



Study of Scientific Production on Production of Wooden Doors

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Abstract

The forest sector has a significant role for society reaching economic, social and environmental spheres. There is a range of products from reforestation, the most important are raw wood or logs, sawn wood, cellulose, wood panels, biomass and doors. The world door export market alone reached 3.84 billion dollars, considering an interval of ten years, it achieved an average growth of +3.3% per year. With the growing demand and the demand for quality from the external environment makes door manufacturers invest in innovation and studies on the subject. The present work used a bibliometric method in four databases (Scopus, ScienceDirect, Scielo and Mendeley) and articles and publications were searched in conference proceedings until 1996, with the theme of wooden door production, in order to understand what is being disseminated in the academic environment regarding this theme. Data were compiled on the year, authors, journals, countries and database that obtained the most publications. In general, we deduce the low explanation of this content, as few articles were found, the non-appearance of an author who stands out in this theme, in addition to the lack of publications between the years 1999 to 2010 and the lack of studies from China. which in turn is more exporter of this product.

Keywords: Bibliometric Analysis. Door Manufacture. Forest Industry.

1. Introduction

The forest zone is divided into native and planted, containing 3,75 billion hectares and 290 million hectares respectively, this represents a total of approximately 4 billion hectares of forests in the world. The countries with the largest forest areas are Russia with about 20% of the world's forest area, followed by Brazil with 12% and Canada with 9%. (FAO, 2020).

Brazil plays a key role in the global forest industry, the composition of forests is 98,4% native and 1,62% derived from plantations. A large part of the Brazilian native forests is aimed at the protection and conservation of flora, see the Amazon forest which contains a great biodiversity important for the maintenance of a sustainable planet. Tree plantations in Brazil are made up of a large part of pine with 20% of the trees planted and eucalyptus with 73%, the other 7% are divided into several species. (Sector Study, 2019).

The reforestation products are comprehensive, among them the most important are: raw wood or logs, sawn wood, pulp, wood panels, biomass in the form of charcoal, chips derived from wood machining, briquettes and pellets from the compacted saw and treated wood. By-products are also relevant to the industry, such as the production of essential oils, resins and latex, where they are not wood per se, but use substances

extracted from it. (Minini et al., 2021).

The forest industry contributes significantly to society and affects economic, social and environmental sectors, these impacts can be seen in Table 1.

Table 1: Contributions from the forestry sector.

Economic	Local, regional and national development; Generation of income and foreign exchange; Contribution to Gross Domestic Product (GDP); Collection of taxes; Movement of the economy; Attracting and attracting investment
Social	Generation of jobs; Income generation; Environmental education; Incentives for the development of scientific research, training of employees and local society; Increase in the Human Development Index of the region and the state.
Environmental	Maintenance of Permanent Preservation Areas, Legal Reserve and Private Natural Heritage Reserve; Protection of soil, springs and springs; Conservation and protection of biodiversity; Regulation of climate and greenhouse gases by fixing atmospheric carbon; Reduction of deforestation of natural habitats; Reduction of greenhouse gas emissions

Source: Adapted (Sector Study, 2019).

The points discussed in the table above are linked to the pillars of sustainability that the activity is committed to carrying out.

The use of wood has been widespread for a long time, it is believed that the use of sawn wood is made since 6 thousand years before Christ, by the Egyptian civilization who used it to manufacture sarcophagi (Williston, 1976). This extensive manipulation of wood made in the past is due to the fact that it is a versatile material, considered a noble object, great abundance in nature, accessible for handling and a resistant material. (A. L. Gonzaga, 2006; Laguarda Mallo & Espinoza, 2015).

Despite presenting great benefits for the use of wood as a raw material, we consider it as a biological material, and for this characteristic wood is not a standardized element, and may contain anatomical, chemical and mechanical anomalies. All these faults can occur in trees of different species or even within the same trunk. (Panshin & Zeeuw, 1980).

In the environmental field, the timber industry suffers from a popular judgment associated with

deforestation to obtain raw material. This is due to the history of some companies in the lumber sector in the overexploitation of tropical forests, harming the environment, but wood manufactured by responsible companies gains advantages over other products that can be replaced such as concrete, plastic and iron, because the manufacture of these materials is more harmful to the ecosystem than the production of sawn wood. (C. A. M. Gonzaga, 2005).

