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THE EFFICIENCY OF BEECH TIMBER PRODUCTION FOR THE DOMESTIC MARKET

Abstract: The research on the efficiency of production of timber and sawmill products was based on averaged results obtained from elementary wood processing enterprises characterised by medium volume of production. The data covered one calendar year. The production and sales of edged and unedged timber, chiefly produced from WC0 class wood, was analysed in the study. The raw material for processing was supplied by the 'State Forests' National Forest Holding. The ratios of the efficiency of production of timber and sawmill products for sale on the domestic market were verified and compared. The research showed that the average unedged timber production efficiency was higher than the edged timber production efficiency. The economic ratios for the year under analysis showed improvement in the efficiency of production of low-processed products. There was a simultaneous increase in the costs of further processing and in the demand for unprocessed timber, which enabled wider use of the product in different areas of the wood sector.

Keywords: sawn wood, wood quality, efficiency, wood prices

INTRODUCTION

The sawmill industry largely depends on raw material resources. The availability of raw material depends on the forestation rate in a particular area. Forests occupy 9.4 million ha, i.e. 29.7% of the area of Poland(www.lasy.gov.pl).

Most forested areas, i.e. 7.6 million ha, are managed by the 'State Forests' National Forest Holding. Coniferous forests are predominant – they make about 69.1% of the tree stand. Pine-trees are the most common species in the forests (58%). The share of deciduous forests is much smaller. The predominant species are: birch-trees (about 8%), oak-trees (about 7%), and beech-trees (about 6%) (www.lasy.gov.pl).

The aim of the sawmill industry in Poland is to rationally process different round wood species into solid wood materials. According to the Eurostat data, Poland is the sixth largest European producer of timber, making about 5.6 million m^3 a year. Hardwood makes 20%, whereas softwood makes 80% of the total volume (www.sosnowemeble24.pl).

The sawmill industry is the second largest sector of the wood industry, following the furniture industry. It is an important part of the European manufacturing industry (Jarvinen, 2014).

The share of the wood industry in the GNP exceeds 2%.The employment rate in the wood industry amounts to 6%. The technological equipment used by Polish wood processing enterprises is constantly improving. The efficiency of material processed in Polish enterprises is about 65-68%. It is similar to the efficiency in the German and Swedish sawmill industries although Polish companies are not so modern and do not use such a wide variety of machinery (Ratajczak et al., 2010).

In order to improve the competitiveness and increase the processing efficiency in small and medium sawmills it is necessary to increase automation and modernise the technological process

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(Gotych et al., 2008). The improvement of the technological process involves numerous challenges. Maintaining the highest quality and high material efficiency are the most important elements which will guarantee keeping the current position in the market. It is necessary to shorten the sawmill production process and extend the period of using sawn materials.

Production profitability can be increased by standardising the specification of products and improving quality control. It is very important for sawmill enterprises to have stable access to wood material. As far as the costs of transport are concerned, it is very important to limit the distance to raw materials bases. The process of timber production unquestionably depends on the quality of material processed (Ratajczak 2011).

The development of the sawmill sector and the modernisation of individual companies give a possibility to increase the sawmill production effectiveness and efficiency. The automation of wood processing reduces employment per 1 m^3 of material processed (Hruzik 2006).

AIM AND RANGE OF STUDY

The aim of the study was to determine the correlation between the efficiency of production of selected types of beech timber in the domestic market and the dimensional and qualitative variability of the products. The research was conducted on small and medium wood processing enterprises, which are the most common in Poland.

The research encompassed analysis of wood processing in a full financial year as well as verification of qualitative and quantitative data concerning the processing of beech wood into sawn materials. The results were analysed by describing how variability in the material type, quality and dimensions influenced basic processing parameters.

METHODOLOGY

The volume of timber and other materials was measured according to the guidelines of the Polish Standard PN-EN 1309-1:2002Round Wood and Timber – Dimensions Measurement – Part 1: Timber. The data analysis consisted in classification of the assortments according to their type, dimensions and quality. Third quality class logs (WC0) of three thickness classes were used as the material for comparing the processing efficiency.

