

Original scientific paper

Received:23.06.2020

Accepted:13.11.2021

UDK: 674:330.567.22(497.7)''2015/2020''

**ANALYSIS OF WOOD REMOVALS AND CONSUMPTION
IN NORTH MACEDONIA IN THE PERIOD 2015-2020**

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ABSTRACT

In this paper wood industry of North Macedonia was analysed. According to this analysis, there are many major and minor problems. One of the biggest problems is bad condition of the Public Enterprise “Makedonski Shumi”, insufficient equipment in the sawmills and poor quality of Macedonian forests. Minor problems are, for example, low salaries and low number of employees, or poor state support for companies. All these problems lead to low removals, which are annually decreasing, when in 2020 total removals were 735 000 m³. These problems lead to low quality of removed wood too, when only about 17% of wood is used as industrial roundwood.

Key words: Wood industry, Removals of wood, Production of wooden primary products.

1. INTRODUCTION

The Republic of North Macedonia is one of the countries in the Balkans with high forest coverage. Thus, the high importance of production and consumption of roundwood can be expected. The aim of this work is to describe the state of Macedonian forests, wood processing industry and the market of industrial roundwood, with a focus on a specific tree species - beech. The work was carried out within a short-term study stay on the basis of bilateral agreements between the Czech Republic and the Republic of North Macedonia.

2. METHODOLOGY

Apart from several articles and monographs, the main source was the data obtained by request from the State Statistical Office. These data were supplemented by statistical data from a number of international organizations. Field work also played a major role. For the purposes of this work, several wood processing companies and forests were visited in different parts of Macedonia. Many thanks for the assistance offered by prof. Goran Zlateski, prof. Mira Stankevikj and prof. Zivka Meloska.

3. RESULTS

3.1. General introduction

The Republic of North Macedonia is located in the south of the Balkan Peninsula. The total area of this country is 25 713 km² [2][9] with a total population of about 2 million people [2], making it the second smallest and least populated internationally recognized country on the Balkans. Mountains represent about 79% of the land area, 19% of the land is lowlands and the remaining 2% is water bodies [1]. According to data from 2017, North Macedonia ranks 4th among the countries with the lowest GDP per capita in the Balkans, with a GDP per capita of \$ 15 231, after Serbia, Albania and Bosnia and Herzegovina.

In 2020, forest land in Macedonia was 1,04 million hectares, with forested land increasing in recent years [8]. After recalculating the data since 2010, there is an average year-on-year increase in the forested area of 8 189 ha. The forest cover of the Republic of North Macedonia was thus approximately 40,5% in 2020, which means that Macedonia lags behind the European average by 5-6% [10]. Information on the composition of forests varies; according to the research team of prof. Stankevikj, high forest reaches 29% of the total forest area, while the remaining 71% is coppice forest [6]. According to the monograph of the State Forests, high forest makes up 28%, low forest 64,5% and bushlands and brush-woods 5,3% [1].

According to international statistics, the total growing stock in North Macedonia in 2020 was 76,41 million m³ [12], while the monograph states a growing stock of 80,16 million m³ for 2018 [1]. After examining other scientific works from previous years, the second data can be considered correct. After recalculation, the average growing stock per 1 ha of forest land is 77,1 m³. The State Statistical Office does not have data on annual growth. According to the authors, the total annual growth in the past was 1,83 million m³ [2][3][9], as per the State Forests in the past 1,62 million m³ [14] and according to more recent data 1,57 million m³ [1]. The annual growth per unit area is therefore approximately 1,8 m³/ha.

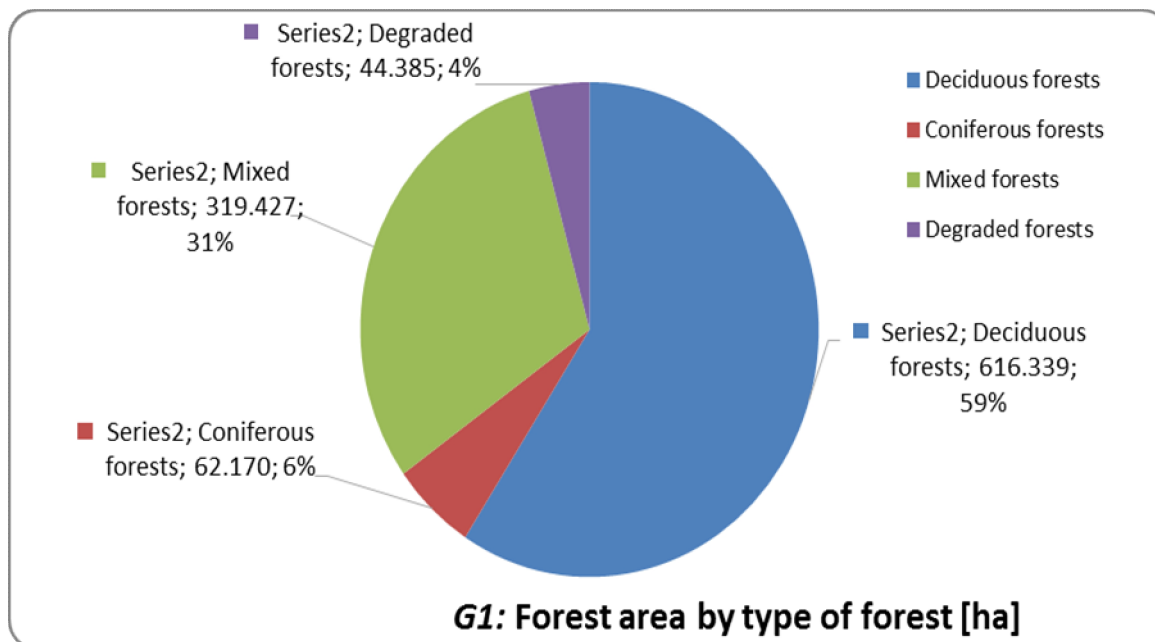


Figure 1. Forest by type of forest (ha)

If we look in more detail at the composition of forests, we find out that as reported by the statistics for 2020, deciduous forests accounted for 59,1% of the total forested area. Mixed forests accounted for 30,6%, coniferous 6% and degraded 4,3% [8].

