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MEXICAN TIMBER INDUSTRY AND ITS ECONOMIC PERFORMANCE IN THE PERIOD 2003 - 2022

Georgel Moctezuma Lopez

Master of Science by Postgraduate College,
Mexico / Branch of Agricultural Economics
Institution: National Center for Disciplinary
Research in Ecosystem Conservation and
Improvement Forestry of the National
Research Institute Forestry, Agriculture and
Livestock. Mexico
Mexico City, Mexico

Lourdes Velázquez Frago

Doctoral student in Economic Sciences at
the National Polytechnic Institute, Mexico /
Higher School of Economics
Mexico City, Mexico

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Abstract: The study opened a period of 20 years, from 2003 to 2022, which included four presidential periods, or first in 2003/06, which second on the basis of data from INEGI opened only the last four years, or secondly the third only complete periods (2007/ 2012 and 2013/2018) the fourth quarter is also incomplete, just the first four years of the mandate, during the four years analyzed and the behavior and contribution of the wood industry and two three sub-branches: Sawing and conservation of wood, Manufacture of laminated and cast wood and Manufacture of other wood products to the Gross Domestic Product (GDP) that served to determine its comparison and importance in the sector of the processing industry. The objective of the work was to quantify the growth that the wood industry has and its contribution to the Mexican economy. The methodology to determine the behavior of the GDP made was a five-phase documentary type, which was supported by data from the Mexican National Accounting System of INEGI, the mathematical function that was used to determine the increases (positive or negative) was the average tax. annual growth rate (AMR). The main result was that the timber industry in the period of analysis had a positive, more modest growth, because it was poorly matched in the percentage point and its best component was the sawmill industry, which is considered the icon of the forestry industry, since Its industrial units are normally located in forested areas or in tropical forest areas and experienced the best growth in the 2007/12 semester with CAGR = 3.68%. Finally, it is a qualitative consideration that the timber industry plays a determining role in the sustainability of the timber resources of tropical forests and forests, as long as there is a management plan that broadly considers the reforestation of the areas that are explored and included in the programs. governments

to support foresters to contribute to a greater national well-being

Keywords: economic evolution, six-year periods, Gross Domestic Product, average rates of annual growth trends.

INTRODUCTION

The wood industry is a key piece within the forestry sector, since it plays a determining role in the utilization of forests and in their reforestation to reconvert the sector and transform it into an activity sustainable, through short-medium- and long- term planning that allow ever greater production, but without the deterioration caused by the deforestation, without his due replanting of forest species suitable, immediately after of the cutting of the masses forests destined for sawmilling, so that it builds with a better environment and that in turn turns out to be an activity profitable from economic point of view, as well as contribute to the generation of jobs and avoid migration from one of the economic sectors where they live populations of the poorest. For its part (Industria Plus 2024) points out that the manufacturing industry wood plays a fundamental role in the global economy and according to data and statistics, is one of the most important industrial sectors and generates a high added value in economic terms; Not only does it contribute to economic growth, but it is also a source of employment; This industry is fundamental for sectors such as construction and furniture; without wood, the construction of houses, bridges and other types of infrastructure would be more expensive and difficult, in addition, the timber industry provides the raw material for the furniture manufacturing, which is an important source of income and employment in many countries. The indicator that was taken into consideration, for the quantification of the economic valuation was the international indicator Gross Domestic

Product (GDP) in general and in particular that relating to the Manufacturing Industry wood and according to Cue and Quintana ((2014), said macroeconomic indicator is the sum of all the goods and services produced in a country during a period specific period (year, semester, quarter) and is expressed in monetary units of the country in question and in American dollars to make comparisons world besides GDP can be calculated at prices currents that are known as nominal, or at constant prices that are calls real; In the present study, both: current (nominal) and constant (real) GDP were used for its comparison and behavior in their economic contribution. Based on CEMDA (2018), Mexico has 138 million hectares with vegetation forestry, what do they mean 70 % of national territory and part of that surface is covered with forests and jungles with 64.9 million hectares, of which which is estimated to be 15 million have a productive potential for the commercial use that are located, mainly, in the massifs mountainous from the east and west from the country; finally, the surface in the which is performed production forestry is 5.53 million hectares (SEMARNAT, 2019) and within the forestry manufacturing GDP (transformation activities), the sawing activity has a relevant participation (INEGI 2019)

The objective of this research work was quantifying the growth (positive or negative) since point of view of the industry wood to the Gross Domestic Product in a period of 20 years and its growth to know the relative importance of your contribution within the manufacturing industry of Mexico.