The index of technological processing efficiency was calculated according to the assumptions, using the formula below (1) (Hruzik et al., 1996). The efficiency was expressed as percentage. It was the ratio between the total volume of products made from the raw material and the purchase price of the material used in production.

$$E(p)=(\Sigma Vw*Cw+\Sigma Vz*Cz+\Sigma Vo*Co\Sigma Vs*100)\ /(Cs+Tr)\ [\%] \quad (1)$$

Vw – volume of products processed for the domestic and European market,
Cw– unit price of products,
Vz– volume of woodchips,
Cz –contractual price of woodchips,
Co– volume of waste and sawdust,
Vs– contractual price of waste and sawdust,
Vs –volume of raw material,
Cs– contractual price of raw material,
Tr – cost of transport of raw material.

RESULTS

Table 1 shows the data concerning the structure of beech wood sawn per annum. If we assume that the real volume of beech timber production amounted to about 10,000 m^3, we can see that the processing was relatively equal in the consecutive months of 2016. The amount decreased in the summer months and at the end of the year.

The highest production (Table 1) was noted in the first months of the year. The monthly production of timber amounted to about 960 m^3. Beech wood was chiefly processed into un edged assortments (79%), where medium-length timber, made by shortening side timber, had a considerable share (12%). The analysis of the annual amount of beech wood processed into sawn materials showed that the production of 50 mm logs and 26 mm timber was predominant – these were the main products made from sawn wood (Fig. 1).As far as edged assortments are concerned, laths up to 1 m in length were the largest group of products made from beech wood.

It is necessary to take the quality of raw material into account when analysing the quality of sawn products (Fig. 2). The third class of wood quality was predominant in the products sawn from lower quality round wood – about 52%. The share of the first quality class amounted to about 27%. About 8,000 m^3 of timber was made from un edged beech wood. The share of the third quality class wood amounted to about 63%, whereas the share of the first quality class amounted to about 20%. About 2,000 m^3 of timber was made from round wood. The share of the first class sawn assortments amounted to about 56%, whereas the share of the second class amounted to about 34%.

Table 1. The structure of beech wood sawn per annum in 2016

Thickness [mm]	The thickness of the obtained sorts - share in months [%]												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
n/o 20	0,00	0,41	0,00	0,00	0,00	0,00	0,00	0,56	0,97	0,00	0,13	0,00	2,07
n/o 22	0,00	0,00	0,00	0,00	0,00	0,61	0,00	0,00	0,00	0,00	0,00	0,00	0,61
n/o 26	1,54	2,08	1,69	1,17	2,15	1,68	1,80	0,35	0,38	0,90	1,81	0,00	15,54
n/o 32	1,54	0,52	0,16	1,12	0,00	0,00	0,00	0,41	1,34	0,71	1,69	0,00	7,48
n/o 35	0,29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,36	0,65
n/o 42	1,42	1,89	1,55	1,69	0,98	1,30	0,94	0,57	0,60	2,03	0,00	0,00	12,98
n/o 50	2,05	1,81	2,41	2,80	1,69	1,85	2,92	1,76	2,36	2,27	2,52	3,13	27,59
n/o 55	0,00	0,00	0,00	0,00	0,74	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,74
42x88	0,00	0,21	0,29	0,00	0,00	0,00	0,20	0,20	0,00	0,00	0,00	0,00	0,91
68x68	0,19	1,28	0,45	0,67	0,45	0,45	0,22	0,00	0,22	1,12	0,90	0,45	6,38
85x145	0,84	0,21	0,21	0,00	0,61	0,42	0,21	0,24	0,00	0,21	0,36	0,00	3,31
120x220	0,00	0,21	0,18	0,36	0,19	0,19	0,00	0,00	0,22	0,00	0,43	0,22	2,01
150x240	0,00	0,00	0,33	0,00	0,00	0,92	0,59	1,62	1,06	0,31	0,34	0,52	5,68
160x250	0,28	0,02	0,23	0,24	0,22	0,44	0,00	0,00	0,00	0,00	0,43	0,21	2,08
Unedged timber, medium length	1,47	1,07	1,02	0,90	0,83	1,13	0,85	0,44	0,97	1,19	1,17	0,94	11,98
Total	9,62	9,70	8,53	8,96	7,85	8,98	7,73	6,16	8,12	8,73	9,79	5,83	100