Table 1. Representation of tree species in the Macedonian forests

Species	Area [ha]	Species	Area [ha]
Beech	250 340	Fir	5 693
Oak	297 192	Pine	49 451
Walnut	11 717	Other coniferous trees	6 206
Other deciduous trees	57 090		

Table 1 records the representation of tree species in Macedonian forests based on the statistical data for 2020 [8]. We see a clear predominance of beech and oak. Out of the conifers, pine plays the most important role, while the representation of Macedonian pine on 3 362 ha of forest area is interesting. Macedonian pine (*Pinus peuce*) is a typical five-coniferous Macedonian endemic growing in the highlands [1]. As part of the field survey, we encountered it mainly in the Baba Planina mountain at an altitude of 1 700 to 2 100 m above sea level.

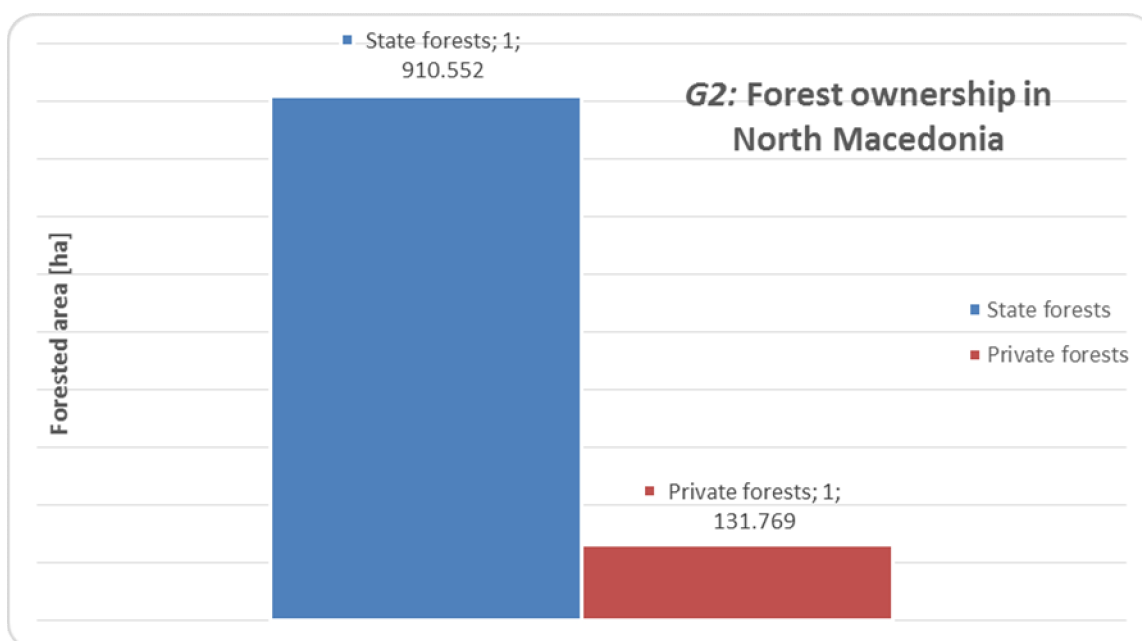


Figure 2. Forest ownership in North Macedonia

The last data examined in this chapter was ownership representation. The state plays an absolutely crucial role here. The Public Enterprise "Makedonski Shumi" owns 87,4% of forests in 2020 [8]. In the recent past, this Public Enterprise even owns up to 90% of the forests [2][9].

3.2. Logging, export and import

The authors of various surveys agree that forestry in North Macedonia has a share of 0,3 – 0,5% of GDP, whereas the entire wood processing industry and forestry has a share of 2,5 - 3% [1][9]. This is also confirmed by statistics, which in 2019 attributed a share of 1,26% of primary wood processing industry to the total value of Macedonia's industry. Paper industry accounted for 1,03% and furniture production for 2,91% [17]. Paper industry, logging and primary wood processing therefore play a relatively marginal role in Macedonian industry, only furniture production is more important.

Table 2. Total wood removals in years 2015-2020 [thous. m³]

	2015	2016	2017	2018	2019	2020
Total wood removals	849	890	807	802	759	735
Deciduous species	762	810	746	728	689	658
Coniferous species	87	80	61	74	70	77

In Table 2, we see that total wood removals in 2020 amounted 735 000 m³. Deciduous species accounted for almost 90% of total removals. According to the previously mentioned information, we see that total removals are about 50% of the annual increase, which is confirmed by the statistics of the State Forests, which for 2019 shows removals of 47% of the annual increase [1]. However, other authors state 60-70% [3][6].