METHODOLOGY

The methodological process that was used was the five-stage documentary type:

i) First: selection of the topic to be studied, for the research in question was chosen the one that deals with evolution of the industry

wood and its three components (sawing and conservation of the wood, Manufacture of laminates and agglutinates and Manufacture of other wood products).

ii) Second: collection of the information in sources secondary documentaries, central idea was that of collecting statistics with the purpose of carrying out your quantification, ordering and classification to size and value the importance about the topic. It was resorted to precise search and location of documents stored in information centers, libraries, reference centers, databases, as well as articles and summaries of proceedings from seminars and conferences national and international, among others. During this phase, a database was designed and developed in Excel, the which was fed with the information that generates he National Institute of Statistics, Geography and Informatics (INEGI) in its various documents that it publishes periodically and that served to organize the documentary sequence. The study period was delimited according to the accounts nationals published by the fountain noted during the 20- year period 2003 – 2022 and the base year that served as the basis for using constant prices as which data can be comparable was he of the year 2018.

iii) Third: elaboration of the research plan, with he purpose of ordering and exercising he thought and understanding, as well as that the concepts have a logical and systematic structure and the definition of subtopics to prioritize was chosen the economic indicator known as the Gross Domestic Product of the Manufacturing Industry command at the aggregate level of its three components: Sawing and conservation of the wood, Laminated and agglutinated and Manufacture of other wood products with quantifications annually. To facilitate the Understanding the aggregates was based on the North American Industrial Classification System (NAICS, 2013), the which frames them in Sectors, Branches and

Subramos of the following manner:

- Sector 31–32–33. Manufacturing Industry.
- Branch 321. Industry Wood.
- Sub-branch 3211 Sawing and conservation of wood.
- Sub-branch 3212 Manufacture of laminated and bonded wood
- Sub-branch 3219 Manufacture of other wood products.

iv) Fourth: organization of the information that was collected was carried out through indexing of the content and secondary sources of information, for which was segmented into the wood in the mentioned components and determine the contribution of each one of them to the economy, as well as the aggregate that included the three components, as well as the variations in its value compared to the previous year and its percentage participation within the Industry wood, which would allow a better comprehension about the topic.

v) Fifth: selection of the statistical indicator, it was considered that the mathematical formula that best reflects the growth annually is the rate average annual growth because it is supposed to be the one that best reflects the growth of an activity in a medium- and long-term period, its mathematical expression is:

$$TMCA = (Vf / Vi)^{(1/n) - 1} * 100.$$

Where Vf means the final value of the period; Vi corresponds to the initial value of period yn represents the number of years considered by the analysis.

Likewise, the growth of a specific year, the which was compared with his immediately preceding, to facilitate and identify the sizes of positive and negative increments that result throughout the period (Addin Technology, 2018). Likewise, a trend line was included to have a better understanding in evolution of the indicators.

RESULTS AND DISCUSSION

The variable that was selected to visualize the economic behavior in the 20 years that it covered the analysis period was the value of Gross Domestic Product (GDP) expressed in millions of Mexican pesos at constant prices with base year of 2013. Likewise, the results of each of the components that make up the to the Mexican timber industry and then the total is consolidated as the sum of each of them.

Sawing and conservation wood. In the Table 1, it is shown the evolution of the value of its GDP and trend, as well as the percentage variation with Over the previous year.

Year	Millions of Mexican pesos	Variation %
2003	17,456	0.00
2004	16,757	-4.17
2005	16,021	-4.59
2006	16,171	0.93
2007	17,472	7.45
2008	15,754	-10.91
2009	16,094	2.11
2010	17,359	7.29
2011	19,019	8.73
2012	21,699	12.35
2013	20,453	-6.09
2014	19,263	-6.18
2015	19,885	3.13
2016	19,091	-4.16
2017	19,750	3.34
2018	18,864	-4.70
2019	18,561	-1.63
2020	18,297	-1.44
2021	19,599	6.64
2022	17,900	-9.48

Table 1: Gross Domestic Product of the Sawing and conservation wood and its percentage variation in the period 2003 - 2022

Source: Elaboration own with data from INEGI.