Source: compiled by the author

n/o – un edged timber

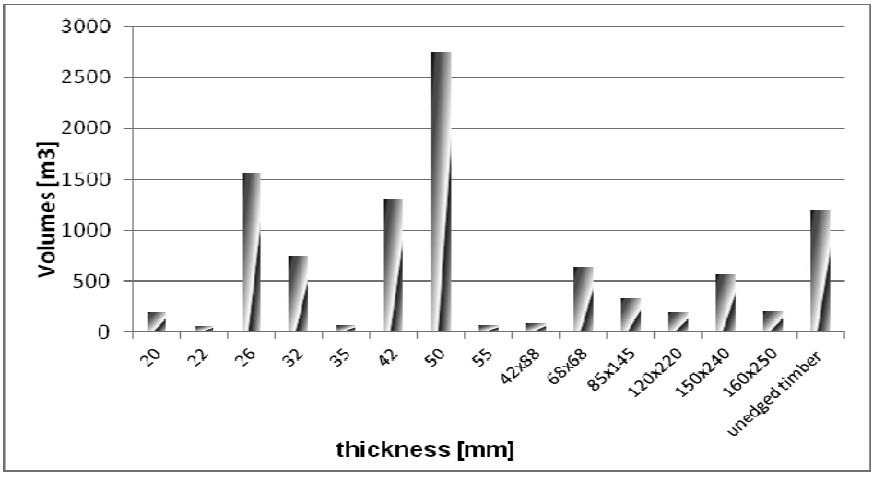

Fig. 1. The annual hardwood processing

Source: compiled by the authors

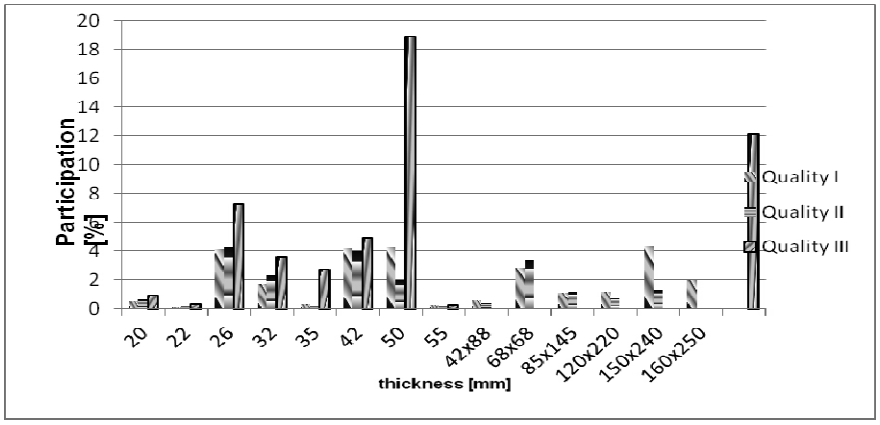

Fig. 2. The volume of beech wood sawn according to quality classes

Source: compiled by the authors

SALES PRICES OF SAWN MATERIALS

The average purchase prices of beech wood were verified in order to assess the profitability of round hardwood processing (Fig. 3). The results of sales of edged and un edged sawn materials are shown in Fig. 4 and 5. In view of the fact that WC0 class beech wood is mostly sold in Poland at 269-430 zlotys/m^3, the average price of 345 zlotys/m^3 was assumed for calculations. Table 4 shows the prices of timber with division into different thicknesses of un edged assortments and quality classes. The value of individual sawn materials was assessed when they were wet. It ranged from 700 to 1,470 zlotys/m^3. The thicker the timber was and the better the quality class was, the higher the price per m^3 was.

