

COMPARATIVE ANALYSIS OF RESOURCE EFFICIENCY IN PARQUET BLANK PRODUCTION: DEDICATED VS. BY-PRODUCT SAWMILLING STRATEGIES

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INTRODUCTION

The sawmill industry represents a key component of the wood industry. It is the first technological process that predetermines the entire wood processing chain and its utilization.

The quality of the sawmilling process is directly related to the quality of the wood products. Although the primary objective of sawmilling is to obtain the highest-quality wood products from sawlogs, an important aspect of the process is the percentage of **quantitative yield**.

From a practical point of view, **quantitative yield** plays an important role. From an economic point of view, the key indicator of a successful sawmilling operation is the **quantity of wood products obtained from a single sawlog**. Another important indicator of utilization is **qualitative utilization**.

Raw material



Sawlogs



Sawn products



INTRODUCTION

The primary source of raw materials for processing in the wood industry sector are the **forest resources**, which are an important branch for the economic life of the human population.

Trees in forests grow and develop in close association with other plant species and the entire animal world, forming a complex plant-animal system called the forest biocenosis.

Of interest for primary wood processing are commercial and private forests, and their managing methods. These forests are sources of forest assortments, all with the aim of obtaining the highest quality sawmill products after sawing and processing the raw materials, i.e. the sawlogs.

The main objective of the technological flow in sawmilling is to obtain the primary sawmilling products (boards, planks, and structural lumber intended for construction). During the sawing of these products, a certain amount of waste is generated. Waste occurs as **fine and coarse waste**.

From the coarse waste, small wooden elements and **flooring elements** can be produced, as well as wood-based fuels. One of the ways the industry has found to utilize sawing by-products is through the production of flooring elements. Flooring elements are relatively small pieces and generally require a higher quality class.

Sawing and utilization



Coarse waste



Fine waste

MATERIALS AND METHODS

Raw material

The raw material used in this research consisted of **beech** (*Fagus sylvatica* L.) sawlogs. The sawlogs originated from domestic forests in North Macedonia.

The mean diameter of the sawlogs used in this research ranged from **34.0 to 36.0 cm**, and all logs had an untrimmed length of **3.0 m**.

A total of **12 logs** were processed for the purposes of this research. The logs were graded as quality classes **A, B, and C** according to the Macedonian standards MKS EN 1313-2:2010 Round and sawn timber – Permitted deviations and preferred sizes – Part 2: Hardwood sawn timber and MKS EN 1316-1:2013 Hardwood round timber – Qualitative classification – Part 1: Oak and **beech**.



Beech sawlogs

MATERIALS AND METHODS

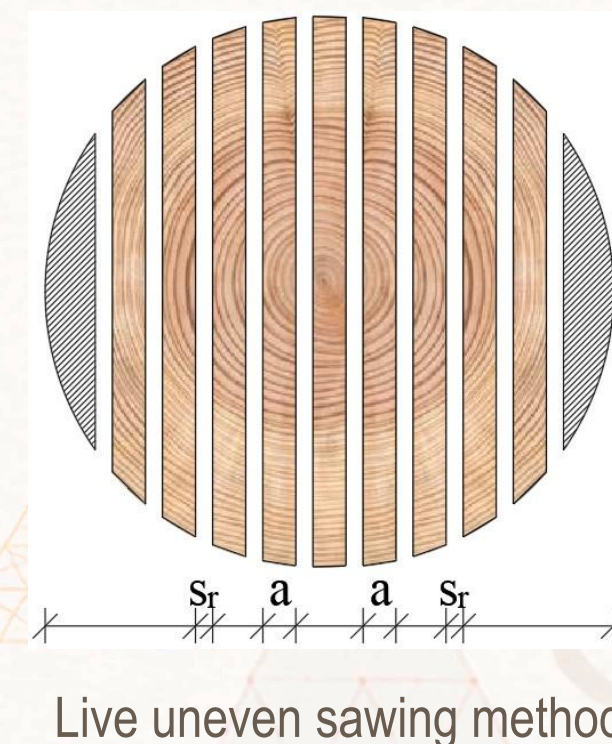
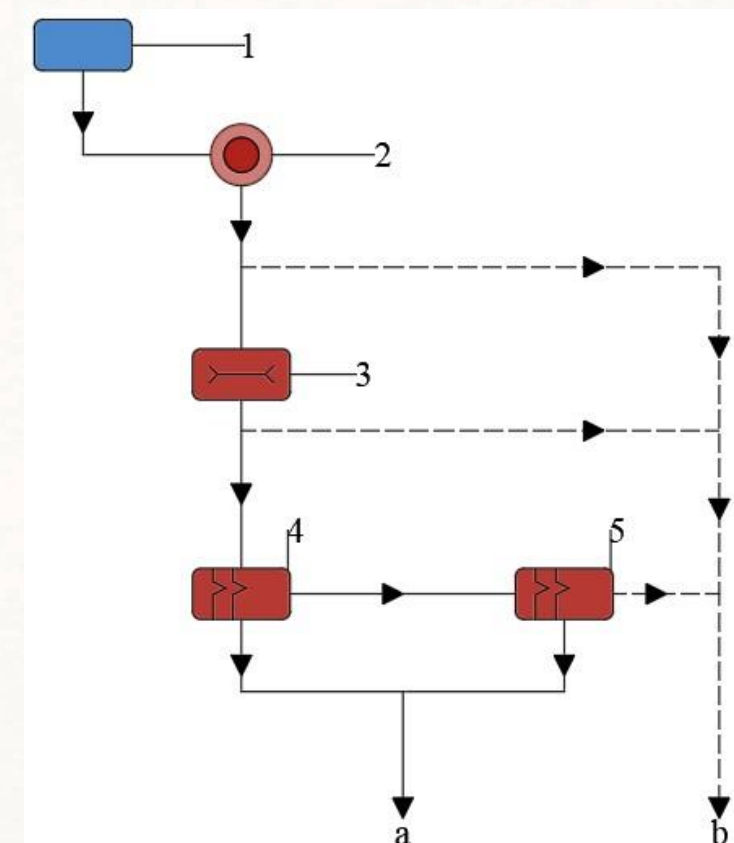
Technological flow

