



# POTENTIAL OF THE CROATIAN WOOD INDUSTRY IN ACHIEVING CARBON NEUTRALITY – PRODUCTION TRENDS ANALYSIS FROM 1900 TO 2020

PETAR ĆURIĆ, ANDREJA PIRC BARČIĆ, DARKO MOTIK, MAJA MORO,  
MARTINA BASARAC SERTIĆ, ŽIVKA MELOSKA

16<sup>th</sup> International Scientific Conference WoodEMA 2023 **Current Trends and Challenges for Forest-Based Sector: Carbon  
Neutrality and Bioeconomy**

Prague, Czech Republic  
June 13<sup>th</sup> -16<sup>th</sup>, 2023

## 1.) INTRODUCTION

- The total area of forests and forest lands in Croatia is 2,76 million ha, which is 49.3% of the land area of the country.
- 2,1 million ha are public owned forests, while 661,721 ha are owned by private forest owners.
- The majority of forests owned by the state are managed by the public forest owner company.
- A total amount of wood stock is 418.6 million m<sup>3</sup>. Croatian wood-based industry has been developed on high quality forest raw material and as such, it represents an important economic segment of the country.

**Wood products are carbon stores**, the retention time of carbon in wood products is different because it depends on the type of wood product and its purpose, for example, firewood can be burned in the same year in which it was 'produced';

The lifespan of paper and paper products is usually less than 5 years (it may also include the recycling process), while sawn timber or wooden panels in wooden building elements can have a lifespan of more than 100 years).

Likewise, 'used' wood products can be deposited in landfills where they can remain for a very long period of time (IPCC Guide, Chapter 12: HWP; p. 12.5). Despite the storage in wood products in use and wood products deposited in landfills, the carbon oxidation of these products in a given year may be less or potentially greater in relation to the total amount of wood products produced in that particular year. Globally, according to studies by Winjum et al. (1998) and according to UNFCCC reports (2003), it is to be expected that the amounts of carbon stored in wood products will increase.

## 2.) OBJECTIVE

The objective of this paper is to present production trends of selected wood products from 1900 to 2020 in Croatia aiming to motivate all relevant stakeholders within wood-based sector to pay more attention about its potential and emphasize its importance in achieving carbon neutrality goals.

### 3.) MATERIALS AND METHODS

- a) Categories of wood products: sawn wood; wood-based panels (veneer sheets, plywood and particle board) and paper and paper board.
- b) Analyzed period: 1900 – 2020;
- c) **For the period from 1991 to 2020**, the data was taken from the **UNECE/FAO database**, which the Republic of Croatia submits to the UNECE/FAO Forestry Department once a year, based on the data of the National Bureau of Statistics on the production, export and import of wood products (Harvested Wood Products – HWP).
- d) **For the period from 1960 to 1991**, data on wood products in the Republic of Croatia were taken from numerous statistical yearbooks, statistical reports, statistical bulletins, and statistical yearbooks, which are stored/available at the National Bureau of Statistics.

- **For the period from 1900 to 1960**, for certain years, data were found and taken from some of the previously mentioned statistical reports of the National Bureau of Statistics, while for other years, according to the recommendations of the IPCC Guidelines for HWP, 'backward predictions' were prepared.
- According to IPCC guide the estimated annual rate of change in log consumption for the Republic of Croatia in the period from 1900 to 1961 was **0.0151** (considering that of the offered world areas, the Republic Croatia belongs to the territory of Europe)
- a) systematizing data - an MS Excel database was created, in such a way that a 'row' of the worksheet represents one wood product, and a 'column' of the worksheet represents the year for which the data is collected, which refers to the period from 1900. ending with 2020.