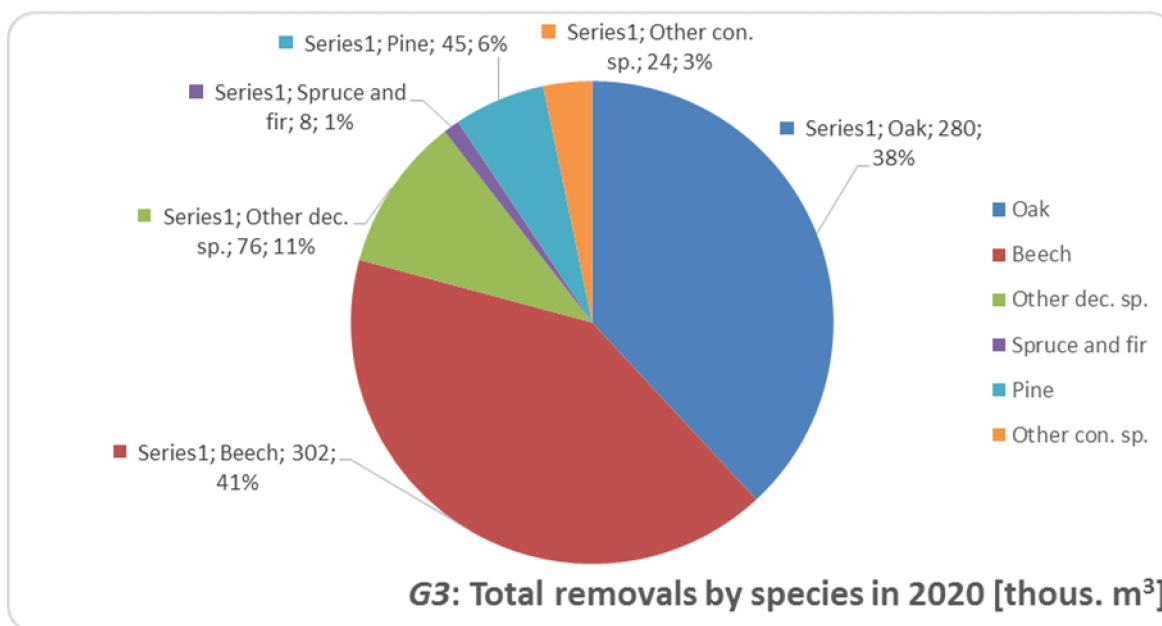


Figure 3. Total removals by species in 2020 (thous. m³)

According to the Pie Chart G3, we see that beech has the highest share in total removals (41,1%), followed by oak (38,1%) and coniferous pine (6,1%).

Table 3. Logging by ownership structures in 2020 [thous. m³]

	Total	Deciduous sp.	Coniferous sp.
State Forests	548	485	63
Private forests	187	173	14

We see that the State Forests accounted for 74,6% of total logging. Owners of private forests logged practically only deciduous trees. Being given ownership of almost 90% forests, the State Forests could be expected to log more compared to private forests.

Table 4. Logging according to ownership structures and assortment in 2020 [thous. m³]

	Industrial w.	Fuel w.	Residue
State forests	105	413	30
Private forests	19	159	8

According to statistics, it is clear that most of the gross felled timber is used as fuel wood [8]. The State Forests use 75% of their felled timber as fuel wood, private owners even 85%. Only 16,9% of the gross felled timber is used as industrial wood.

Table 5. Industrial roundwood - removals and import

Year	Total removals(deciduous sp. removals)					Total import(import of deciduous sp.)				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Vol. [thous. m³]	127(61)	133(77)	120(73)	121(68)	110(62)	6(3)	34(2)	34(2)	58(2)	58(2)

Annual data of international organizations were processed [11]. As stated in the results, it is clear that production of industrial wood in North Macedonia has been slightly declining since 2015, both in total and in production of deciduous sp. industrial roundwood. Contrary to that, the import of industrial roundwood increased considerably, when in 2019 the total import increased by 866% compared to the import in 2015. Almost exclusively coniferous industrial roundwood was imported in Macedonia.

Table 6. Sawnwood - production, consumption, import and export

Year	Production(Consumption)					Import(Export)				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Vol. [thous. m³]	4(43)	4(46)	6(39)	6(39)	8(41)	45(6)	53(11)	38(5)	37(4)	37(4)

Annual data of international organizations were processed [11]. The volume of sawnwood produced in North Macedonia is growing slightly, but it certainly does not reach the necessary threshold to meet the demand. Only coniferous sp. sawnwood is imported into the country. North Macedonia exports a small volume of sawnwood, mostly domestic deciduous sp. sawnwood and resale of purchased sawnwood from abroad.

Table 7. Products of the woodworking industry

Year	Veneer [m ³]	Parquet [m ³]	Windows [pcs.]	Doors [pcs.]	Other [m ³]
2015	705	4 024	1 709	2 057	9 335
2016	1 237	2 851	4 369	5 356	7 032
2017	1 136	5 896	2 242	5 452	3 792
2018	1 437	6 418	1 266	11 195	3 897
2019	1 082	9 677	863	9 410	4 180
2020	922	2 397	302	8 565	3 961
Avg.	1 087	5 211	1 792	7 006	5 366

Table 7 was created by combination of data from the State Statistical Office [8] and the research work of prof. Stenkevikj [6]. We see a relatively appreciable impact of parquet production in

the wood processing industry, which we were convinced of in the field survey. Each sawmill had its own parquet production facility, which was one of the few areas in which modernization funds had recently been invested. Thus, a sharp increase in the total production of parquet can be expected in the coming years. The production of wooden windows is dropping sharply, which is due to transition of production to plastic windows in Macedonia. Plywood and veneer production plays a minor role. The production of wooden doors has been growing in recent years, which is probably linked to the overall development of the furniture industry in Macedonia. The category Other includes pallets, crates and boxes. This production has been in decline in North Macedonia in recent years.