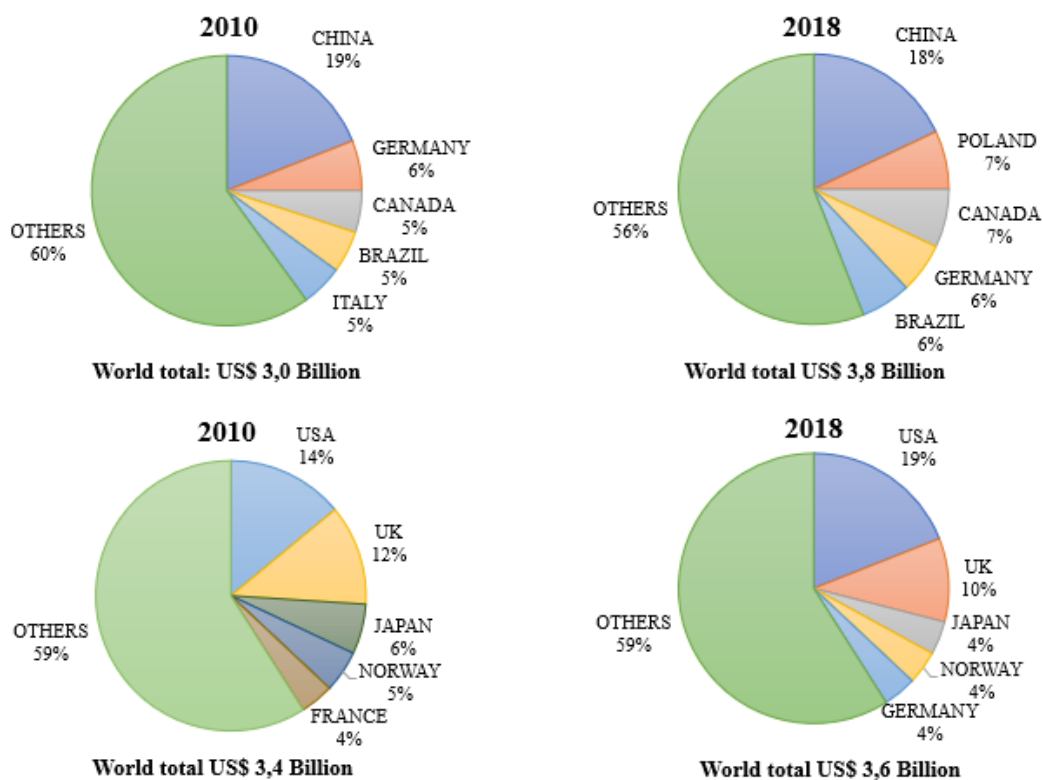
The timber industry has been modernizing in recent years and with it there are improvements in the company's internal management, this is due to increases in raw material costs, value of labor and charges for better use of natural resources. Initiatives to reduce waste and errors make the trade more competitive. One of the ways to improve is to reach the productive sector to help the market demand. (Fariza & Surjandari, 2018).

Among the forestry sector is the production of wooden door, it consists of an object that moves with the aid of hinges or travels on rails and has the main objective of closing and covering openings or blocking and preventing the passage of environments. There are several ways of manufacturing the doors, the most common are the hollow ones that consist of being coated with a sheet and its empty interior, solid that, unlike the hollow ones, are filled with wood, as well as those using MDF (Medium Density Fiberboard) panel. (Souza et al., 2014).

In 2018, the world door export market had the highest rate in the 10-year period, reaching about 3,84 billion dollars, this growth is equivalent to +3,3% per year., that is, the difference between 2009 and 2018 is +33,5%. (Sector Study, 2019).

Figure 1 shows the main countries as exporters and importers for the year 2010 and 2018.

Figure 1: Major world exporters and importers of wooden doors.



Source: Adapted (Sector Study, 2019).

Referring to the image above, an increase of 800 million dollars in exports and an increase of 200 million dollars in imports can be seen, this variation is related to the years 2010 to 2018. Despite losing a percentage between the year interval, it continues to be the most responsible for port exports. Germany maintained its percentage of 6% in the year, but lost its position, from second in 2010 to fourth in 2018, Poland took its place, which in 2010 did not appear in the 5 countries with the highest number of exports and in 2018 it represents the second place with 7% followed by Canada which both years was in third place, but it increased to 7% also in 2018. Brazil increased its percentage in port exports, however it lost a position getting fifth and Italy which was among the 5 largest exporters in 2010 and lost that position in 2018. (Sector Study, 2019).