- The shares of domestically produced logs (domestic harvest) in Croatia in to the total log production of Croatia for each individual year were calculated



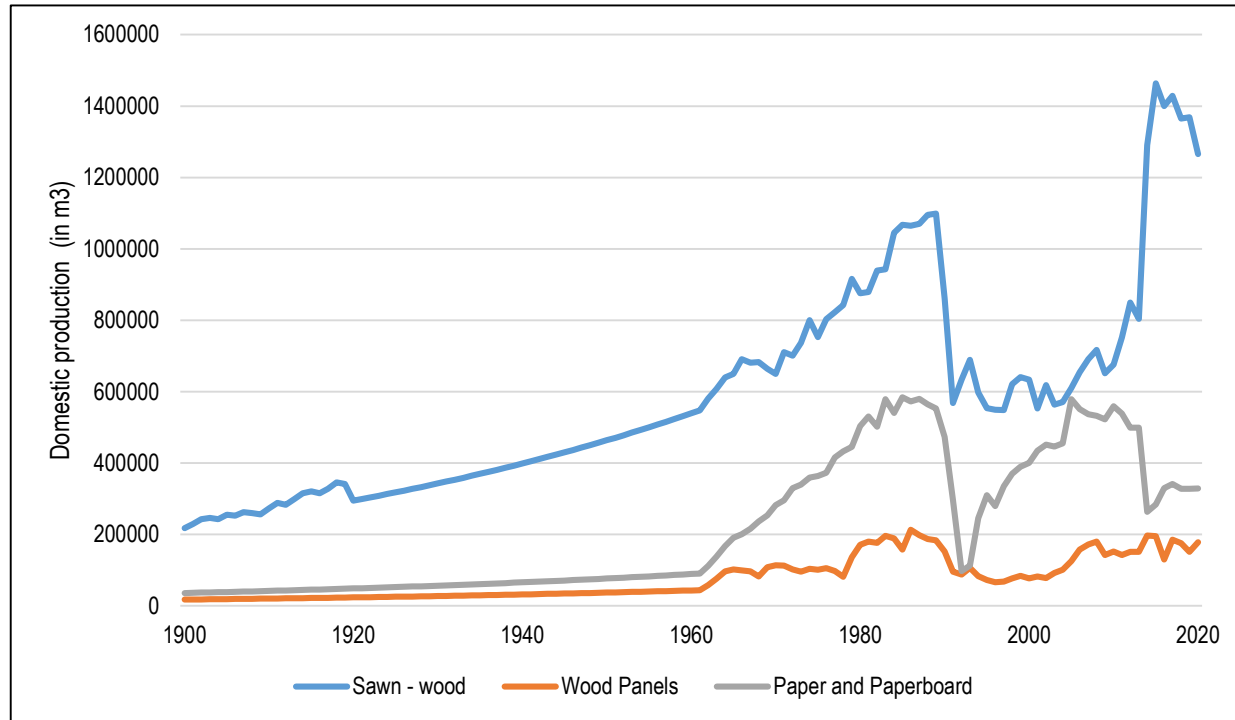
were multiplied by the production values of each of the defined product categories (sawn wood; wood based panels and paper and paperboards), which defined the production values of defined product categories based on domestic production (domestic harvest) Croatia for each observed year in the period from 1900 to 2020



The correlation coefficient  $r=0.99202183$ , as well as the coefficient of determination  $R^2=0.98410732$  are extremely high, which indicates that the trend equation perfectly describes the movement of the value of the variable in the analyzed period.

## 4.) RESULTS

### Production trends of wood products from 1900 to 2020



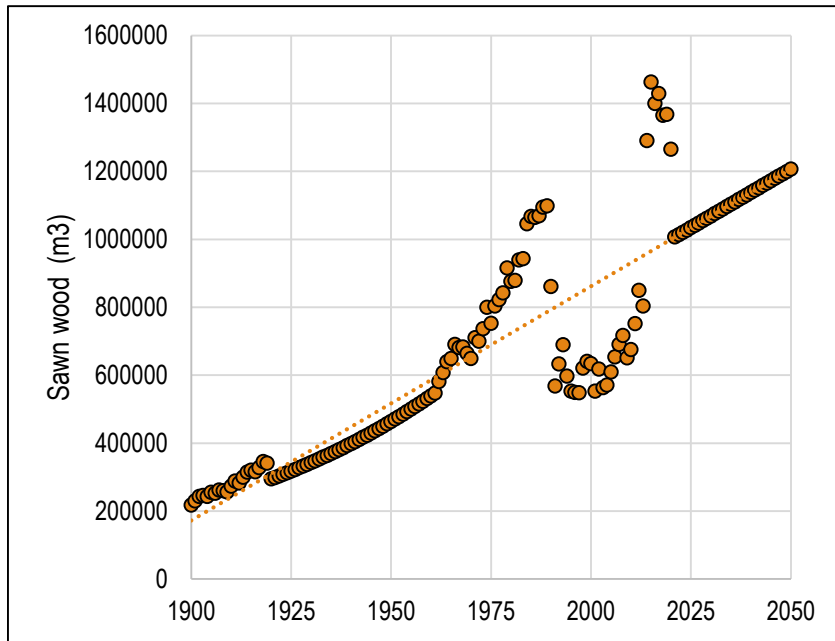
*Figure 1. Domestic production trends of selected wood-products from 1900 to 2020*