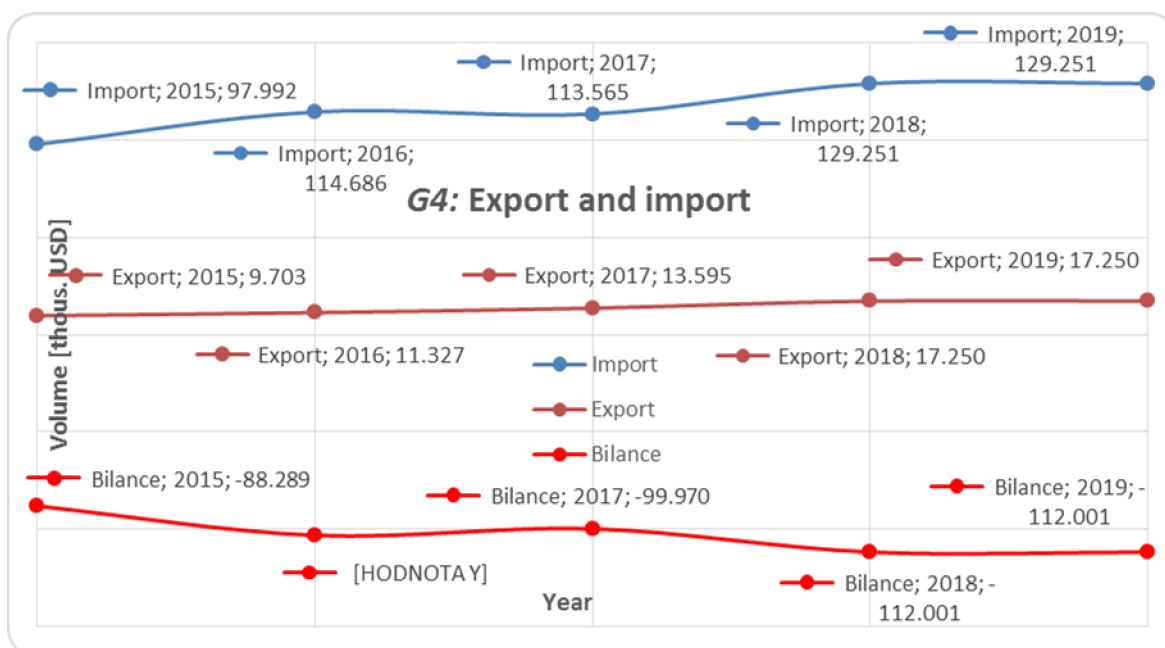


Figure 4. Export and import

Total imports in 2019 were approximately 129 251 000 \$. Since 2015, imports have been gradually growing. Exports are also growing, but the balance is still very negative. North Macedonia can only fully meet the demand of the domestic market in the firewood sector. Imports of paper and sawnwood do not make dizzying sums, as demand is not very high and Macedonian industry is able to supply the market at least partially with domestic products. Most imports are made up of agglomerated materials, for which demand is very high in North Macedonia and is rising every year. Currently there is no production capacity in North Macedonia for production of agglomerated materials.

3.3. Problems of Macedonian forestry and wood industry

As can be seen from the above data, logging and wood processing in North Macedonia is not at an optimal level. For a more accurate analysis of the situation, it is necessary to describe and understand the individual problems.

One of the few geographical advantages is the good position of Macedonia, located in the central part of the Balkan Peninsula. Thus, important trade routes pass through North Macedonia. However, there are many geographical disadvantages. Almost all forests are located in alpine terrain, which makes logging and transportation very difficult. The Mediterranean climate causes dry and long summers. The composition of forests is not good, as a large part is low forest with minimal increments, compared to other European countries. The low forest also provides relatively poor quality wood.

A big problem is the Public Enterprise “Makedonski Shumi”. The company’s biggest problems include outdated equipment, poor condition of forest roads, poor planning and a monopolistic position on the wood market. Historically, there were 30 separate units, which were artificially merged into one unit on 1 July 1998 [1][2][3]. According to previous statistics, this merge was not the most appropriate

step. The company is governed by a number of forest laws (primarily Law of Forests, Official Gazette of Rep. of Macedonia No. 47/97 and 7/2000). "Makedonski Shumi" took part in a number of government programs, of which the "Den na drvoto" (The Tree Day) in 2008-2016 is worth mentioning, when a considerable number of trees were planted. "Makedonski Shumi" is therefore in charge of planting, which is one of the sectors in which it is showing relatively good results. The company has 19 modern forest nurseries, which annually produce 3 500 000 to 5 500 000 seedlings [1][8].

The technological equipment of the company is in a disastrous state. The equipment is often outdated and does not allow quality logging and timber transport in the problematic alpine terrain of Macedonia [1][8][9]. In 2020, the State Forests owned 60 transport units, 47 tractors, 138 chainsaws and 1 forest cable car [1][8]; no significant investments have been made in recent years.