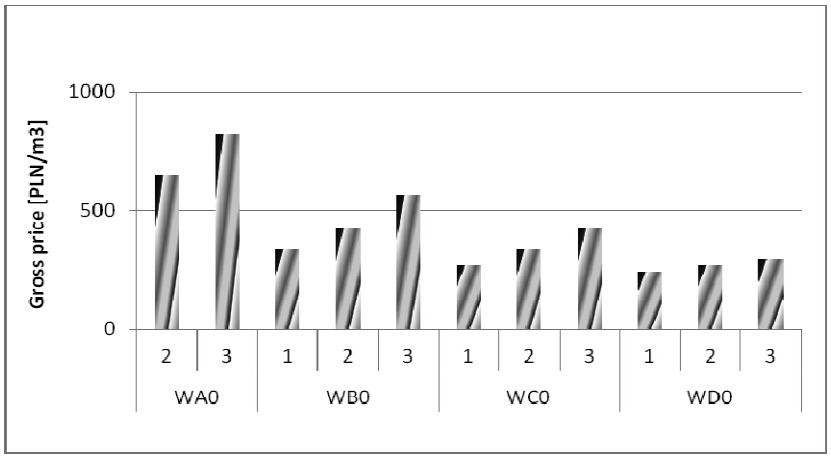

Fig. 3. The prices of beech wood according to its thickness and quality class

Source: the author's compilation based on enterprises' documentation

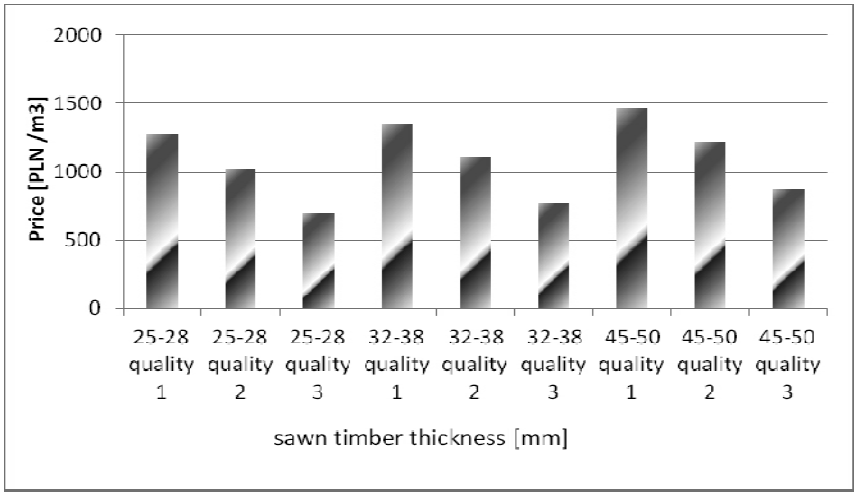

Fig. 4. The prices of unedged beech timber according to its thickness and quality class on the local market

