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**RAW MATERIAL POTENTIAL OF WOOD INDUSTRY IN
THE REPUBLIC OF MACEDONIA**

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ABSTRACT

Wood raw material is the basis for competitiveness of wood industry production. The raw material from domestic production is very important for growth and development of this industrial branch in the country.

Production of wood mass is the basic raw material in primary wood processing in the Republic of Macedonia. It depends on the country's available forest fund.

Subject of analysis was the surface of forest land, forested area – forests by species, gross felled timber by assortments and species, in total and state-owned forests and the forest products in state forest for the period 2011-2016.

The assortment structure of the annual cut is unfavorable. This is a result of the high fuel wood and scraps participation.

Key words: wood raw material, wood industry, forest fund, assortment structure, annual cut

1. INTRODUCTION

The forest, as a renewable natural resource, is a source of raw material that meets the numerous economic and social needs in the society in the process of wood processing and trade. In addition, the forest is only a conditionally renewable natural resource that must be used in accordance with the criteria and principles of sustainable development. Therefore, the economic and social potentials of forestry and wood processing are limited, because forests can be used exclusively in a manner and scope that ensures the ecological, economic and social functions of current and future generations.

The Republic of Macedonia has signed and ratified many international treaties and conventions for protection of forests and the environment that affects the forestry sector. The country's orientation towards the European Union requires harmonization of forestry policy with its obligations to it.

The real conditions currently imply the need to create an efficient system for multifunctional forest management and development of a modern wood industry with high standards.

In the production process, the wood industry uses various raw materials, but the basic raw material, as we know, is wood, as well as wood materials. Wood as the basic raw material in wood-industrial production characterizes a series of specificities. It is a raw material of natural origin with limited amounts to use. Wood has universal uses and is widely used in all parts of the economy, therefore it is a deficient raw material. It is characterized by a great variety, such as wood species, by size (height, diameter), by shape, and especially by its physical and mechanical properties, which are different in longitudinal, transverse and radial cross sections in the same log.

The production of wood raw material is the basic raw material for the primary wood processing and depends exclusively on the country's available forest fund.

2. FOREST FUND OF THE REPUBLIC OF MACEDONIA

The existing forest fund of the Republic of Macedonia is the base and dictates the volume and the assortment of the wood processing production. The possibilities and the supply of the wood processing industry with raw material directly depend on the conditions, i.e. the volume, structure, quality and other characteristics of the forests.

According to the last census of the forest fund as of 31st December 1979, the forests in the Republic of Macedonia cover an area of 905653ha, which accounts for 37,6% of its territory. Thus, of the total area in forests and forested land, 905653 ha or 69,6% are forests, while 395398 ha or 30.4% are under forested land. In the Republic of Macedonia the forests are mostly state-owned. Of the approximately 906000 ha, state forests are prevalent on 817000 ha or 90.2%, and forests in private ownership are 89000 ha or 9.8%. According to its purpose, the highest percentage is the economic forests, i.e. 92,0%, then the national parks 5,0%, with the lowest percentage represented by the protected (2,0%) and forests with special purpose (1,0%). Forest preservation is a significant indicator of the productive opportunities and economic potential of the forest fund. Out of the total forest area in the Republic of Macedonia (906000 ha), the preserved forests are represented by 58,0%. The fact that the least-preserved forests (degraded forests and shrubs), that is, forests of very low economic value occupy 42,0% of the total area of the forest fund, speaks of its low economic value. The forests origin is the main indicator for forest fund quality and its potential like raw material source for the wood industry. So, high forests cover 29,0% and coppices cover 71,0%. It is known that high forests provide most of the raw material for the primary wood production, but also the coppices are the source for wood industry production. According to the form of stands in the Republic of Macedonia, we have pure trees stands and mixed trees stands of forests in the Republic of Macedonia. The pure trees stands cover 64,1% and mixed trees stands only 35,9% from the total forest area. The pure trees stands of deciduous cover 94,0% and the pure trees stands of coniferous are 6,0% from the total pure trees stands area. Mixed trees stands of broad - leaved cover 85,5%, mixed trees stands of coniferous are 1,9% and the mixed trees stands of broad - leaved and coniferous cover 12,6% from the total mixed trees stands area (Stankevik, M. 2007).