Another big problem is the complete inadequacy of the quality of the forest road network [2]. Although the company invests in construction of new roads, it builds exclusively softroads with lower quality, because it is a less financially demanding investment [1]. According to the statistics for 2020, the State Forests had 6 301 km of softroads and only 1 972 km of solid roads [8]. The density of forest road network in Macedonia is approximately 8 m/ha, which is about twice as little compared to the Czech Republic. Every year large amounts of money must be spent on maintaining and restoring these unpaved roads [1][8]. In addition to that, softroads are also seasonal, which means that in the winter months, logging and timber transport is minimal [6]. These factors cause high costs and discontinuous deliveries of material to the wood processing companies. We personally became convinced of the poor condition of the forest roads during the field work. "Makedonski Shumi" is not able to objectively assess its options, which results into highly unrealistic logging plans. These plans have rarely been fulfilled in recent years by at least 75% [1][8]. The State Forests often does not even have good data for analysis of the situation. It must be acknowledged, though, that the State Forests and the government are trying to solve this problem by monitoring and certifying forests, which resulted in adoption of the PEFC certification system in 2018 [1][13][15][16]. The monopolistic position of the State Forests is also a problem, which leads to irresponsible behavior towards wood processing companies (irregular deliveries with long delays) [9].

In North Macedonia, there are significant economic losses due to four factors – illegal logging, forest fires, natural disasters and biotic wood pests.

The biggest problem is clearly caused by illegal logging [9]. Illegal logging mainly concerns logging of firewood [2]. It is caused by the poor economic situation in the country and the insufficient number of forest guards [1][2]. The largest illegal logging took place in the northern areas, affected by ethnic conflicts between Albanians and Macedonians. In 2002, the period of the greatest national unrest, there was an illegal mining operation of an incredible 177 000 m³. Macedonia responded to this by strengthening the powers of the Forest Guard, arming, increasing the number of Forest Guards and launching Operation „Gora“ in 2014 [1]. Illegal logging continues to date, but according to the Statistical Office, its volume has decreased significantly [8].

Fires occur quite often in Macedonia. The reason is hot and dry summers. Fires are often caused by human fault. It is not easy to put out fires in poorly accessible alpine forests, so the state is trying to create investment plans for the purchase of new equipment [3]. In 2013 the program MRFFIS (Macedonian Forest Fire Information System) was launched [1]. New equipment was purchased and a training center was set up. It is not clear whether these steps were effective, as the occurrence and spread of fires depends on many uncontrollable factors. However, it is appropriate to say that the State and the State Enterprise have made a considerable effort to rectify the situation in this area.

Today, pests are practically no problem for Macedonian forests. Decreases are minimal, pests have not received more attention from experts so far.

Table 8 . Fires, Illegal logging, biotic pests and natural disasters

Year	Fires [ha]	Illegal logging [m ³]	Pests [m ³]	Natural disasters [m ³]
2015	3 455	22 054	1 274	506
2016	2 166	18 662	549	88
2017	8 115	20 128	1 576	90
2018	6 094	24 322	6 775	1 299
2019	10 661	45 795	303	8 008
2020	438	19 282	223	-
Avg.	5 155	25 041	1 783	1 998

Micro-enterprises with less than 10 employees make up 55% of wood processing sector, small enterprises with up to 50 employees take up 30%, and the remaining 15% belong to medium-size enterprises with up to 250 employees [5][7]. Many companies are unregistered, which causes unfair competition in the market [9]. We see that micro-enterprises, which have a minimum capital and are not able to modernize in most cases, play a big role in Macedonian woodworking industry. Therefore, according to statistics, the number of wood processing companies decreases every year [8].

The equipment of most saws dates from the period of socialism of the last century [9]. In terms of equipment, Macedonia was able to keep up with the Western woodworking industries at that time [7]. Today, however, this equipment is extremely unsatisfactory and outdated. During field work, we observed frequent machine failures and low work productivity. The machines have a small production capacity and therefore, even at maximum output, are not able to process more than 20-25 m³ of logs per shift. No woodworking machines or tools are produced in Macedonia, everything must be bought from abroad [7][9]. Importing machines from abroad is financially and technically demanding, so only a small number of companies have recently invested money in modernization. When working in the field, we observed the effort of the sawmills to invest in technologies for waste treatment, often a pellet production facilities. However, we did not see any effort to invest in the main machines (band saw) and auxiliary machines (edging saw, riping saw, crosscut saw, On the contrary, this equipment often date from the 1950s - 1960s.

Shortage of employees worries most companies. The number of forestry employees has gradually decreased from the previous 3 000 to 2 235 in 2020 [8]. The situation is similar at sawmills. The cause can be found in low salaries. Although the statistical office reports quite high monthly salaries, if we look at the data of other international organizations, we find that the average monthly salary of an employee in the primary wood processing industry is less than 300 \$. We also confirmed this during field work, when sawmills consider 400 \$ a month to be a very good salary. This is a sector with undoubtedly the lowest salaries in entire Macedonian industry, with an average salary reduction of 25 \$ per month compared to 2005 salaries [17]. This is also caused by a lack of qualified and educated staff, where practically all graduates are looking for work abroad after completing their studies.

The government has concluded a number of international agreements. North Macedonia has been a member of the WTO since 2003 (World Trade Organization), and member of CEFTA since 2007 (Central European Free Trade Agreement) [9]. However, North Macedonia does not sufficiently support wood processing companies and does not oversee the fairness of the market, which results in, for example, a monopolistic position of "Makedonski Shumi". North Macedonia can be commended for its tree planting, illegal logging and forest fire fighting programs, as previously written.