Base year 2013

From the previous table it is observed that the elderly input monetary of the Sawing and conservation wood was reflected in the year 2012 and the youngest of it occurred in year 2008. Figure 1 shows the evolution and trend of said industry.

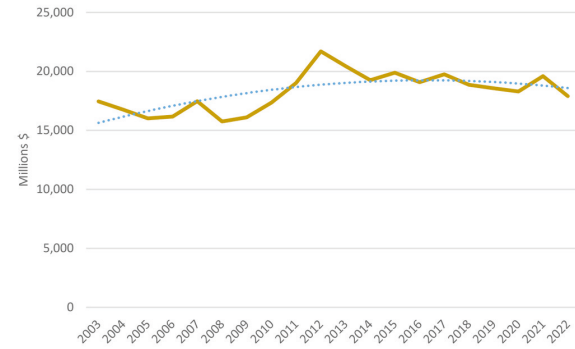


Figure 1: Behavior and trend of Sawing and conservation wood

Source. Elaboration own with data from INEGI.

Base year 2013

The previous figure shows that the best curve that explains the behavior of the GDP of the sawing is a polynomial type with formula $y = 20.376x^2 + 583.02x + 15075$, and with an $R^2 = 0.4582$ which is considered low correlation due to unstable of the GDP value of this industrial activity.

Their variations are shown in Figure 2. percentage growth (positive and negative) with relation to the previous year.

The previous figure shows how the GDP of the Sawing and conservation wood decreases in 50 % of the years that were analyzed, with a sharp drop in the year of 2008 and the better contribution to the indicator was presented for four consecutive years from 2009 to 2012, which is when has his elderly participation in GDP.

Manufacture of laminates and wood agglutinates. Like the previous component in the Table 2 is shown the value of its GDP and trend, as well as the percentage variation with Over the previous year.

Year	Millions of Mexican pesos	Variation %
2003	2009	0.00
2004	2,118	5.15
2005	2,301	7.95
2006	2,262	-1.72
2007	2,032	-11.32
2008	1979	-2.68
2009	1,806	-9.58
2010	1,705	-5.92
2011	1,869	8.77
2012	1,899	1.58
2013	2,130	10.85
2014	2015	-5.71
2015	2,136	5.66
2016	2,261	5.53
2017	2,133	-6.00
2018	2,109	-1.14
2019	2,075	-1.64
2020	2,157	3.80
2021	2,611	17.37
2022	2,545	-2.59

Table 2: Gross Domestic Product of the Manufacture of laminates and agglutinated wood and its percentage variation in the period 2003 – 2022.

Source: Source: Elaboration own with data from INEGI.

Base year 2013

The table above shows that the largest contribution to GDP from this industrial transformation activity occurred in 2021 and the smallest in 2010. Of the three components analyzed, this is the one with the lowest participation in the GDP of the Wood Industry. Figure 3 shows the behavior and trend of this component.