In terms of exports, there were not many changes between the years. The USA remains the most importing country, followed by the United Kingdom, Japan and Norway. The difference was Germany's entry into the largest importers, taking fifth position, which was previously France. (Sector Study, 2019)

The high demand for doors due to the growth of civil construction and the demand of the external environment in relation to the quality and customization of doors demanded by the consumer makes door manufacturers have to invest in innovation, technologies and studies in the area. Consequently, the increase in efficiency and effectiveness is the result of the search for this improvement, thus generating gains in the environmental, social and economic spheres. (Francisco et al., 2018; Pedzik et al., 2020).

This article aims to demonstrate a bibliometric study on the production of wooden doors until 1996 using searches in Scopus, Science Direct, Mendeley and Scielo databases. With this study it is possible to understand what researched topic is being promoted in the academic environment, understand which countries most address this subject, the most relevant authors and in which years they obtained more publications.

2. Methodological Procedures

To carry out the study, bibliographic and documentary procedures were used to collect the articles. The bibliometric study is the basis for the production of projects and helps to sustain the reference, in addition to being essential for scientific dissemination, it uses tools and techniques that enable the researcher to distinguish the level of influence that the study exerts in the academic environment, making it possible to characterize the research areas and the needs and trends for future studies. (Moraes et al., 2013; Oliveira et al., 2012).

Bibliometrics shows advantages in the organization and standardization of research, enabling the measurement of the information obtained. The use of statistical tools facilitates these benefits, in this way the bibliometric study, in essence, is a quantitative study. (Araújo, 2006).

This research is quantitative because it uses static procedures for the demonstration and analysis of results. The use of the descriptive method is also considered, as it describes the particularities and facts that occurred in the searches of this research.

The first step to be defined was the topic that would be researched, then it was found the need for a bibliometric study in the area of manufacturing wooden doors. With the demarcation of the theme, the next

step was the establishment of the word “door production” as keywords in the searches through the databases. With the guidance of an expert, four databases were defined to search for articles: Scopus, ScienceDirect, Scielo and Mendeley.

Based on these definitions, he began searching the four databases using quotation marks between the two words so that the search system would understand that “door production” needed to be together in the context of the publication. To further refine the search, a time-limited filter was applied using a range of publications from 1996 to March 2022. For the search, only articles and publications in conference proceedings were considered.

As the next filtering, titles and abstracts were read, thus discarding those that were not consistent with the subject sought. All the data obtained after reading the abstracts were arranged in Excel software to organize and analyze the number of publications per year within the pre-established intervals, which type of document was most predominant in the research, which database with the greatest amount of results on the theme, the authors with the most publications and the number of authors per document, the journals that contain the largest number of publications in the area studied and, finally, the countries with the most publications on the subject studied. In this way, the graphs were created to perform the data analysis.

3. Results and Discussions

In the Scopus, ScienceDirect, and Mendeley databases, 26, 36 and 23 results appeared, respectively, the Scielo database did not show even one result, but after removing the quotation marks between the words, 24 publications appeared, thus, totaling 109 results found. After reading, 91 documents were discarded, about 83,49%.

