

Sustainability in wooden structures linked to the concept of eco-efficiency

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SUMMARY

This article addresses the sustainability of wooden structures in civil construction, relating it to the concept of eco-efficiency. Wood, being a renewable, recyclable material with low carbon emissions, stands out as a viable alternative to conventional construction systems. Thus, the objective of this study is to verify the sustainability of wooden structures linked to the concept of eco-efficiency. For this purpose, a literature review was carried out with studies dated from 2019 to 2024 and it was observed that, when coming from responsibly managed reforestation, wood contributes to environmental conservation and reduction of ecological impacts. In addition, it has advantages such as lower energy consumption during production and ease of transportation and assembly, favoring the rationalization of resources. The concept of eco-efficiency, which combines economic performance with environmental responsibility, is applied in the analysis of wooden structures, demonstrating that its use promotes more sustainable constructions without compromising functionality or costs. It is concluded that investing in wooden construction systems is an effective strategy to meet the demands of sustainability and environmental efficiency in the construction sector.

Keywords: Wood, Eco-efficiency. Sustainability.

ABSTRACT

This article addresses the sustainability of wooden structures in civil construction, relating it to the concept of eco-efficiency. Wood, being a renewable, recyclable material with low carbon emissions, stands out as a viable alternative to conventional construction systems. Thus, the objective of this study is to verify the sustainability of wooden structures linked to the concept of eco-efficiency. To this end, a literature review was carried out with studies dated from 2019 to 2024 and it was observed that, when coming from responsibly managed reforestation, wood contributes to environmental conservation and reduction of ecological impacts. In addition, it has advantages such as lower energy consumption during production and ease of transportation and assembly, favoring the rationalization of resources. The concept of eco-efficiency, which combines economic performance with environmental responsibility, is applied in the analysis of wooden structures, demonstrating that its use promotes more sustainable constructions without compromising functionality or costs. It is concluded that investing in wooden construction systems is an effective strategy to meet the demands of sustainability and environmental efficiency in the construction sector.

Key-words: Wood, Eco-efficiency. Sustainability.

1. INTRODUCTION

Wood is among the earliest building materials and its structural use can be found throughout the existence of humanity. Throughout history, wood has been gradually integrated into building materials such as bricks and mortar, and, more recently replaced by concrete and steel, due to their greater strength, flammability and its susceptibility to biotic and abiotic agents (Oliveira et al., 2024).

However, wood, and especially wooden buildings, are still quite encouraged in civil construction, due to the concepts that involve the theme, relating architectural and design innovation, and also the issue of eco-efficiency, aimed at the fight against global carbon dioxide (CO₂) emissions through the use of materials sustainable (Nascimento et al., 2022).

In Brazil, there is still underutilization of wood with a short life cycle and low value aggregate, which generates serious environmental impacts. Implementing biomaterials for purposes permanent, such as structural systems or walls, exploiting the best characteristics physical-mechanical properties of the material, generates many advantages and contributes to the goals of decarbonization of construction (Shigue, 2018).

In this sense, the construction and civil engineering sector has a lot of responsibility, as it is a of the largest consumers of natural resources and energy, accounting for one third of global greenhouse gases, from the consumption of up to 40% of all energy, about 3 billion tons of natural raw materials, and 12% of existing water resources (Zubizarreta et al., 2019).

Global shifts towards a carbon-limited future

(CO₂) bring a deeper analysis of wood as a building material, due to the its unique environmental credentials, beauty and versatility, and how wood is a material renewable, recyclable and biodegradable; its production and processing are energetically efficient; and its use in construction contributes to combating the greenhouse effect (Souza et al., 2021).

In Civil Construction, Architecture and Engineering, the performance of these sectors requires a lot of energy throughout its useful life, from the construction site to use and demolition. The construction contributes a large part of total greenhouse gas emissions and consumes a large amount of water and energy resources, so that the material and components used in the construction sector have gained an important role in the discourse of sustainability. Therefore, the trend is to use natural renewable materials that generate less environmental damage than conventional ones and that are capable of meeting the needs and architectural (Nascimento et al., 2022).

Therefore, this study should highlight the advantages and promote wood in the sector. construction, being a relevant and necessary factor to boost the bioeconomy, aiming move towards a new paradigm based on renewable energies and raw materials biological, since the use of wood in the construction sector will play a role important in achieving these eco-efficiency goals.

Furthermore, the growing demand for sustainable and healthy indoor environments has been accompanied by new, reusable and recyclable materials with low embodied energy, as wood products and wood from sustainably managed forests is one of the most environmentally friendly materials available and from a technical point of view, the properties positive physical and mechanical properties of wood as a structural material mean that it is ideal for the construction of building structures, except when exposed to flooding (Roque and Pierri, 2019).