In 1900 domestic production of sawn wood was 230.000m<sup>3</sup>, in 1950 was 460.000m<sup>3</sup>, followed by 630.000m<sup>3</sup> in 2000. In 2020 domestic production of sawn wood was 1.265.000 m<sup>3</sup>. In 1900 domestic production of wood panels was 17.500 m<sup>3</sup>, in 1950 was 37.200 m<sup>3</sup>, followed by 77.000 m<sup>3</sup> in 2000. In 1900 domestic production of paper and paperboard was 36.000 m<sup>3</sup>, in 1950 was 76.000 m<sup>3</sup>, followed by 400.000 m<sup>3</sup> in 2000.

Correlation analysis to determine the degree of correlation between the values of domestic production of sawn wood, wood panels and paper & paperboard as dependent variables and time ( $t$ ) as independent variable were used. We found that the direction and strength of the correlation relationship was positive and relatively ( $r_1=0,89$  for sawn wood;  $r_2=0,90$  for wood panels; and  $r_3=0,89$  for paper & paperboard), so we developed linear trend models for prediction of future values of sawn wood, wood panel and paper & paperboard domestic production.

In all models,  $t$  is mark for the *time*, where  $t = 0$  compared to year 1900,  $t = 1$  for year 1901; ... ,  $t = 91$  to year 1961, etc. Unit for predict values of sawn wood, wood panel and paper & paperboard is in  $m^3$ . Constructed models for predicting the future values of sawn wood, wood panel and paper & paperboard domestic production were as follows:  
 $y_1 = 6893,4x - 1E + 07$ ;  $y_2 = 1394,4x - 3E + 06$ ; and  $y_3 = 4490,1x - 9E + 06$

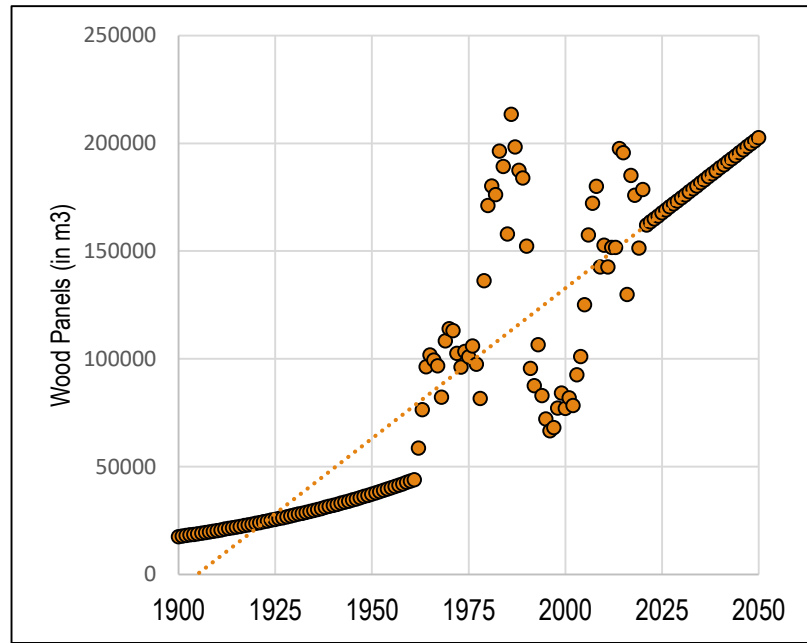
## Projection trends of wood products production to 2050



According to the linear trend model (Figure 2) the **expected linear increase in the annual sawn wood domestic production values is 6.893 m3**. The **expected production of sawn wood domestic production according to the linear trend model in 2050 would amount to about 1.200.000 m3**.