Oak is the most present tree species in the forest fund of the Republic Macedonia. It covers 546000 ha. After it comes beech with 220000 ha from the total broad - leaved area. Black pine covers 27000 ha, white pine only 3000 ha, spruce covers 2000 ha and the other coniferous cover 2000 ha from the total coniferous area (34000 ha) (Stankevik, M. 2007).

For acquisition of information on the existing condition of the forests in the Republic of Macedonia, as a potential raw material for wood industrial production, the data from the State Statistical Office of the Republic of Macedonia has been analyzed. According to this data (MAKSTAT database), the analysis of the area of forest land for the period 2011-2016 is presented, as well as the analysis of the area under forest according to types of trees in the Republic of Macedonia for the year 2016.

Table 1 shows data on the area of forest land in the Republic of Macedonia, total and by structure, as well as the structure regarding the ownership of the area under forest, in hectares for the period 2011-2016.

Table 1. Forest land area (in ha)

Year	Total	Forest area	State forest area	Another forest land	Infertile land
2011	1083202	981812	889834	91906	9484
2012	1102002	988835	888503	101523	11644
2013	1101521	987545	888127	102261	11715
2014	1128442	983388	874245	100660	44394
2015	1149689	994403	882471	106862	44424
2016	1141351	1001665	890890	106887	32799
Average	1117701	989608	885678	101683	25743
AAR	1,05	0,40	0,02	3,07	28,20

From the data in the previous table it can be seen that the total area of forest land in the Republic of Macedonia is 1117701 ha, of which 989608 ha are areas under forest, 101683 ha is another forest land, and the infertile land is 25743 ha for the analyzed period. All analyzed forest lands have a positive trend of growth.

Of the total average area of forest land (989608 ha), 89,5% or 885678 ha belong to the state forest area, while the remaining 10,5% or 103930 ha are privately owned.

Data on the area under forests by types of trees and trees in hectares for 2016 was obtained from the MAKSTAT database of the State Statistical Office of the Republic of Macedonia. According to the same data, from the total forest area (1001665 ha), the broad - leaved plantations cover 605661 ha, coniferous area 66774 ha, mixed plantations 286315 ha and degraded forests 42915 ha.

The most abundant tree species in the broad – leaved area is the oak with 309748 ha, the beech with 231980 ha, followed by other hard broad - leaved species with 57716 ha and other soft broad - leaved species with only 3995 ha. For coniferous of the total area (66774 ha), the black pine covers 42545 ha, the white pine 8387 ha, the fir 5886 ha, the 972 ha spruce and the other soft conifer species 4707 ha.

Such forest condition shows that the less quality form of stands and species (oak and black pine) represent the majority, and beech and fir-spruce species are in minority.

3. GROSS FELLED TIMBER

Gross felled timber (annual cut) represents the total wood mass which is cut or can be cut every year. It is one of the most important factors for development of primary wood production. The annual cut may be as high as the annual increment, but in principle it is better to be lower than the increment (Stankevik, M. 2007).

The annual cut is planned on the basis of the Forest Management Plans for economic purposes. In the previous year, on the basis of the forest management plans, at the level of subsidiaries and PE "Makedonski Sumi", production and financial plans were prepared and adopted. The use of the annual cut by the Public Enterprise is not in line with what was anticipated. The coefficient of utilization of the annual cut is around 0,70 in relation to the possible forecast by the special plans for forest management. This problem is closely related to the planning of the volume of cuts, the openness of the forests, the seasonal nature of the road infrastructure, inadequate and outdated mechanization, unfair competition in the firewood market, etc. Due to the mentioned reasons, large quantities of wood in the Public Enterprise remain on the plates (for later to be declassified), in conditions of incomplete use, which inflict huge damages and losses (Monograph, Macedonian Forests 1998-2008).

The data for gross felled timber (annual cut), i.e. its structure in terms of ownership for the period 2011-2016, was obtained from the State Statistical Office of the Republic of Macedonia (MAKSTAT database). It is shown in Table 2.