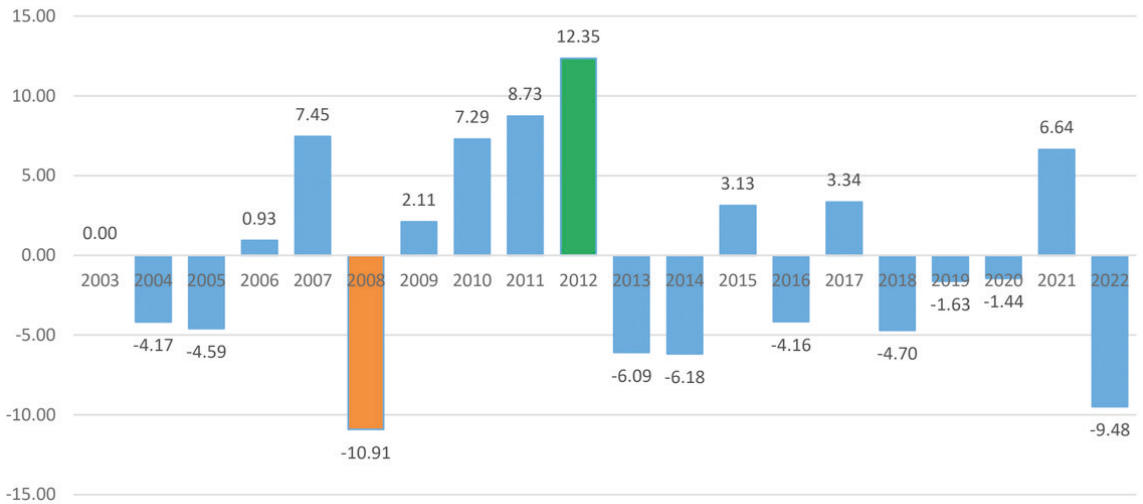
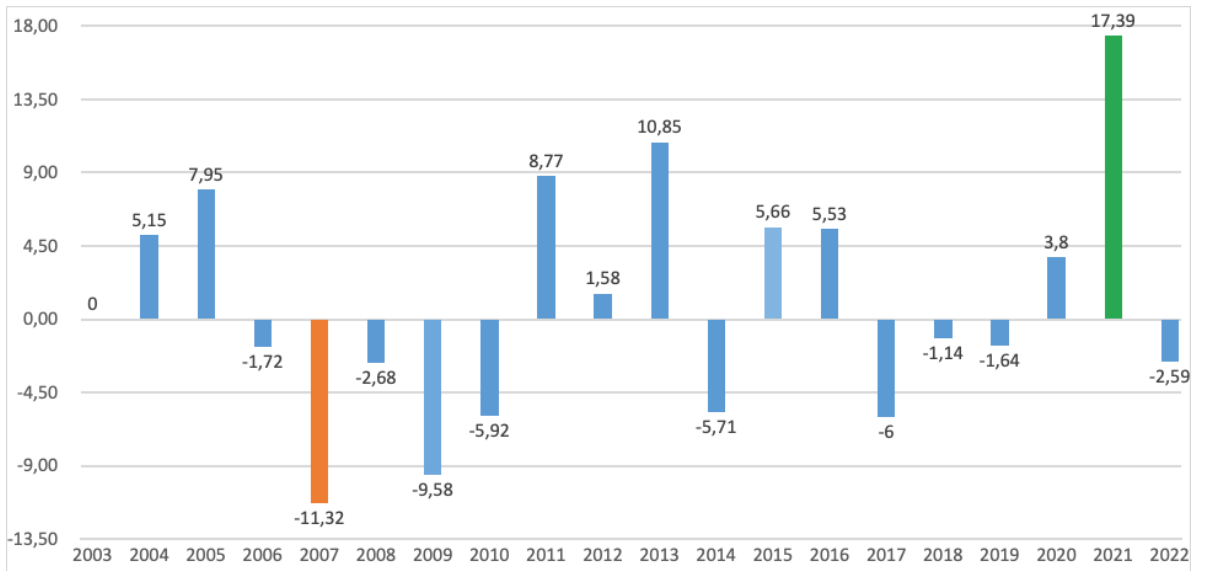


Figure 2: Percentage variation in GDP of the industry manufacturing of the Sawing and conservation wood from the years 2003 to 2022.

Source. Elaboration own with data from INEGI. Base year 2013



Source. Elaboration own with data from INEGI.

Base year 2013

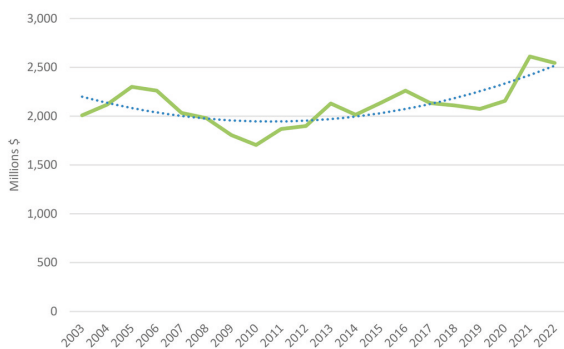


Figure 3: Behavior and trend of Laminates and Wood Agglutinates

Source: Elaboration own with data from INEGI.
Base year 2013

The previous figure shows that the best curve that explains the behavior of the GDP of the laminates and agglutinates of the wood is a polynomial type with formula $y = 4.3986x^2 - 75.667x + 2270.9$, and with an $R^2 = 0.5653$ which is considered low correlation due to unstable of the GDP value of this secondary transformation activity.

Figure 4 shows how they were the variations percentages with compared to the previous year of this component of the wood industry.