3.4. Beech logging and processing analysis

As already mentioned in Table 1, beech is the second most represented tree in Macedonian forests after oak. European beech (*Fagus sylvatica*) is the most common here.

Beech is the most logged species in Northern Macedonia. Since 2015, beech has accounted for an average of 40,9% of total logging. Only 9,3% of the total beech removals are industrial roundwood

logs. This is a very low percentage. The remaining 90,7% of beech is used by Macedonians as fire wood and for other purposes. This negative phenomenon is caused by the low quality of the logged wood and other problems described in the previous chapter.

Table 9. Beech logging and processing

Year	2015	2016	2017	2018	2019	2020
Removals	324 000	380 000	352 000	320 000	303 000	302 000
Industrial w.	25 937	36 123	34 445	29 890	27 266	29 833
Sawnwood	1 654	2 390	3 479	4 576	4 513	4 709
Parquet	4 024	2 851	5 896	6 418	9 677	2 397

Beech industrial roundwood is often used for sawmilling. Most sawmills in North Macedonia work at least occasionally with beech industrial roundwood. Beech logs with an average thickness of about 45 cm are used for processing [4]. Sawmills process logs of I., II. and III. category. When working in the field, we observed a significant predominance of logs of III. category (estimated 60-70%), a smaller part consisted of logs of II. category. According to the price list of "Makedonski Shumi", the price of beech sawmill logs of III category is currently 60-70 USD per cubic meter. The price of logs of I and II category is about 80 USD per cubic meter [14]. However, according to the reports by the owners, the price of beech logs of III category is currently 90 USD per cubic meter, and for logs of II category about 120 USD per cubic meter. Beech sawnwood of A/B quality is often exported abroad (Italy, Serbia,...), lower quality beech sawnwood is sold by sawmills on the local market. A very important part is the production of beech parquet, which is produced by almost every bigger sawmill. Funds have been invested in this area in recent years and an increase in the total production of beech parquet can be expected.

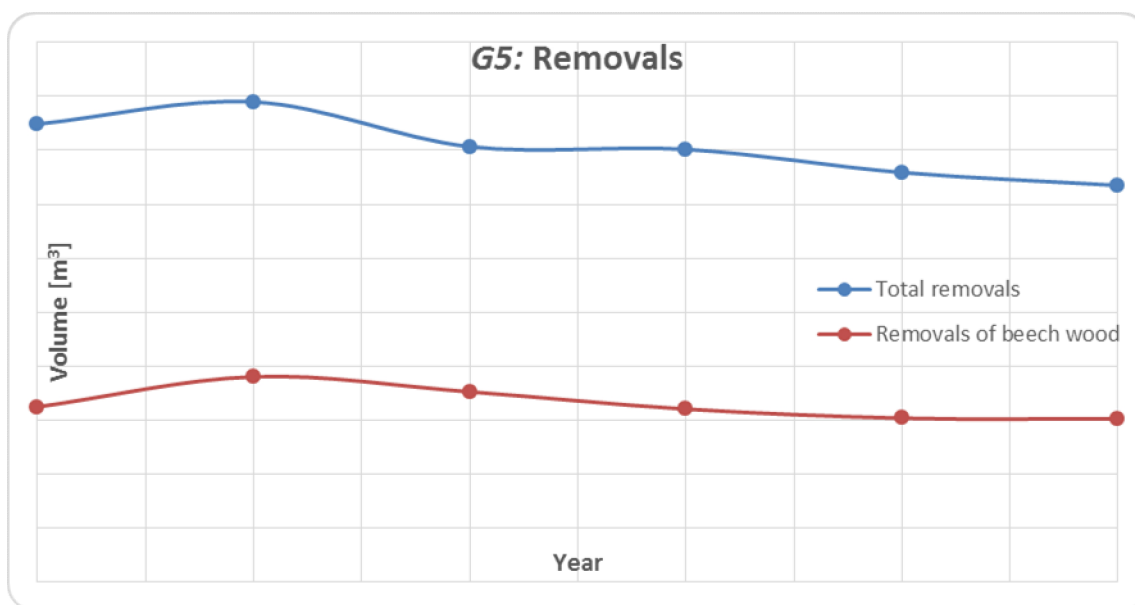


Figure 5. Removals

According to Figure 5, we can see that overall logging is declining. The same is true of beech removals. In recent years, however, total beech production has stopped at around 300 000 m³ per year.