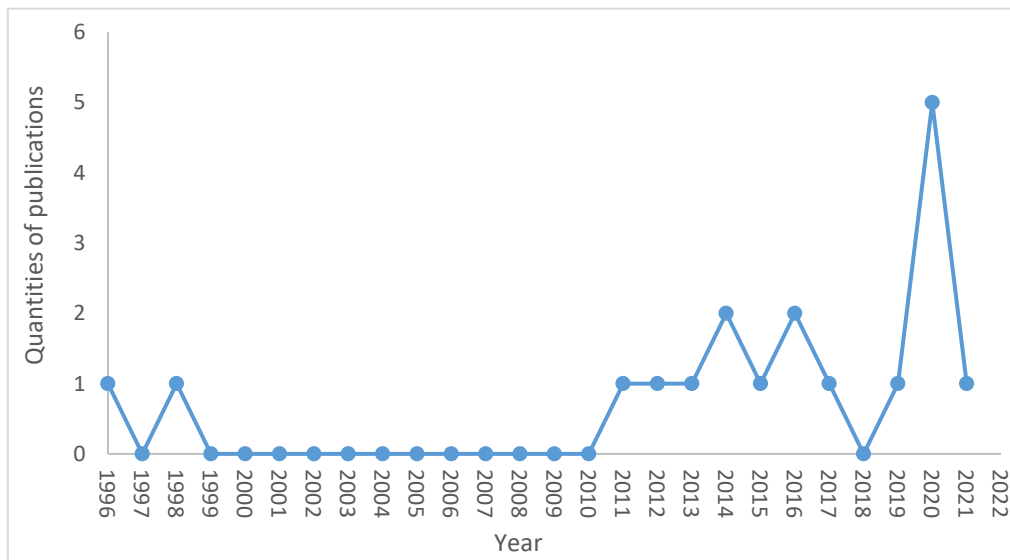
In addition to finding repeated results in some databases, topics were obtained that did not cover the content studied, among them are subjects such as doors made of other materials such as aluminum, manufacturing of automotive and aeronautical doors, civil construction and plant cultivation. Finally, 18 documents are separated in total.

Number of Publications Per Year

In the research presented, it was noted that the first document published with the theme of wooden door production was in 1969. The article was published by the magazine “Assembly & Fastener Methods” whose author is Burton A.J. and contains the title “ASSEMBLY OF TIMBER DOORS”.

The year with the highest number of published articles was 2020 with a total of 5 publications, followed by 2016 and 2014 with two publications and the rest of the years 2021, 2019, 2017, 2015, 2013, 2012, 2011, 1998 and 1996 with only one publication each year. Figure 2 shows a hiatus of publications in the year interval between 1999 and 2010.

Figure 2: Publications by year



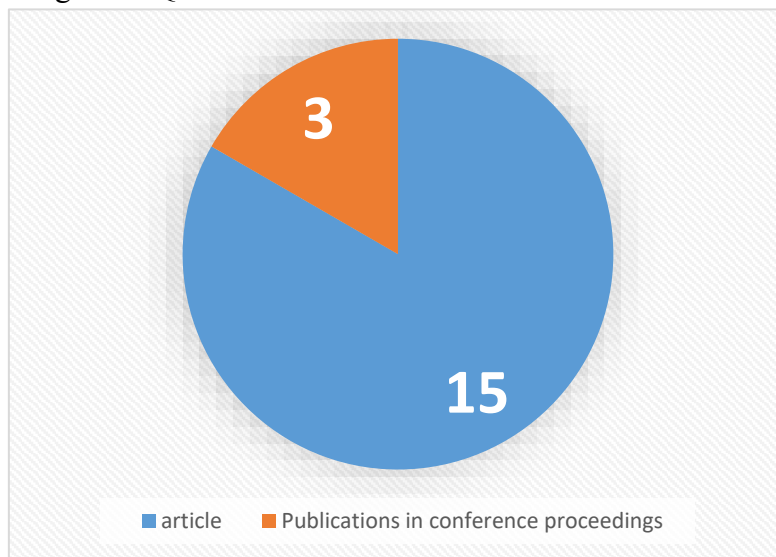
Source: Authors (2022).

It can be seen in Figure 2 the return of publications in 2011, this resumption may be a portrait of the economic growth in exports around the world, we can see that there is a greater constancy of publications in this interval from 2011 to 2019, but in 2020 there was a disproportionate increase in publications, it is assumed that due to the series history that occurred in 2018, investments in the research area have increased, consequently generating more publications (Sector Study, 2019). The 2021 low is due to the economic freeze caused by the COVID-19 pandemic.

Types of publications

The searches focused on two types of publications, as it is believed that these manuscripts demonstrate what the scientific study is researching in this area. There is a greater number of published articles compared to publications in conference proceedings, this fact can be evidenced in Figure 3.

Figure 3: Quantities of conference articles and documents



Source: Authors (2022).