In the previous Figure, it is observed that the Manufacture of laminates and agglutinated wood, had a consecutive drop of five years (2006 - 2010), with its maximum decrease in 2007, while, its elderly Percentage growth compared to the previous year was in 2021.

Manufacturing of others wood products:

This component groups together a wide variety of products such as construction wood, plywood, containers and packaging, tool handles, picture frames and paintings and a wide variety of other products. Table 3 shows the monetary value of its contribution to GDP, the trend and the percentage increase compared to the previous year.

Year	Millions of Mexican pesos	Variation %
2003	16,799	0.00
2004	17,947	5.40
2005	17,688	-1.46
2006	18,289	3.29
2007	18,055	-1.30
2008	17,179	-5.10
2009	14,142	-21.48
2010	14,508	2.52
2011	14,147	-2.55
2012	15,537	8.95
2013	15,406	-0.85
2014	15,754	2.21
2015	16,693	5.63
2016	17,107	2.42
2017	17,375	1.54
2018	17,865	2.74
2019	17,952	0.48
2020	17,238	-4.14
2021	18,816	8.39
2022	19,424	3.13

Table 3: Gross Domestic Product of the Manufacture of other products wood and its percentage variation in the period 2003 – 2022.

Source: Source: Elaboration own with data from INEGI.

Base year 2013

The last year of available data was the one in which the largest contribution to GDP of this component was reported and the year in which it contributed the least was in 2011 and its behavior and trend are shown in Figure 5.

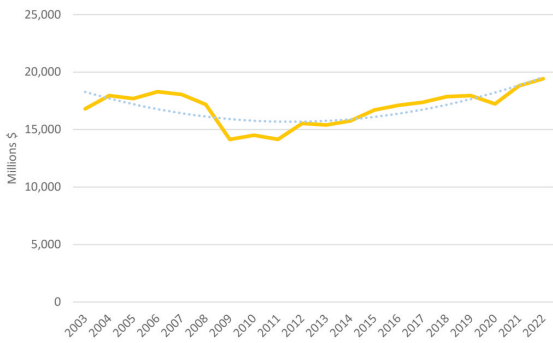


Figure 5: Behavior and tendency of others products of the wood.

Source: Source: Elaboration own with data from INEGI.

Base year 2013

The previous figure shows that the curve that best explains the behavior of the GDP of the Manufacturing of others products of the wood is a polynomial type with formula $y = 35.559x^2 - 679.39x + 18927$, and with an $R^2 = 0.5746$ which is considered low correlation due to fluctuations in the production and GDP value of this secondary transformation activity. This tendency, values and behavior of the others component, has a similarity with that of Sawing and conservation of the wood.

The variations percentages compared to the previous year in the GDP value of the component Manufacture of other wood products seen in Figure 6.

From the previous Figure, the fact that for six consecutive years, 2014 to 2019, positive increases were achieved. The most drastic percentage drop occurred in the year of 2009 and the most relevant was in the year 2012.

Industry of wood: It is made up of the three previous components under the following expression:

$$IM = \sum MCA + FLAM + FOPM$$

Where: IM = Industry wood, ACM = Sawing and wood conservation wood, FLAM = Manufacture of Laminates and Agglutinates of the wood and FOPM = Manufacture of Other Products of the wood.

In the Table 4, it displays the total value of the GDP of the Mexican timber industry, as well as its percentage variation compared to the previous year.

From the above table it can be observed that the year of greatest contribution to GDP by the timber industry was 2021 and its lowest contribution occurred in 2009, while the highest percentage variation with respect to the previous year was in 2012 and the opposite, this is the smallest variation, occurred in 2009. Figure 7 shows the behavior of the GDP of the timber industry, as well as its growth trend line.