Even so, wood, like all construction materials, must comply with a series of standards so that it can be used in the most efficient way possible from an environmental point of view. As a result, in recent decades, different project models have been developed in favor of sustainability of buildings and the different materials and components that make them up and of these assessment models take into account the 3 basic pillars of sustainability: economic, social components and environmental impact.

In such sustainability models, linked to eco-efficiency, it is necessary to promote more studies specifically about the sustainability of wooden buildings, as they are scarce. Some examples of studies that analyzed the sustainability assessment of structures hybrid or mixed, in which wood is an additional component and these studies must also include environmental impacts to assess sustainability at the structural level of wood (Almeida et al., 2021).

Given this theme of dealing with wood and its use in civil construction, it is clear that following problem question: What are the advantages associated with the use of wooden structures within the concept of sustainability and eco-efficiency?

According to Almeida et al. (2021) the increasing use of engineered wood products is driven by the adoption of new regulations and physical, environmental and superior economic benefits for these products compared to building materials mineral base and therefore highlight the advantages of using wood in civil construction, relating to the concept of sustainability and eco-efficiency in civil construction.

Thus, this study on the use of wood in civil construction is justified, focusing on eco-efficiency can address several aspects involving both environmental benefits and

economic and how construction is one of the industries with the most impact on the environment environment, being responsible for large volumes of consumption of natural resources, emission of greenhouse gases and waste generation.

Thus, the objective of this study is to highlight the importance of using wooden structures in civil construction as a means of promoting sustainability and eco-efficiency

2. MATERIALS AND METHODS

This study is an integrative review, of an exploratory nature, which aims to synthesize results obtained in research on a topic, in a systematic, orderly and broad. In the case of this study, it was an integrative literature review, where the bibliographic survey encompassing all the literature that has been collected on a certain topic, and bibliographical references and all the material used, which was cited in the work.

For the data collection procedure, an exploratory study was carried out through filings which included studies on the topic, with a study of the feasibility of applying the methods, collecting data from an integrative review, through theme-based research of the study, making an analysis of the theme.

Thus, it was based on studies of the Scielo portal and the academic search engine (Google Scholar) and This was done in this study and after exploring the theme, the studies addressed in the scientific journals, according to the databases: Scientific Electronic Library Online (SciELO), with the search limited to between 2019 and 2024 and that the studies used concerning the theme, which had the following inclusion criteria: primary and secondary articles review and prospective studies published in English and Portuguese: demonstrating studies empirical, analysis and clinical trials.

The following inclusion criteria were met: studies dated from 2019 to 2024, in the languages English and Portuguese, and published in the last 5 years, with the following inclusion criteria: studies of scientific databases dated from the last 5 years and that dealt with the topic in the languages Portuguese and English, being original articles and the oldest studies that were not address the topic itself.

In the analysis process, data related to the periodical were collected, showing in the table the title, with the year of publication dated from 2019, the name of the authors of each study, objective, methodology, and conclusion of each study.

The initial search obtained 30 articles, of which 10 were duplicates and were excluded. Of these, 20 were analyzed, as the others did not have any relevant reference to the study, 16 potentially relevant abstracts were selected and evaluated. A total of 16 documents have been fully read, and the others do not meet the inclusion criteria which was to encompass the three descriptors selected in the theme, totaling 11 documents selected for meeting the eligibility criteria, ending with 11 (eleven) studies for results table and discussion.

Thus, the universe of works on the subject, according to the review that composed this research, was a record of the data was made and in possession of these, using studies crossing the references, discussing the data in the table as illustrated in the discussion of this study.

3. LITERATURE REVIEW

3.1 The origin of the use of wood in civil construction

We sought to address the main concepts on the topic in the literature. Given this theme, it is relevant to question what are the advantages of using wooden structures linked to the concept sustainability and eco-efficiency to better support the study, and a division by topics to elucidate the theme in a more coherent and organized way, dividing it into: the origin the use of wood in civil construction, the advantages and disadvantages of its use, and, finally, the use of wooden structures linked to the concept of sustainability and eco-efficiency in civil construction. Thus, the theoretical elucidation begins:

Wood has been used in construction for thousands of years and is still one of the most construction most widely used and due to certain properties of wood for construction engineers have successfully harnessed this natural resource to build a variety of of structures, and with the advancement of the steel industry it was gradually replaced by concrete and steel (Almeida et al., 2021).

Since prehistoric times, early humans have used wood to build shelters with trunks and branches, already serving to create temporary structures and over time, the Ancient civilizations were perfecting their handling of wood, such as the Egyptians and the Romans and began to integrate it into their constructions in a more sophisticated way, using it in roofs, doors and windows, as well as auxiliary structures (Cordeiro Junior, 2017).