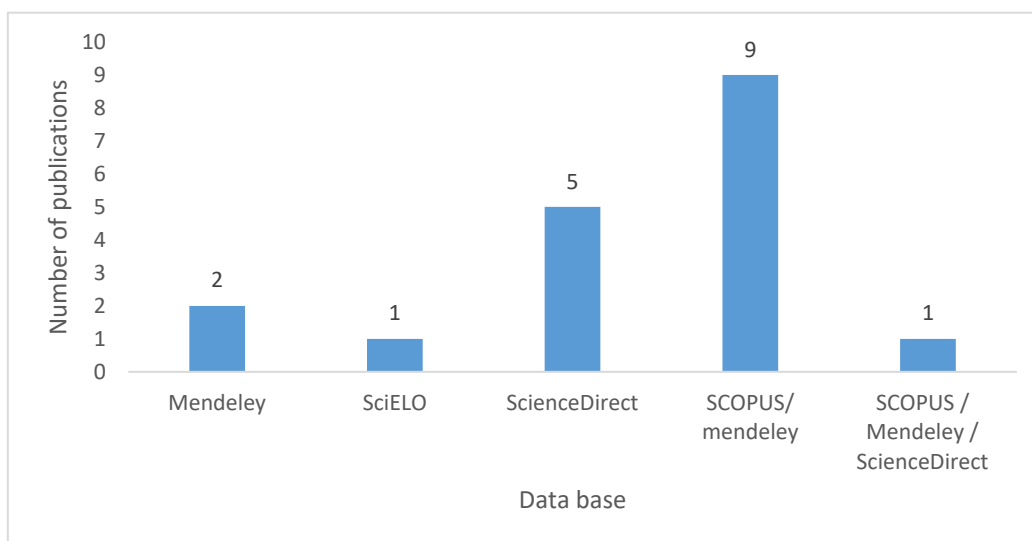
The articles represent 83,33% of the documents collected and the remaining portray 16,67% of conference documents. The appearance of more articles encourages the growth of research on the subject and the decrease of conferences that address this topic.

Number of publications per database

The databases present a conglomerate of documents from certain journals, for this reason some publications appeared in two or more databases. For a better understanding, Figure 4 was separated into documents in categories:

- “Mendeley”: Documents found only in the Mendely database
- “SciElo”: Publications discovered only in the SciElo database
- “ScienceDirect”: Documents identified only in the ScienceDirect database
- "SCOPUS/Mendeley”: Publications found in two databases, SCOPUS and Mendely
- "SCOPUS/Mendeley/ScienceDirect”: Documents discovered in three SCOPUS databases, Mendeley and ScienceDirect.

Figure 4: Publications by database



Source: Authors (2022).

With Figure 4 we can see that all publications that stood out on the subject in the SCOPUS database were also published in other bibliographic databases. The Scielo database presented only one document related to the topic. Mendeley showed the greatest number of publications, followed by the SCOPUS database. The Mendeley, Scopus and ScienceDirect databases belong to the ELSEVIER group, which cover a conglomerate of journals, publications and books, making them a robust search engine and, as a consequence, they were the ones with the most results and many of them repeated in both databases.

Most Productive Authors

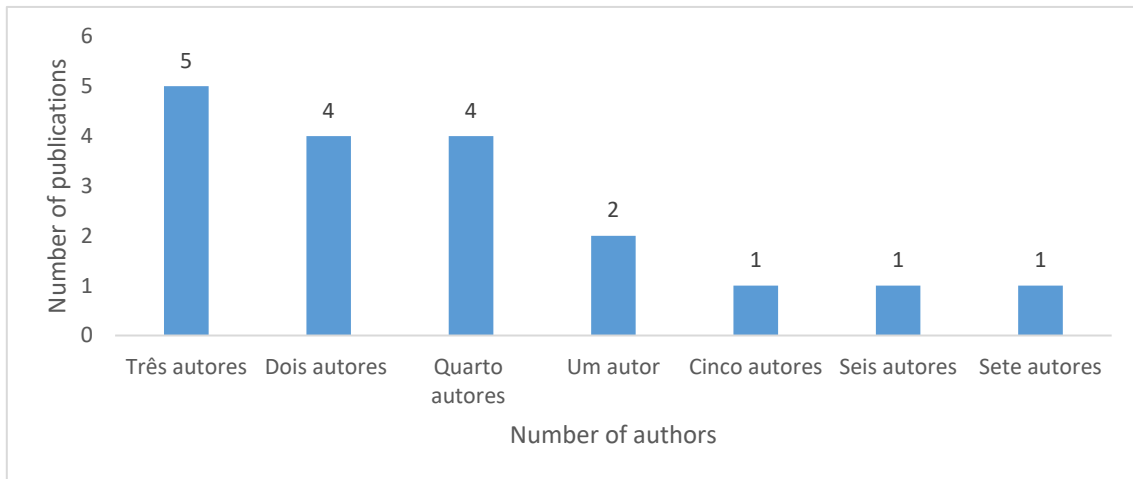
In the analysis of the authors, we sought to verify who contained the largest number of publications on the topic studied. For this, only the main authors of each study were considered, so it was found that not one researcher published more than one document, namely: BELL S., BUYUNG N., BUYUNG N., COBUT A., DALLASEGA P., DIENER B.J., DUKIC I., FARIZA V., HAAG V., KARLSSON K.F., KWIDZUNSKI Z., LEJAVS J., OWUSU F.W., PEDZIK M., RIBEIRO MASSOTE C.H., RIHARDS ROZINS J.L, SAHIN Y., WEIZHUO L. and WENKER JL.