Table 2. Gross felled timber (annual cut) according to ownership (in 000 m³)

Year	Total gross volume	State forests	Forest in private ownership
2011	857	658	199
2012	779	621	158
2013	692	567	125
2014	532	532	-
2015	849	618	231
2016	890	655	235
Average	767	609	158
AAR	0,76	- 0,09	3,38

From the data in Table 2, it can be seen that in the period 2011-2016, the average annual value of the annual cut, i.e. the felled timber is 767000 m³. The largest realized annual cut was realized in 2016,

i.e. 890000 m³, and the lowest realized in 2014 when it is 532000 m³. Data for 2014 refer only to state forests, while for private forests data is not available. Felled timber on annual average in the state forests is 609000 m³ or 74,9%, while in the private forests it is 158000 m³ or 25,1%. Total felled timber, as well as the annual cut in private forests, has a trend of increase, unlike the felled timber in state forests, where the trend is negative with AAR of -0,09%.

Data on the assortment structure, as well as gross felled timber by tree species, for the period 2011-2016 was obtained from the State Statistical Office of the Republic of Macedonia and is presented in Table 3.

Table 3. Gross felled timber per structure and by species of trees (in 000 m³)

Year	Total gross volume	Technical wood	Fuel wood	Scrap	Deciduous species	Coniferous species
2011	857	143	636	78	785	72
2012	779	127	579	73	711	68
2013	692	114	536	41	627	64
2014	655	121	495	39	588	67
2015	849	126	683	40	762	87
2016	890	133	713	44	810	80
Average	787	127	607	53	714	73
AAR	0,76	- 1,44	2,31	- 10,82	0,63	2,13

The assortment structure of gross felled timber annually for the period analyzed was: 127000 m³ or 16,1% technical wood, 607000 m³ or 77,1% firewood, and 53000 m³ or 6,8% scrap. Technical wood and scrap have a trend of decline, while firewood had a trend to rise, with average annual growth rate of 2,31% for the period 2011-2016.

The data related to the gross felled timber according to the types of trees is as follows: broad - leaved species participate annually with an average of 714000 m³ or 90,7%, while the conifers are represented with 73000 m³ or 9,3% in the period studied. Gross felled timber in both broad - leaved and coniferous plantations has a trend of increase in the period analyzed.

Data on the structure of the gross felled timber by tree species is shown in Table 4. The data was obtained from the State Statistical Office of the Republic of Macedonia.

Table 4. Felled timber in and outside forest, by tree species (in 000 m³)

Year	Total gross volume	Broad - leaved					Coniferous			
		Total	Oak	Beech	Other hard wood	Other soft wood	Total	Fir and spruce	Pine	Other
2011	857	785	320	358	103	4	72	8	43	21
2012	779	711	289	353	58	11	68	7	41	20
2013	691	627	242	328	44	13	64	5	36	23
2014	655	588	216	311	51	10	67	8	38	21
2015	849	762	341	324	52	45	87	6	55	26
2016	890	810	336	380	46	48	80	6	47	27
Average	787	714	291	342	59	22	73	7	43	23
AAR	0,76	0,63	0,98	1,20	- 14,89	64,38	2,13	- 5,59	1,79	5,15

According to the data in Table 4, from the total 714000 m³ of broad - leaved tree species, 291000 m³ or 40,8% of oak is recorded, the beech is represented by 342000 m³ or 47,9%, while the other hard and soft broad - leaved belong to 81000 m³ or 11,3% annually for the period 2011 - 2016.

In coniferous tree species, of the total of 73000 m³ analyzed, pine is the most represented with 43000 m³ or 58,9%, followed by other coniferous species with 23000 m³ or 31,5%. Fir and spruce participate with 7000 m³, i.e. a minimum of 9,6% in the period studied.

Felled timber in all types of trees has a trend of growth, except for the hard leaves and fir and spruce, where the trend decreases annually in the period analyzed (2011-2016).

4. FOREST PRODUCTS

Forest products are the basis for providing raw materials for production of wood, that is, for the wood industry. The assortment structure of the products in the forestry in state forests refers to roughly processed timber (wood in the rough), which are composed logs (broad – leaved and coniferous), other long wood, stack wood, firewood, mining wood, and other wood in the rough.

The data was obtained from the State Statistical Office of the Republic of Macedonia for the period 2011-2016 and is shown in Table 5.