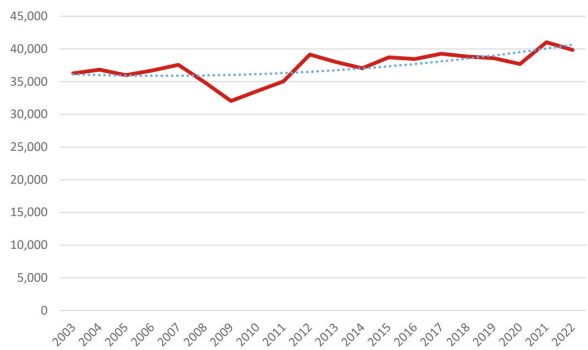


Figure 7: Behavior and trend of the GDP of the Manufacturing Industry wood

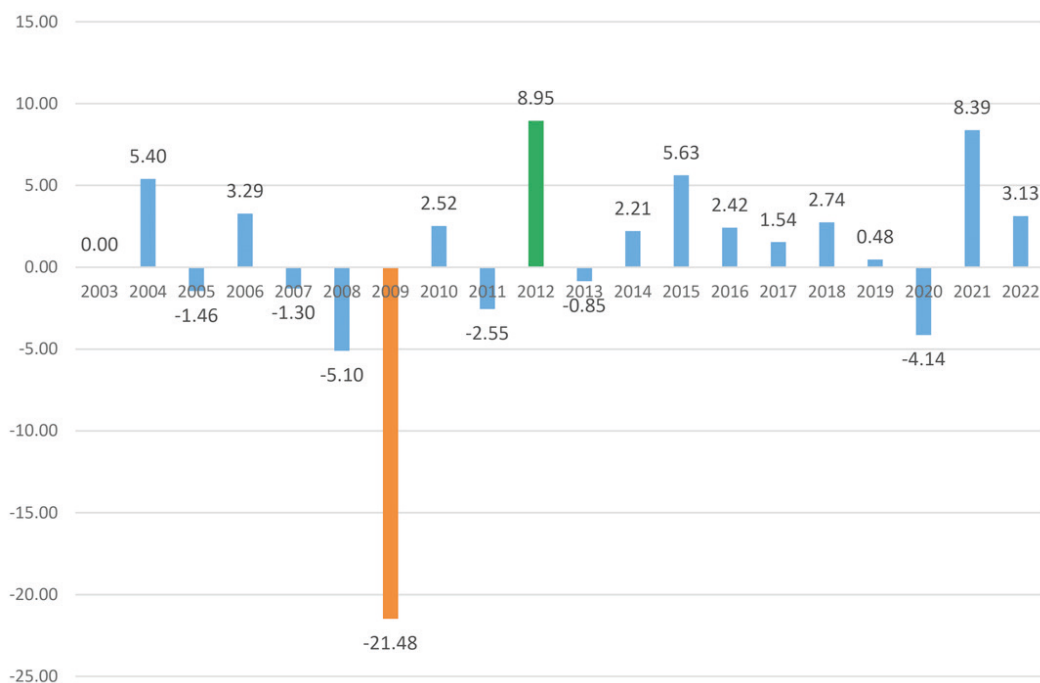
Source: Elaboration own with data from INEGI.

Base year 2013

The best curve that describes the behavior and trend of the wood industry in the study period is one of a kind polynomial with formula $y = 19.582x^2 - 172.04x + 36273$ with an $R^2 = 0.4894$ indicating a low correlation due to the fluctuations (increases and decreases) of its GDP.

The variations percentages with respect to the previous year and that show the fluctuations in the GDP of the wood industry can be seen the Figure 8.

In the figure 8, it highlights the fact that in the middle of the period (10 years) the wood industry had decreases, in which in the biennium 2008/2009 were the largest falls and



Source. Elaboration own with data from INEGI.

Base year 2013

Year	Sawing and Millions \$	Laminates and binders Millions %	Others products Millions \$	industry Wood Millions \$	Variation %
2003	17,456	2009	16,799	36,264	0.00
2004	16,757	2,118	17,947	36,822	1.52
2005	16,021	2,301	17,688	36,010	-2.25
2006	16,171	2,262	18,289	36,722	1.94
2007	17,472	2,032	18,055	37,559	2.23
2008	15,754	1,979	17,179	34,912	-7.58
2009	16,094	1,806	14,142	32,042	-8.96
2010	17,359	1,705	14,508	33,572	4.56
2011	19,019	1,869	14,147	35,035	4.18
2012	21,699	1,899	15,537	39,135	10.48
2013	20,453	2,130	15,406	37,989	-3.02
2014	19,263	2015	15,754	37,032	-2.58
2015	19,885	2,136	16,693	38,714	4.34
2016	19,091	2,261	17,107	38,459	-0.66
2017	19,750	2,133	17,375	39,258	2.04
2018	18,864	2,109	17,865	38,838	-1.08
2019	18,561	2,075	17,952	38,588	-0.65
2020	18,297	2,157	17,238	37,692	-2.38
2021	19,599	2,611	18,816	41,026	8.13
2022	17,900	2,545	19,424	39,869	-2.90

Table 4: Gross Domestic Product of the Industry wood and its percentage variation in the period 2003 – 2022

Source: Elaboration own with data from INEGI.

