the analysed sample of 55 entities by LEVÁ et al. (2016). The indicator ROE, which was not included in this study, completes the view on profitability in the forestry sector. The rate of profitability was called efficiency by KUPČÁK (2004) and the state forest company of the Czech Republic showed lower values than in this study. Its level at 1.04 is comparable with results of the Slovak forestry sector. Return on sales (3.8%) in the Czech state forestry sector presented by KUPČÁK (2004) is much lower than in the whole Czech forestry sector, but comparable with the Slovak forestry including private companies. The interesting results were found out in return on investment, especially in the Czech forestry, which indicates the ability of investment to generate a multiplied profit increase. The indicator ROI was not included in the analyses of other authors. The forestry sector is a producer of raw wood and represents the first link in a wood processing chain and from this fact, a high level of creating value added results. It was confirmed by results of the Czech forestry where value added is above revenues. It indicates that value added is created not only by the production of wood, but also by further supplied products. However, in the Slovak forestry, the situation is not the same because the rate of value added is only 50% of sales. It can be connected with higher costs than in the Czech forestry. Compared to results of the wood processing industry analysed by SUJOVÁ et al. (2015b), the value added rate is much lower than in the forestry sector, it reached only the one-third level in both countries.

Labour force is utilized more effectively in the Czech Republic, where labour productivity is higher and the number of employees for the creation of sales is lower, and also costs per employee. In 2013, despite the lower number of employees the labour productivity also decreased. Labour productivity in Slovak and Czech forestry sectors has not been yet analysed in any work by means of the group of indicators used in this work. In comparison with results of the wood processing industry analysed by SUJOVÁ et al. (2015b), the labour productivity is lower by 30% in Slovakia, but there is a minimal difference in labour productivity between the forestry and wood processing sector in the Czech Republic.

As for investment, a higher share of investment in the creation of profit (70%) was noticed in the Slovak forestry, while in the Czech Republic the investment accounts for only 20% of profit. It can be concluded that forestry in the Czech Republic uses mostly subsidies and other external financial

resources while investment can generate higher positive changes of economic results. The obtained results cannot be compared with works of other authors due to no available information about the existence of such studies.

More authors (HAJDÚCHOVÁ, HLAVÁČKOVÁ 2014; KOEBEL et al. 2016; ZHANG et al. 2016) advise to take into consideration also median values of indicators when assessing the performance of the sector because they are not affected by extreme values. Some limitations can be seen by measuring marginal indicators: marginal labour productivity and marginal efficiency of investment. For their measuring, it is necessary to keep the value of all other inputs fixed and it requires to modify input data. Some authors (KOEBEL et al. 2016; YANG et al. 2016) recommend using total factor productivity to measure performance in this context.

CONCLUSIONS

The analysis of the level and development of performance of the forestry sector in the Czech Republic and in Slovakia brought the following findings:

- (i) The sector shows a high rate of value added creation, which has been increasing and is above the amount of sales;
- (ii) The forestry sector of both countries is profitable, it is able to create a stable growing level of profit;
- (iii) Labour productivity has a positive upward trend, however in Slovakia there is still a high rate of employment which causes higher labour costs and lower ability to create value added and profit in the forestry sector.

The positive factor influencing the performance of the sector is a high investment profitability, which is supported by the utilization of external financial resources. An increase of investment affects mostly an increase of production and value added, a lower effect is on sales and profit. The analysis and comparison of results of performance have shown that performance growth in the Slovak and Czech forestry sector can be achieved especially by an increase of investment. A decrease of the number of employees has much lower effects on the sector performance. An interesting finding is that much higher performance in Slovakia is achieved in a non-state sector, while in the Czech Republic it is in a state sector.

The results of the presented analysis can be considered to be an average of the forestry sector and a benchmark by assessing the performance of individual forestry subjects.