The logs were processed using a **vertical bandsaw** at a representative sawmill in North Macedonia. All logs were measured before processing.

The logs were divided into two categories: dedicated logs intended for the production of parquet blanks and logs intended for the production of planks, with parquet blanks produced from the by-products. The two groups consisted of **six logs each**.

The logs were processed using the live uneven sawing method.

From the dedicated logs, parquet blanks with dimensions of **25 × 50 × 450 mm** were sawn.



Single-phase log processing:

1) logs warehouse, 2) main bandsaw, 3) transversal circular saw, 4 and 5) small bandsaw, a) parquet blanks, b) coarse waste

MATERIALS AND METHODS

Production of planks and blanks

From the logs intended for the production of primary sawmilling products, planks with a thickness of **25 mm** and various lengths and widths were produced. From the by-products of these logs (slabs, cut-offs, and cut-outs), parquet blanks with the same dimensions as those produced from the first group of logs were manufactured. After sawing, all obtained wood products were measured accordingly (length, width, and thickness), and their volume was calculated.

The technology of processing logs into parquet blanks is based on the **single-phase technology**, while the technology of processing logs dedicated for planks is based on a **two-phase technology**.

Parquet blanks



Planks



MATERIALS AND METHODS

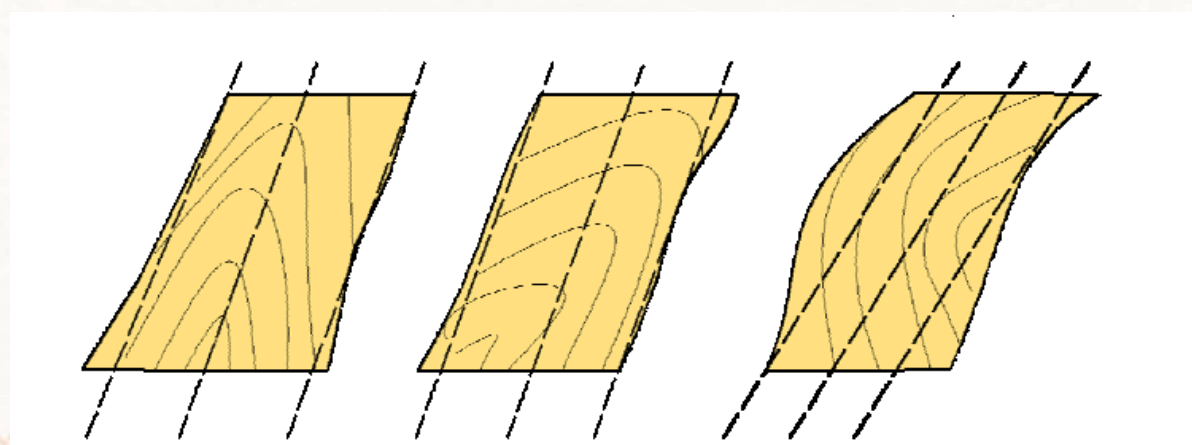
Obtained products

Parquet blanks are wooden elements with **parallel-edged sides and ends**. They are intended for the production of parquet lamelas (strips). Parquet blanks are sawmill products used as raw material for the production of parquet.