*Figure 2. Existing and projected Sawn Wood domestic production values (in m3)*

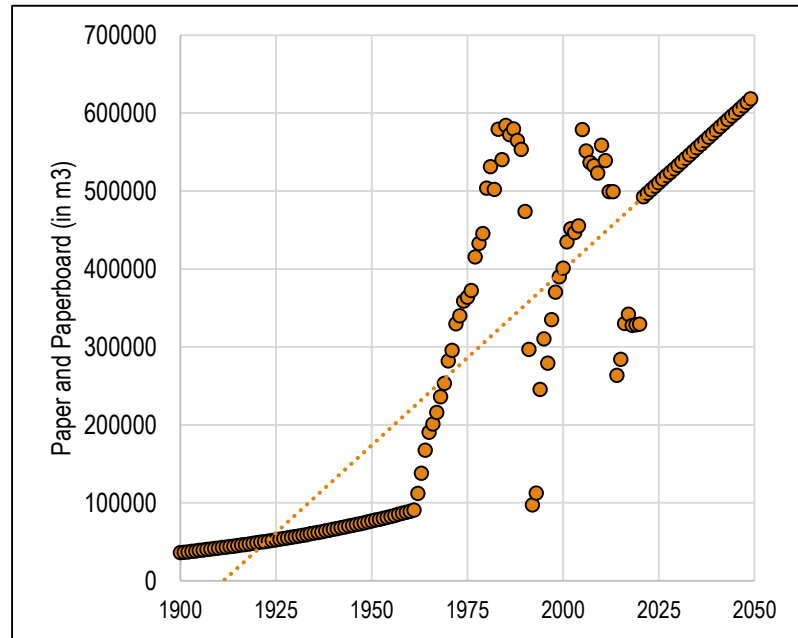
## Projection trends of wood products production to 2050



*Figure 3. Existing and projected Wood Panels domestic production values (in m3)*

According to the linear trend model (Figure 3) the **expected linear increase in the annual wood panel domestic production values is 1.394 m3**. The **expected production of wooden panels according to the linear trend model in 2050 would amount to about 200.000 m3**.

## Projection trends of wood products production to 2050



According to the linear trend model (Figure 4) the **expected linear increase in the annual paper & paperboard domestic production values is 4.490 m3**. The **expected production of paper and paper boards according to the linear trend model in 2050 would amount to about 600.000 m3**.

*Figure 4. Existing and projected Paper & Paperboard domestic production values (in m3)*

## 5.) CONCLUSIONS

There are high-quality statistical reports on the wood industry for a large number of years.

The collected data of the requested product categories within the wood industry are uniform, which indicates the relative accuracy of the data.

According to the projections (linear trend models), it is to be expected that in future periods the production of wood products, both sawn timber and wood panels, as well as paper and paperboard, will increase.

**It is very important to continue activities of collecting all relevant data of wood processing and production of wood products and that they are updated in the shortest possible period of time, so the analysis of carbon storage parameters in wood products would be as accurate as possible.**

# THANK YOU!

---



**Authors address:**

Ćurić, Petar, Pirc Barčić, Andreja; Motik, Darko; Moro, Majal<sup>1</sup>; Basarac Sertić, Martina<sup>2</sup>;  
Meloska, Živka<sup>3</sup>

<sup>1</sup> Department for production management; Faculty of Forestry and Wood Technology, Zagreb, Croatia

<sup>2</sup> Croatian Academy of Sciences and Arts Act; Institute of Historical and Social Sciences; Zagreb; Croatia

<sup>3</sup> Faculty of Design and Technology of Furniture and Interior, Ss. Cyril and Methodius University, City, Skopje; Republic of North Macedonia

\*Corresponding author: [petar.curic@gmail.com](mailto:petar.curic@gmail.com); [apirc@sumfak.unizg.hr](mailto:apirc@sumfak.unizg.hr)