Source: the author's compilation based on enterprises' documentation

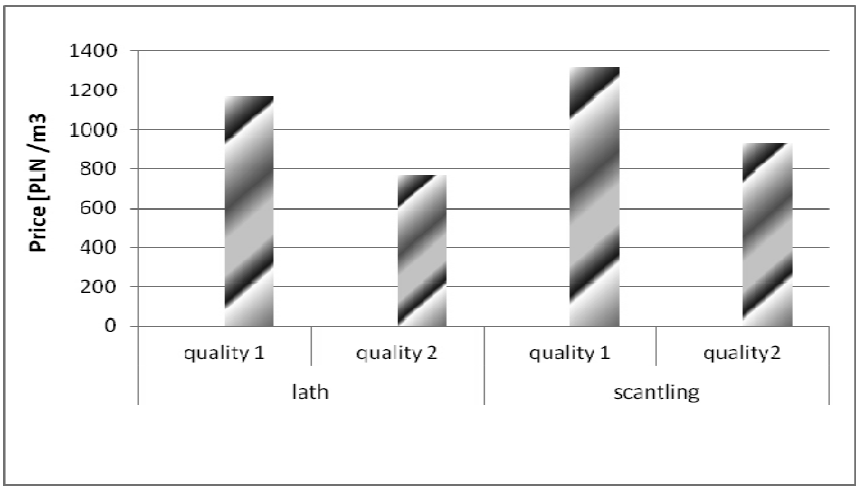

Fig. 5 The prices of beech timber according to its thickness and quality class on the local market

Source: compiled by the authors

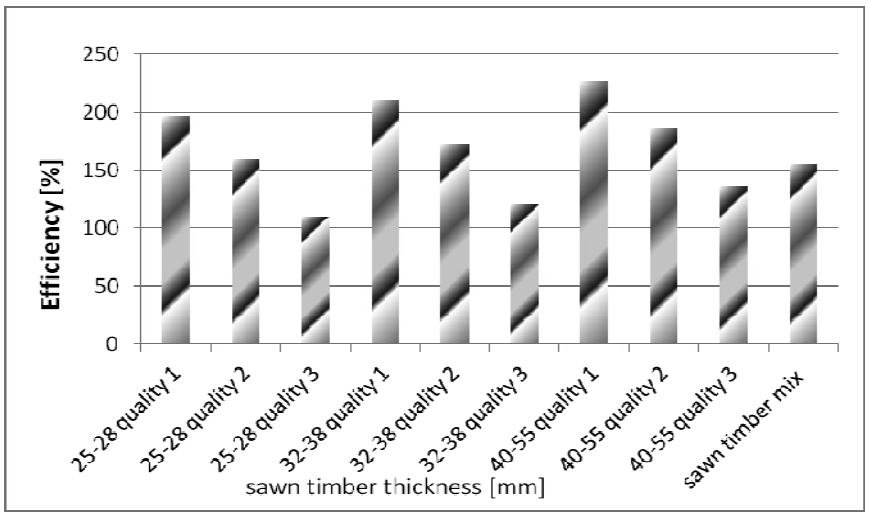

Fig. 6. The efficiency of un edged timber production for the local market

Source: compiled by the authors

Table 6 shows the efficiency of un edged timber production for the local market. The highest efficiency of beech wood processing, i.e. about 195-223% was noted in the first quality class of timber. The lowest efficiency, i.e. 110-136%. was noted in the third quality class of sawn materials. The average efficiency was 167%. The weighted average, which depended on the price of timber and the quality class of elements for sale, amounted to 156%.

The research showed that it is necessary to search for the possibilities to increase the share of higher quality timber in the total amount of beech wood processed.