Beech parquet blanks, during their production, include parts of the sapwood, with small and healthy parts from the heartwood.

Parquet blanks are sawn assortments with **uniform thickness**, **without defects**, with parallel-made edges.

The technology for producing parquet blanks is not standalone, but is most often part of the sawmill processing of logs in the sawmill facilities.



RESULTS AND DISCUSSION

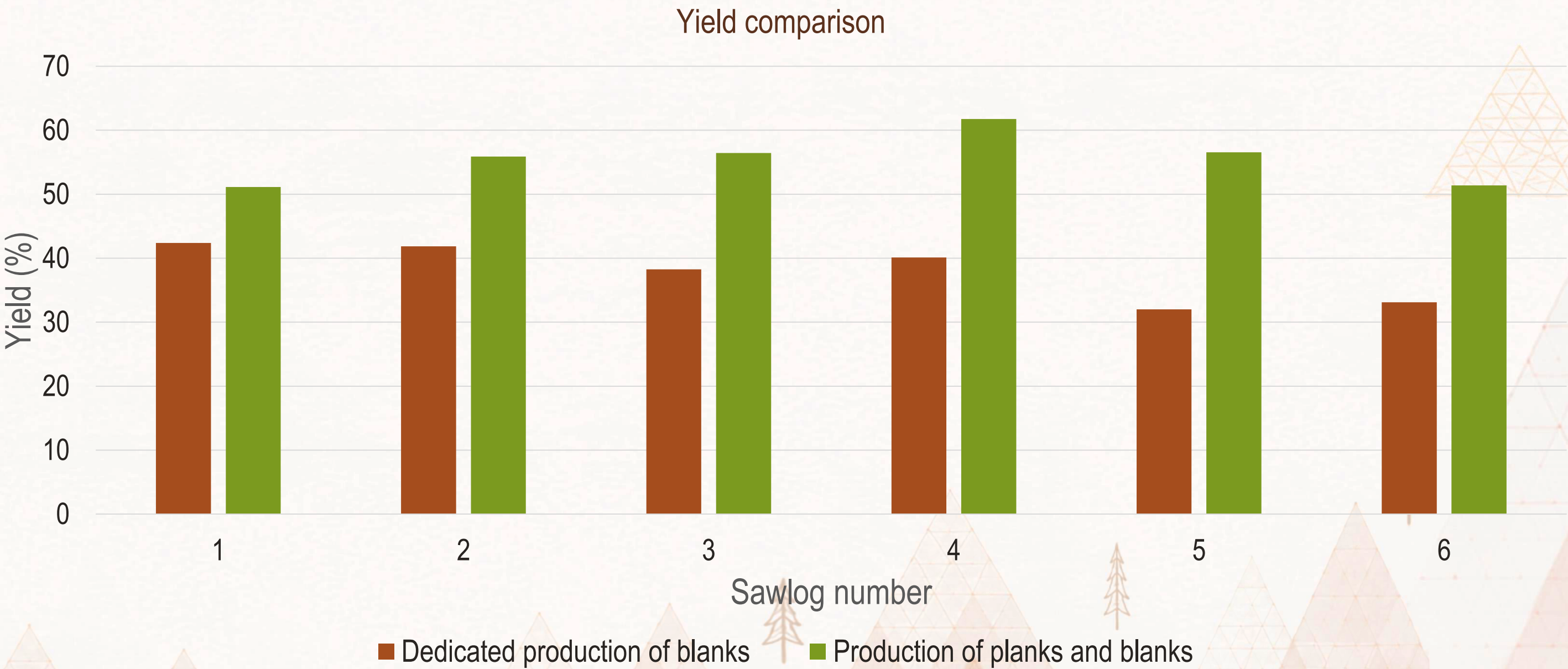
Quantitative yield of the processed beech sawlogs

Dedicated production of blanks				Production of planks and blanks					
Blanks (yield)	Fine waste	Coarse Waste	Total Waste	Planks	Blanks	Total yield	Coarse waste	Fine waste	Total waste
42.38	24.86	32.76	57.62	41.8	9.34	51.14	27.2	21.66	48.86
41.86	26.58	31.56	58.14	43.6	12.3	55.9	26.32	17.78	44.1
38.25	24.27	37.48	61.75	46.25	10.18	56.43	24.12	19.45	43.57
40.10	24.90	35.00	59.9	48.53	13.25	61.78	23.3	14.92	38.22
32.00	23.85	44.15	68.0	45.2	8.36	56.56	24.12	19.32	43.44
33.12	22.57	44.31	66.88	42.26	9.12	51.38	26.14	22.48	48.62

According to the data presented, it can be observed that the mean yield of the logs intended for the dedicated production of parquet blanks was **37.95%**, whereas the mean yield of the logs intended for the production of planks and parquet blanks was **55.53%**. Regarding the percentage of total waste, the mean value for the dedicated production was **62.05%**, while that for the production of planks and parquet blanks was **44.46%**.