Base year 2013

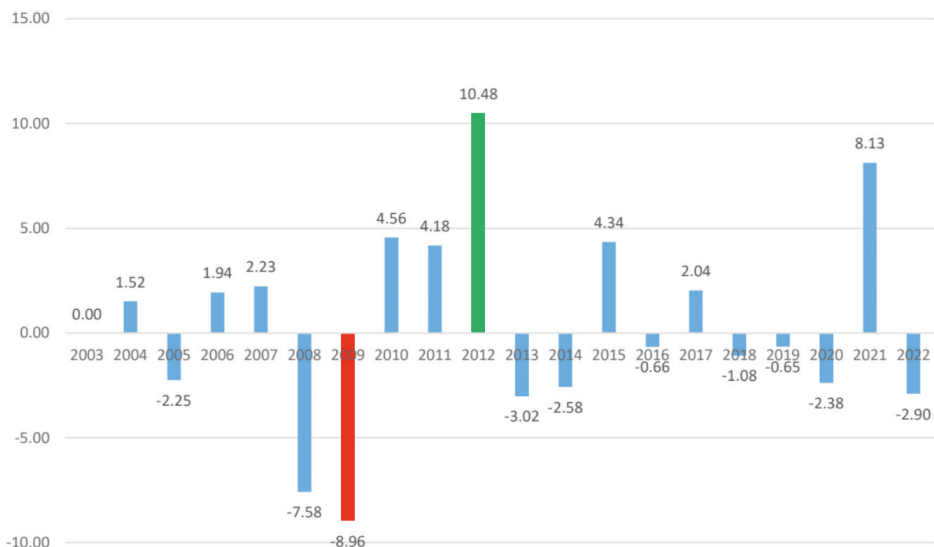


FIGURE 8: Variations percentages (%) compared to the previous year of the wood industry in the period 2003 - 2022

Source: Elaboration own with data from INEGI.
Base year 2013

from there he behavior had three increments consecutive, where 2012 was the best growth of this branch of the transformation industry.

As a comparison of the behavior in the trend and contribution to the GDP of the wood industry and its three components, Figure 9 shows the contribution of each one and of the total.

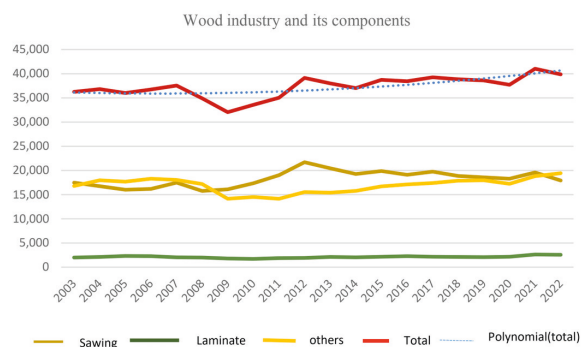


Figure 9. Behavior and trend of the GDP of the Manufacturing Industry wood and its three components.

Source: Elaboration own with data from INEGI.
Base year 2013.

In the previous Figure it is observed as the contribution to the GDP of the Manufacture of laminates and wood agglutinated component is the one with the least contributes to the economy and with a trend almost constant, while the Sawing and preserving wood along with other manufacturing wood products, their contributions to the wood GDP is very even with the maximum difference in the year of 2012.

To determine participation percentage in the GDP of each of the components of the wood industry, Figure 10 shows the composition percentage (%).

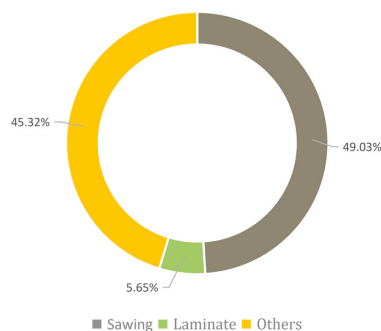


FIGURE 10. COMPOSITION percentage (%) of the members of the wood industry.