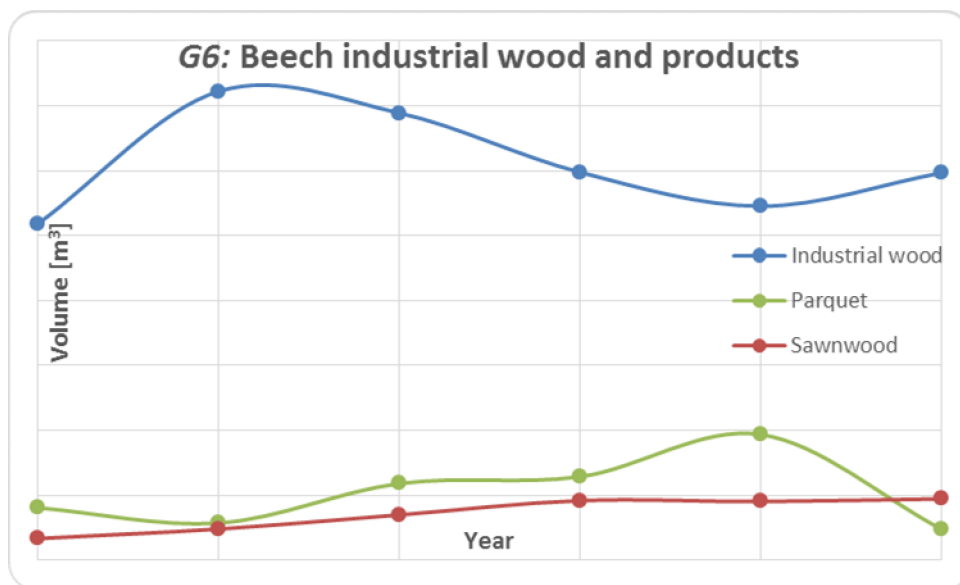


Figure 6. Beech industrial wood and products

According to Figure 6, beech sawnwood production is rising every year. In 2020, it reached almost 5 000 m³. According to our field work, these official statistics are not accurate and the actual production of beech sawnwood reaches slightly higher numbers. Unfortunately, a large part of beech industrial logs is devalued. These logs remain in the forest for a long time and are gradually degraded into fuel wood [1].

Export and import of beech industrial logs and sawnwood is minimal, according to statistics practically incalculable. Therefore, it does not make sense to work with data on beech export and import in this paper.

As presented in the above information and statistics, logging and wood processing are not very high. So we will try to analyze the situation.

Low production of industrial roundwood		
Geographical problems	PE "Makedonski Sumi"	Companies
Forests in hills Low quality of forest Hot and dry summers Low growing stock	Bad equipment Monopolistic position Bad forest roads Low wood removals	Old equipment Lack of employees Low capital Low processing capacity
	Government	Industrial wood losses
	No regulation of market No support to companies	Forest fires Illegal cutting Biotic pests