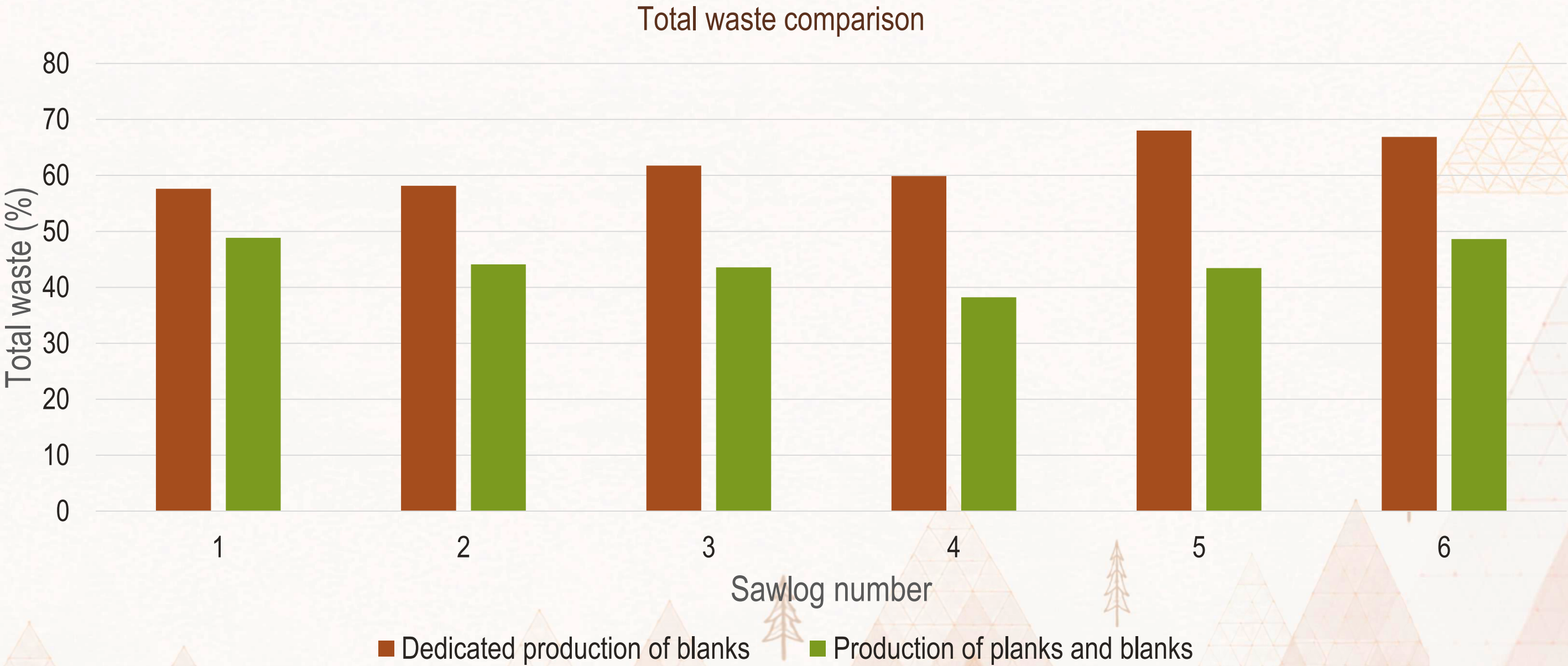
RESULTS AND DISCUSSION

The difference in yield between the dedicated blank production and the production of planks and blanks



RESULTS AND DISCUSSION

The difference in total waste between the dedicated blank production and the production of planks and blanks



CONCLUSIONS

This paper presents an analysis of the efficiency of two sawmilling processes: one intended for the dedicated production of parquet blanks and the other intended for the production of primary sawmilling products (**planks**), with parquet blanks obtained from coarse waste

According to the presented data, it can be concluded that there is a noticeable difference in the quantitative yield between the two production methods.

The **yield percentage is higher** with the traditional sawmilling strategy of producing **planks** and manufacturing parquet blanks from **by-products (coarse waste)**. These favourable results are due to the fewer technological operations and the smaller number of cuts required for producing the blanks compared with the dedicated production of parquet blanks directly from the sawlogs.

In addition, the dedicated production of parquet blanks generates a **greater amount of waste**, which decreases the economic efficiency of the sawmilling process.

Furthermore, the generation of a larger amount of waste also reduces the sustainability of the production process. In conclusion, the dedicated production of small wooden elements is **not efficient in terms of raw material utilization**.

Thank you for your attention

Questions?

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