Source: Elaboration of the own author

Throughout the analysis period (20 years), the average of each of the components of the Industry wood, shows us that almost the half of the contributions to GDP are made by Sawing and conservation wood, hence the industry of the sawmill is considered as the industry icon of the forestry sector, continues in order of importance with almost five points percentages less, the Manufacture of other wood products, where a large number of quantity of various products and the component of laminates and wood agglutinates It had a marginal participation in the value of GDP with just over five percentages throughout the period.

Within the manufacturing industry sector, the contribution you have the industry wood to the GDP of the manufacturing is totally marginal, since, during the period of 20 years of analysis his percentage contribution barely meant on average 0.046 %, with his percentage major in the year of 2003 with a value of 0.052% and a minimum of 0.039% in 2022

AVERAGE growth rates annual (tmca): In order to know he growth (positive or negative) of GDP during the 20 years of study of the wood industry and each of its components, the results of the indicator are seen in Table 5. economical both for component as by periods six-yearly.

The previous Table shows that the GDP of the wood Industry during the 20 years of analysis achieved growth positive but it went down with just under half a percentage point and the better increasing component percentage was that of Laminated and agglutinated, however, its value in terms absolutes was he lower in terms contribution to GDP. In relation to the industry icon of the forestry sector: the sawmill, had a low growth that barely came to a little more than one tenth of a point and its better input percentage to GDP was in period 2007-2012 with just over three and a half percentage points and the Manufacturing of other wood products had a

growth percentage in its GDP of almost three quarters of a point in the analysis period and its highest participation occurred in the 2019-2022 period with just over five percentage points.

In some works by Moctezuma and Galicia (2018) and Moctezuma *et al.*, (2018) as reference mention that the average growth rate annual secondary sector forest was 6.6% in the period 2003-2015, in the second case, for the year 2017, industrial or transformation activities forest within the global economy nationally, it only represented 0.42% of the national GDP.

In a retrospective and historical manner, González (1979) mentions that in the In 1917, the share of the forestry GDP in relation to the national GDP represented 1.45 %, which when compared with current data exists a decrease of almost three times less and according to the report of Banco de México (1979) during he triennium 1965/66/67 forestry GDP had indicators of 1.70%/1.64%/1.57% respectively, which sample he decline of the forestry sector within the economy forestry.

In a research by Torres and Guevara (2002), mention that within the System of National Accounts of Mexico the values are not quantified monetary of different actions that are generated with forestry activity, despite the to have done some studies that achieved quantify monetarily benefits that are not taken into consideration, within the national GDP and only as an example some such as: rainwater collection and filtration, soil retention and enrichment, carbon capture, recreation, landscape, recreation and activities outdoor sports book, greenhouse gas mitigation greenhouse, refuge for flora and fauna and collection of products non-timber forests, among others.

PERIOD	SAWING and wood conservation	Laminated and agglutinated	MANUFACTURE of other wood products	Wood INDUSTRY
2003-2006*	-1.89	3.01	2.15	0.31
2007-2012	3.68	-1.12	-2.47	0.69
2013-2018	-1.34	-0.16	2.5	0.37
2019-2022*	0.04	-0.90	5.24	1.99
2003-2022	0.13	1.19	0.73	0.47

Table 5: Average annual growth rates (%) of the wood industry and its components by six-year periods and globally.

* The first and fourth sexennium they are four years due to data availability and are not comparable, they are only comparable the second and third and can be inferred as the total period.

Source: Elaboration of the own author

CONCLUSIONS

The Industry of wood over 20 years of the analysis period showed a trend in its positive character growth and its best component in terms of contribution to GDP was the Sawing and conservation wood, since on average covered almost the half of monetary value, the second most important subsection of monetary contribution to the country's economy was the Manufacture of other wood products and what contributed the least to the economy were the Manufacture of Laminates and Agglutinates with a marginal contribution, but with the elderly percentage growth. Rate average annual growth of the timber industry remained positive throughout the period, however, said annual growth remained below half a percentage point in the 20 years and the better Annual growth

occurred in the six-year period from 2007 to 2012 with a tenth more than half a point. The participation of the wood industry within the manufacturing transformation sector his contribution to GDP is totally marginal. His greatest importance lies in its contribution to the rainwater harvesting, improvement of the landscape scenic, mitigation from climate change, collection of byproducts, acts as a refuge for flora and fauna and contributes to the sustainability of the environment mainly within the massifs temperate and cold climate forests and tropical forests.

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