On the other hand, we found that although they did not appear as the main author on the topic, some reappeared as co-author, such as Pedzik M. who appears as co-author in the article by author Kwidzunski Z. and the opposite is also repeated.

Number of authors per article

Reflecting on co-authors and their importance in the development of scientific projects, Figure 5 is a report on the number of authors that each document presented.

Figure 5: Number of authors per publications.



Source: Authors (2022).

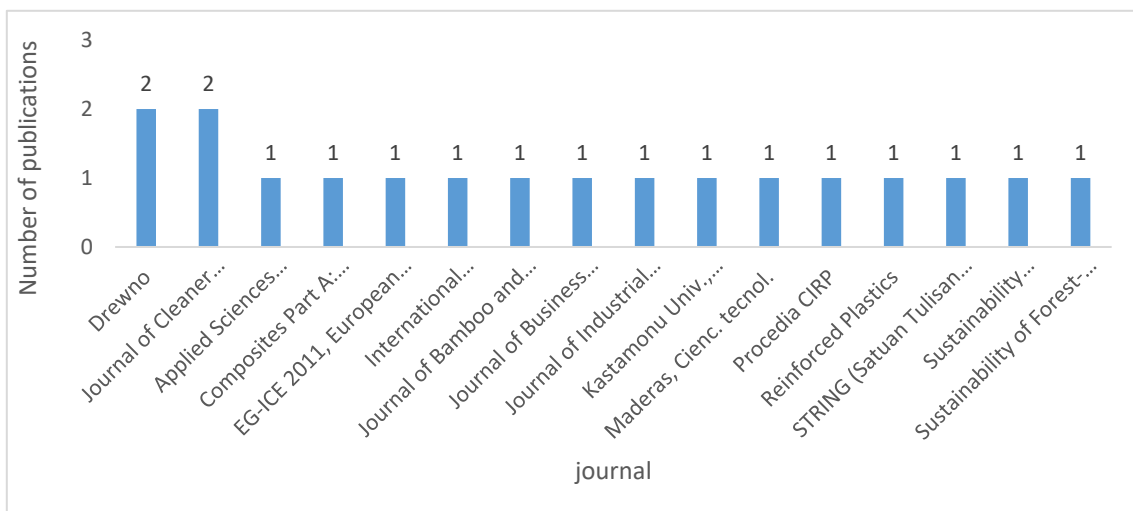
The diagnosis of the chart above is that publications tend to have 2 to 4 authors, as the sum of documents with these intervals represents 72,22%, with three authors obtaining 27,78%, two and four had 22,22% .

Despite the greater number of publications being concentrated in a range of 2 to 4 numbers of authors, we can see that there were articles with one author (11,11%) and six and seven authors (5,56% both).

Magazines with the most publications

Observing the collected data, the journals with the highest number of publications were determined. Among them, two stand out: “Drewno” and “Journal of Cleaner Production”, which both obtained two publications with the subject studied. The other magazines had only one publication.

Figure 6: Number of publications per magazine.



Source: Authors (2022).