Figure 7. Affinity diagram

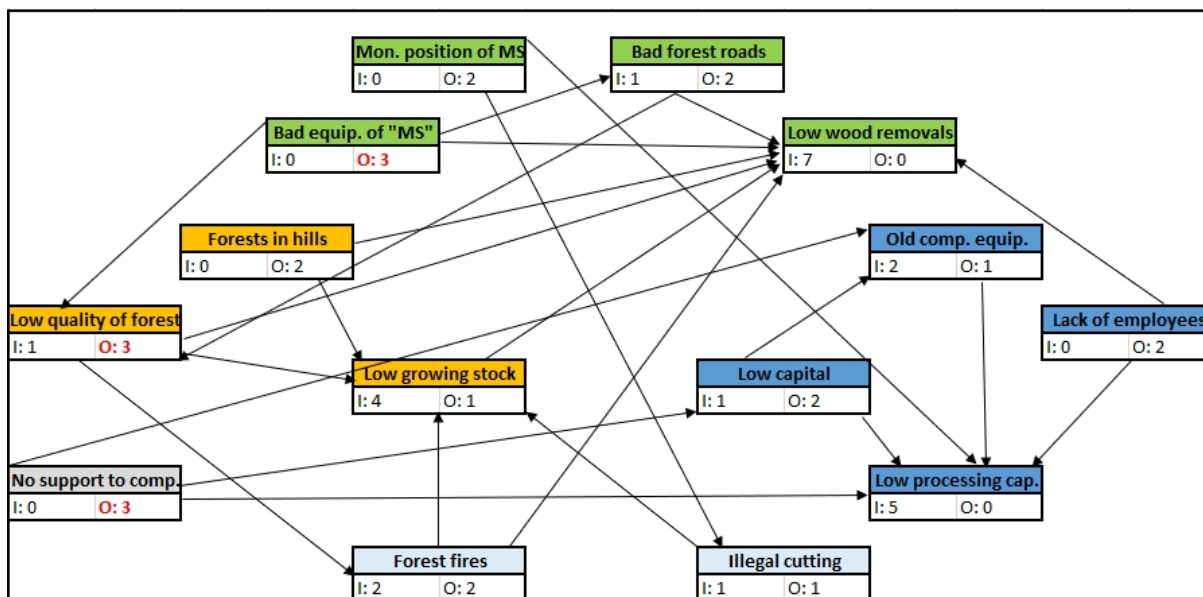


Figure 8. Interrelationship diagram

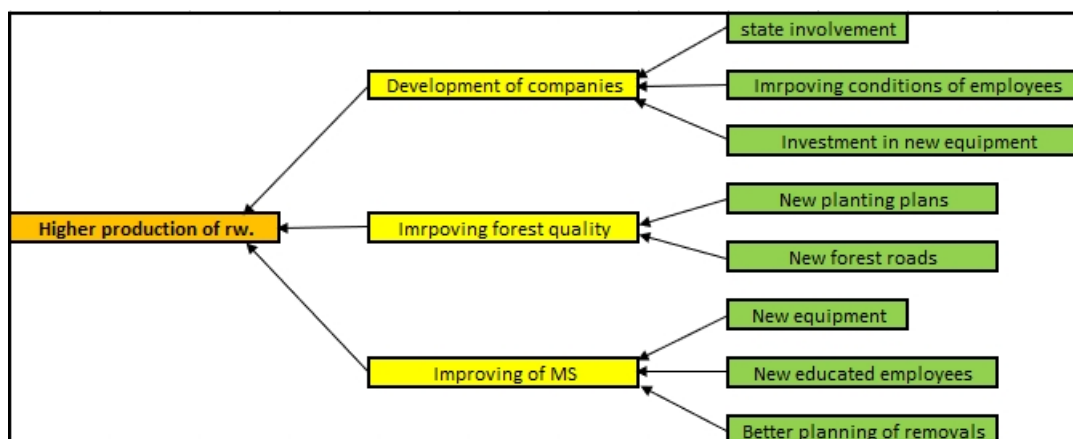


Figure 9. Tree diagram

Based on the above analysis, the biggest problem is the Public Enterprise “Makedonski Shumi”, low quality of forests and poor condition of companies. In order to improve the situation with production and consumption of industrial roundwood, our view is that it is necessary to create an investment plan for modernization of the equipment of the Public Enterprise “Makedonski Shumi”. The technological equipment is completely insufficient in quantity and inadequate in quality, which leads to low removals and transport of wood. We would also recommend a gradual transition to forest solid roads. It would be a costly investment, but it would reduce annual maintenance costs and also reduce the seasonality of logging and transport, and stabilize the supply of industrial roundwood to sawmills.

It is necessary to invest in new sawmill equipment. Currently, sawmills are not able to process larger quantities of logs even at maximum power. Macedonian industrial roundwood cannot be exported abroad with sufficient profit; due to the low processing capacity, industrial roundwood is decreasing in quality to fire wood. With higher state support for wood processing companies (investments, lower interest rates on loans,...) the consumption of industrial wood would increase and degradation of industrial wood would be avoided.

4. CONCLUSION

According to the above statistics and information, logging and processing of industrial roundwood is not at the optimal level. The main negative factor is the inability of the public enterprise “Makedonski Shumi” and the low potential of saw processing capacities for processing industrial roundwood. With the right investments, in our opinion it is possible to achieve a fairly good position of logging and processing of industrial wood within the wood processing industry of the Balkan states.

REFERENCES

- [1] Gorgiev, Zoran. *Monografija na JP Makedonski Sumi 1998-2018*. Skopje: Makedonski Sumi, 2018. ISBN 978-608-4571-38-4
- [2] Nikolov, Nikola. Country report for the Republic of Macedonia. In: *UNECE/FAO Workshop on Illegal logging and trade of illegally-derived forest products in the Unece region*. Geneva, Switzerland, 2004.
- [3] Nikolov, Nikola. Third National Report to UNFCCC. *Project 00075206*. 2012.
- [4] Rabadjiski, Branko, Goran Zlateski, Zoran Trposki, Vladimir Koljuzov. Analysis of diameters and taper of diameter of beech logs in I/III class of quality. *International Journal – Wood, Design & Technology*. Ohrid, 2016, **5**(1), 24-31.
- [5] Stankevik Shumanska, Mira, Živka Meloska, Goran Zlateski. Current condition indicators of wood industry in the Republic of Macedonia. *3 rd International Scientific Conference „Wood Technology & Product Design”*. Ohrid, 2017.
- [6] Stanlevik Shumanska, Mira, Živka Meloska a Goran Zlateski. Raw material potential of wood industry in the Republic of Macedonia. *International Journal – Wood, Design & Technology*. Ohrid, 2017, **6**(1), 77-82.
- [7] Stankevik Shumanska, Mira. Technological development of wood industry enterprises of the Republic of Macedonia. *International Journal – Wood, Design & Technology*. Ohrid, 2014, **3**(1), 83-89.
- [8] State Statistical Office of the Republic of Macedonia, MAKSTAT database
- [9] Stojanovska, Makedonka, Vladimir Stojnovski a Nenad Savic. Analyses of the Competitiveness of Forest Industry in the Republic of Macedonia. SEEFOR. 2006, , 13-21. ISSN 1847-6481.

Internet sources:

- [10] *Evropa v datech*. [online]. [cit. 2021-10-24]. Available from: <https://www.evropavdatech.cz/clanek/63-lesy-evropy/>
- [11] *Food and Agriculture Organization of the United Nations* [online]. [cit. 2021-10-24]. Available from: <https://www.fao.org/home/en/>
- [12] *INForest* [online]. [cit. 2021-10-24]. Available from: <https://forest-data.unece.org/>
- [13] *Macedonian forestry dreams come true with PEFC endorsement. PEFC SYSTEM NEWS* [online]. Skopje, 2018 [cit. 2021-10-24]. Available from: <https://pefc.org/news/macedonian-forestry-dreams-come-true-with-pefc-endorsement>
- [14] *Makedonski Sumi* [online]. [cit. 2021-10-24]. Available from: <http://mkdsumi.com.mk/index.php>
- [15] *North Macedonia ready for national forest monitoring* [online]. Skopje, 2019 [cit. 2021-10-24]. Available from: <https://www.fao.org/europe/news/detail-news/en/c/1194305/>
16. *Supporting stakeholders to develop the Macedonian forest certification system* [online]. [cit. 2021-10-24]. Available from: <https://pefc.org/what-we-do/our-collective-impact/our-projects/supporting-stakeholders-to-develop-the-macedonian-forest-certification-system>
- [16] *United Nations Industrial Development Organization* [online]. [cit. 2021-10-24]. Available from: <https://www.unido.org/>