Table 5. Products in forestry and felling in state forests (in m³)

Year	Wood in the rough (in total)	Logs			Other long wood	Stack wood	Fuel wood	Mining wood	Other wood in the rough
		Broad-leaved	Coniferous	Total					
2011	597519	64232	34315	98547	14778	1563	475955	6117	559
2012	558825	64888	35883	100771	10833	971	439386	6274	590
2013	534032	67073	29880	96953	5776	2355	423589	4987	372
2014	503862	61145	30781	91926	4944	2295	399396	4754	547
2015	566082	58348	34478	92826	5408	2063	461301	3385	1099
2016	626071	66534	30927	97461	5554	3782	514588	4449	237
Average	564399	63703	32711	96414	7882	2172	452369	4994	567
AAR	0,94	0,71	- 2,06	- 0,22	- 17,78	19,3	1,57	- 6,17	- 15,77

According to the data in Table 5, from the state forests, on average annually in the period from 2011 to 2016, 564399 m³ of wood in the rough were produced, from which 96414 m³ or 17,1% were logs. Of the logs, predominant type is beech with 63703 m³, while coniferous logs are 32711 m³. Of the average produced forest assortments of state forests in the analyzed period, the part includes other long wood with 7882 m³, stack wood with 2172 m³, mining wood 4994 m³ and fuel wood with 452369 m³ or 80,2%. The other roughly processed wood has insignificant share in the produced forest assortments from state forests during the studied period.

The produced forest assortments, and the total wood in the rough, as well as the logs of beech, stack wood and fuel wood have a trend of growth, while concerning the logs of coniferous species, other long wood, mining wood and other roughly-treated wood, the trend is declining annually in the analyzed period (2011-2016).

5. CONCLUSIONS

From the analysis of the raw material potential of wood industry in the Republic of Macedonia the following conclusion can be drawn:

The total area of forest land in the Republic of Macedonia is 1117701 ha, out of which 989608 ha are areas under forest, 101683 ha are another forest land, and infertile land amounts 25743 ha for the period 2011-2016. All types of forest land have a positive trend of increase in the period analyzed.

Felled timber, that is, the realized annual cut, annually in state forests is 609000 m³, or 74,9%, while in the private forests it is 158000 m³ or 25,1%. Total felled timber, as well as felled timber in private forests has a trend of growth, in contrast to the annual cut in state forests where the trend is negative in the period 2011-2016.

The gross felled timber of broad - leaved species participates annually with 714000 m³ or 90,7%, while the conifers are represented with 73000 m³ or 9,3% in the studied period. The gross felled timber in both, broad - leaved and coniferous species has a trend of increase in the analyzed period.

Out of the total of 714000 m³ of broad - leaved tree species, 40,8% is covered with oak, 47,9% with beech, while the other hard and soft broad – leaved species are represented with 11,3% annually for the period 2011-2016. For coniferous tree species, out of the total of 73000 m³ analyzed, pine is in the majority, represented with 58,9%, followed by other coniferous species with 31,5%. Fir and spruce participate with 9,6% in the study period. Felled timber in all types of trees has a trend of growth, except for the hard broad - leaved and fir and spruce, where the trend decreases annually in the analyzed period (2011-2016).

In the period from 2011 to 2016, a total of 564399 m³ of roughly-processed timber was produced, out of which 96414 m³ or 17,1% were logs. Of the logs, predominating type is beech with 63703 m³, while the coniferous logs are 32711 m³. Then follow the other long timber with 1,4%, stack wood with 0,4%, mining wood with 0,9% and fuel wood with 80,2%. The other wood in the rough has an insignificant share in the produced forest assortments from state forests during the studied period. Total wood in the rough, as well as the logs of beech, stack wood and fuel wood show a tendency to grow, while in logs of coniferous species, other long wood, mining wood and other roughly-treated wood, the trend decreases annually in the analyzed period (2011 - 2016).

Given that the assortment structure of gross felled timber, or annual available cut is relatively unfavorable due to the high share of fuel wood and wood scrap in the forest, it should be adjusted in terms of quality and conditions of forests and with the needs of the wood processing capacities, that is, the wood industry in the Republic of Macedonia.

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