Analyzing the aspects that these data brought us is that the researched topic is disseminated in several

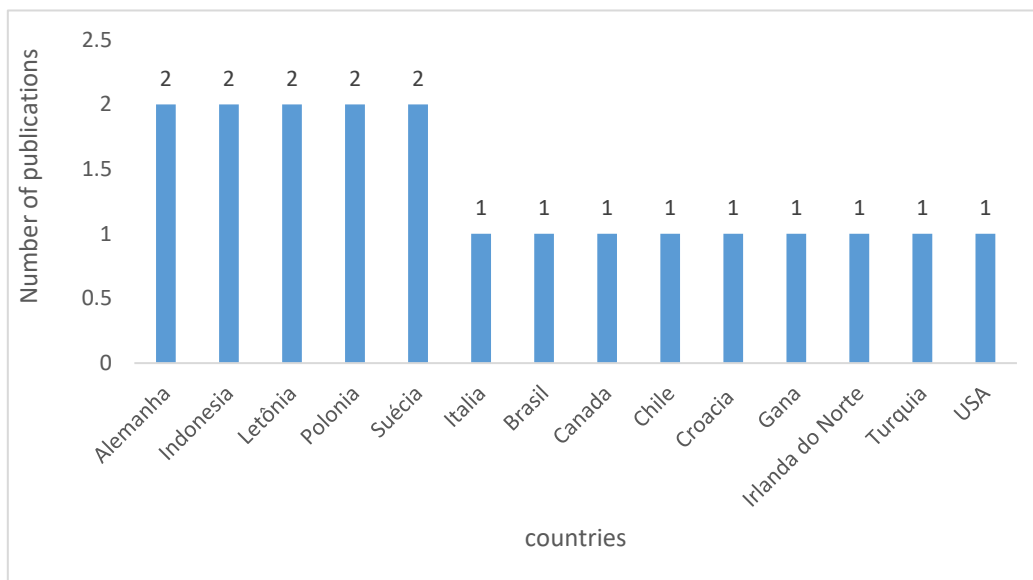
areas of knowledge, among them those that stand out are those related to sustainability, obtaining 33% of the magazines found, followed by engineering topics with 22%, the information and computation with 17% and wood technology with 11%. This demonstrates that researchers in the field are looking for solutions to produce wooden doors in an effective, efficient and sustainable way.

Most productive countries

The countries with the highest number of publications are represented in Figure 6, where you can see that Germany, Indonesia, Latvia, Poland and Sweden scored two publications, while countries such as Brazil, Canada, Chile, Croatia, Ghana, Italy, Northern Ireland , Turkey and USA had a document published.

The partnership between universities from different countries for the elaboration of projects is common in the academic environment, for this reason the project with the title “Customer-oriented Production system for Supplier Companies in CTO” was carried out jointly in universities in countries of Germany and Italy.

Figure 6: Number of publications per magazine.



Source: Authors (2022).

Some conclusions can be drawn from this graph, one of which is the relationship between countries that have a large share of wood door exports with the number of publications made by these countries. As seen in the reasoning Germany, Brazil, Canada, China, Italy and Poland in the last 8 years had a huge participation in the export of doors and consequently all but China, obtained publications on the subject. China, despite being the largest responsible for the export of ports in the world, did not present even a publication.

Countries with shares in imports such as the USA and the UK also have publications in the area of wooden door manufacturing. Other countries such as Indonesia, Latvia and Sweden also appear as protagonists in the research subject. Besides Brazil, Chile is the only Latin American country that had documents found in the bibliographic databases. And the only publication from the African continent came from Ghana.

4. Conclusion

In this study, it is able to explore the results of scientific production on the subject of production of wooden doors in the databases selected for this work, so we can find some conclusions, such as the little exploration of this theme, considering the low number of publications. about the researched subject.

Linked to the few results found, one of the consequences was the absence of prominent authors on the subject and a fluctuation of publications in certain years, not having a constancy and having long periods without publications and years with concentration of research. The countries that obtained periodicals are consistent with the commercial influence they exert, but China stands out, which is the most exporting country and did not obtain even a publication.

For future studies, it is advised to understand why there is a hiatus in publications from 1999 to 2010, in addition to understand why there are no publications from China related to the content and, finally, to update this research for the next years in order to verify the development of the subject studied.

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