References

- Drábek J., Potkány M. (2008): *Ekonomika podniku*. Zvolen, Technical University in Zvolen: 112.
- FAO (2014): *Contribution of the Forestry Sector to National Economies, 1990–2011*. Forest Finance Working Paper FFSM/ACC/09. FAO, Rome: 168.
- Hajdúchová I., Hlaváčková P. (2014): Vplyv globálnej ekonomiky na lesnícko-drevársky sektor v českej a slovenskej republike. *Acta Facultatis Xylogologiae Zvolen*, 56: 135–146.
- Kislingerová E., Hnilica J. (2005): *Finanční analýza*. Prague, C.H. Beck: 137.
- Koebel B.M., Level A.L., Nguyen-Van P., Purohoo I., Guinard L. (2016): Productivity, resource endowment and trade performance of the wood product sector. *Journal of Forest Economics*, 22: 24–35.
- Kupčák V. (2004): Rentabilita státních podniků v lesním hospodářství ČR. *Lesnická práce*, 8: 15–17.
- Kupčák V. (2008): Lesy a jejich význam při rozvoji regionů v České republice. In: *Financovanie 2008 lesy – drevo*. Zborník vedeckých prác, Zvolen, Nov 27, 2008: 1–8.
- Kupčák V., Pek R. (2015): The level of the wood raw material base processing in the Czech Republic. *Procedia Economics and Finance*, 34: 557–564.
- Levá M., Čermáková H., Stárová M., Vostrovská H. (2016): The assessment of forestry companies in the Czech Republic with focus on profitability. *Journal of Forest Sciences*, 62: 116–125.
- Merková M., Drábek J., Jelačič D. (2012): Determinants of effects of foreign direct investment in terms of Slovak Republic and wood-processing industry of Slovakia. *Drvna Industrija: Scientific Journal of Wood Technology*, 63: 129–142.
- Ministry of Agriculture and Rural Development of the Slovak Republic (2013): *Správa o lesnom hospodárstve v Slovenskej republike za rok 2012*. Zelená správa. Available at <http://www.mpsr.sk/download.php?fID=7840> (accessed May 18, 2016).
- Ministry of Agriculture and Rural Development of the Slovak Republic (2015): *Správa o lesnom hospodárstve v Slovenskej republike za rok 2014*. Zelená správa. Available at <http://www.mpsr.sk/download.php?fID=10048> (accessed May 18, 2016).
- Ministry of Agriculture of the Czech Republic (2015): *Information on Forests and Forestry in the Czech Republic by 2014*. Prague, Ministry of Agriculture of the Czech Republic: 28.
- Ojurovič R., Moro M., Šegotič K., Grladinovič T., Oblak L. (2013): Analysis of the investment in wood processing and furniture manufacturing entities by key factors of competitiveness. *Drvna Industrija: Scientific Journal of Wood Technology*, 64: 131–137.
- Paluš H., Parobek J. (2013): Changing patterns of roundwood deliveries in Slovakia. In: Jelačič D. (ed.): *Markets for Wood and Wooden Products*. Zagreb, WoodEMA i.a.: 77–91.

- Šmída Z., Dudík R. (2014): Analýza podnikatelských subjektů v lesním hospodářství České republiky s ohledem na dostupnost účetních informací vybraných subjektů. *Zprávy lesnického výzkumu*, 59: 55–65.
- Sujová A. (2005a): *Makroekonómia*. Zvolen, Technická univerzita vo Zvolene: 163.
- Sujová A. (2005b): *Aspekty reštrukturalizácie drevárskych podnikov*. Zvolen, Technická univerzita vo Zvolene: 68.
- Sujová A., Hlaváčková P., Marcinek K. (2015a): Evaluating the competitiveness of wood processing industry. *Drvna Industrija: Scientific Journal of Wood Technology*, 66: 281–288.
- Sujová A., Hlaváčková P., Šafařík D. (2015b): The analysis of performance in the wood processing industry through ratio indicators. *Acta Facultatis Xylogologiae Zvolen*, 57: 165–178.
- Vlachynský K. (2006): *Podnikové financie*. Bratislava, Iura Edition: 482.
- Wagner J. (2009): *Měření výkonnosti. Jak měřit, vyhodnocovat a využívat informace o podnikové výkonnosti*. Prague, Grada Publishing: 256.
- Yang G., Zheng Z., Yi L.H., Ya L.W. (2014): Forestry investment and output value of forestry in China. *Advanced Materials Research*, 926–930: 3826–3829.
- Yang H., Yuan T., Zhang X., Li S. (2016): A decade trend of total factor productivity of key state-owned forestry enterprises in China. *Forests*, 7: 97–106.
- Zhang Y., Yang G.H., Li Z.W. (2016): Analysis of input-output efficiency of forestry in Beijing based on DEA model. *Journal of Beijing Forestry University*, 38: 105–112.

Received for publication October 24, 2016

Accepted after corrections May 19, 2017