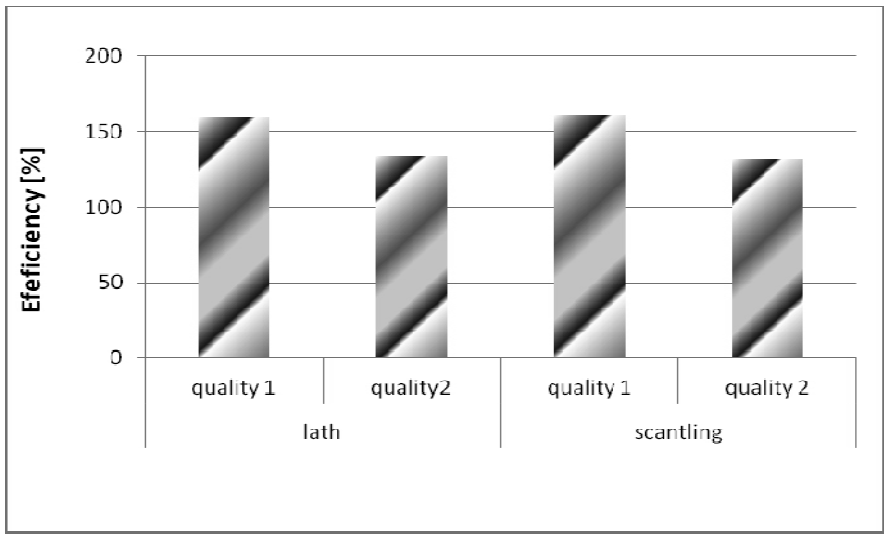

Fig. 7. The efficiency of edged timber production for the local market

Source: compiled by the authors

Figure 7 shows the efficiency of edged beech timber production for the local market. The lath and square timber production efficiency ranged from 134% to 160%. The average efficiency, which depended on the price of timber and the quality class of elements for sale, amounted to 146%, whereas the weighted average exceeded 150%.

Lower processing efficiency ratios, which were noted for edged beech timber, resulted from lesser processing efficiency. Deeper processing involves extra costs of processing and employment. It may also significantly reduce the processing efficiency.

SUMMARY

The available data concerning the amount of domestic beech wood sawn into timber enabled analysis of its processing and verification of the economic aspects of manufacturing low-processed sawmill products. The research resulted in the following conclusions:

1. The sawing data showed that un edged timber was predominant in the total amount of beech wood processed.
2. There were equal amounts of timber produced from beech wood during the year under study.
3. The analysis of the domestic market of beech timber purchasers showed that there was the highest demand for high-thickness un edged timber. It resulted in higher prices of this timber. Simultaneously, this quality class had a smaller share in the total sawmill production.
4. The share of edged beech timber was significantly smaller (by about 20%).Simultaneously, this was higher quality timber. However, it did not result in higher efficiency ratios. The average ratio for the first quality class was 160%. The weighted average for timber amounted to 150%.
5. The production efficiency is influenced by the price of raw material acquired for processing and the possible sales value of processed assortments. The weighted average of un edged timber production efficiency was 159%. The maximum efficiency of 227% was noted for the first quality class assortments, which were 40-55mm thick.

6. The difference between the efficiency of beech wood processing into un edged and edged assortments is caused both by the production process and the demand for a particular type of timber. There was much higher efficiency in the processing of beech wood into un edged timber. There was high demand for this product as it can be flexibly used in different branches of the wood industry.

REFERECES

1. Gotych V., Hruzik G. J., Wieruszewski M. (2008): Production effectiveness of selected sawmill products from large-sized pine timber. Intercathedra 24: 156-158
2. Hruzik G. J., Gotych W. (1996): Wpływ struktury jakościowo-wymiarowej bukowych kłód tartacznych na optymalizację ich przerobu. Przemysł Drzewny 4: 20-22.
3. Hruzik G.J. (2006): Zużycie surowca i materiałów drzewnych w wyrobach przemysłu tartacznego. Drewno. Prace naukowe. Doniesienia. Komunikaty 175: 25–43.
4. Jarvinen K. (2014): Wyzwania dla europejskiego przemysłu tartacznego. Przemysł Drzewny 4: 12-14.
5. Ratajczak E., Bidzińska G., Szostak A. (2011): Foresight w drzewnictwie- Polska 2020.Instytut Technologii Drewna, Poznań: 40.
6. Ratajczak E., Bidzińska G., Szostak. A. (2010): Postęp naukowy w drzewnictwie. Instytut Technologii Drewna, Poznań: 41-56.
7. www.sosnowemeble24.pl 1.06.2017.
8. www.lasy.gov.pl 1.06.2017.
9. PN-EN 1309-1:2002 Drewno okrągłe i tarcica - Metoda oznaczania wymiarów -- Część 1: Tarcica.