Further evolution occurred in the Middle Ages, in which wood became a predominant material in building construction, and in Europe, particularly in areas such as Scandinavia and Germany wooden buildings were visible everywhere, and in the Renaissance era, architecture was modernized and wood was used in many notable buildings, including churches and palaces (Shigue, 2018).

With the Industrial Revolution, new techniques and machines were developed, allowing a more efficient processing of wood and expanding its applications, which continued to evolve in the 20th century, in which wood faced competition from materials such as concrete and steel, but remaining valued due to its peculiar properties and characteristics (Almeida et al., 2021).

There is currently much discussion about the use of wood in civil construction, and its role has been reassessed within the context of sustainability, since previously it was sought to avoid its use due to deforestation, today, it has become a more sustainable ecological option for constructions and with technological advances such as the use of glued laminated timber (CLT), this material gain relevance as a building material for large-scale buildings (Roque and Pierri, 2019).

3.2 Advantages and disadvantages of using wood in Civil Construction

Wood is a traditional material with a long and proud history and has been reintroduced in this scenario thanks to its sustainable characteristics. The wood used in construction is important for being able to capture CO₂ from the atmosphere and incorporate the so-called carbon into the storage. In addition, low process energy requirements and high recyclability increase the potential of wood to become an important construction material (Oliveira et al., 2024).

The thesis begins with a discussion of hybrid, composite and combined materials. The key according to authors is to mix two or more materials with different characteristics, which results into a finished product with better overall properties than the starting constituents. However, such building material systems are not well categorized and therefore a new term is introduced to describe the combination of wood and glass: combination engineered wood glass (Zubizarreta et al., 2019).

For Roque and Pierri (2019) construction companies around the world are becoming raising awareness of climate change and the enormous demand for energy resources and materials related to the construction sector. In fact, based on today's reality, it is required

a lot of energy and materials throughout its useful life, and therefore the life cycle must be considered. life of these, the environmental damage that each material brings, and in this, it is noted that wood has gained importance and has been reintroduced into the construction industry as an engineering product. Compared to other building materials, it generates low environmental impacts, mainly because it is a material produced through photosynthesis, that is, it has the capacity to capture carbon dioxide (CO₂) from the atmosphere to release oxygen and therefore incorporate the so-called carbon storage. Low process energy requirement and high recyclability increase its potential to become an important building material, but for this there needs to be reforestation when it is taken from nature and in practice there is no occurs as it should (Shige, 2018).

The use of wood in civil construction presents a series of advantages and disadvantages that must be considered in the planning and execution of projects, currently being considered sustainable due to the fact that it is a natural resource that has the possibility of regeneration, since if there are the right policies of renewal and control it will be a source inexhaustible (Almeida et al., 2021).

It is noted that if forests are managed responsibly, wood becomes a renewable resource and as a better ecological option compared to non-renewable materials, like concrete, it is also worth noting that wooden structures are generally lighter than those made of concrete or steel, reducing foundation and transportation costs in construction (Cordeiro Junior, 2017).

Other perceived advantages are related to thermal and acoustic insulation, since the wood has good insulating properties, helping to keep the internal temperature stable and reducing sound transmission between environments and still offering a natural and warm, which is valued in architectural projects, bringing improvements to the aesthetic part of environments and making them more cozy and welcoming (Almeida et al., 2021).

Another advantage brought in the studies by Zubizarreta et al. (2019) and Roque and Pierri (2019) is about the speed of construction, since the handling of wood in construction is faster, and can erect more quickly, since many components can be prefabricated and still as to design it allows a wide range of customization, facilitating the creation of shapes innovative architecture.

The disadvantages of using wood include: the vulnerability of this material to be affected by pests, such as termites, or even be affected by fungi that cause damage and can compromise the durability of the structure if not treated properly, the issue that require more maintenance over time, as already mentioned due to pests and

need to apply varnishes or paints and another negative factor is the issue of flammability, as wood is a type A combustible material that is more flammable than that materials such as concrete and steel, requiring additional care in terms of safety against fires.

3.3 The use of wooden structures linked to the concept of sustainability and eco-efficiency in Civil Construction

In light of the growing global awareness of environmental issues and depletion of resources, achieving sustainability in the construction sector has become a necessity and supporting the choice of using ecological materials to obtain sustainable construction, brings feasibility of promoting healthier indoor environments through the use of materials ecological parallel to environmental preservation (Tazmeen; Mir, 2024).

Human activities in the construction industry are crucial to fostering greater or Lower Carbon Emission: During growth, trees absorb carbon dioxide (CO₂), which helps mitigate climate change. When used in construction, wood stores this carbon, contributing to reducing the building's carbon footprint and Wood can be used in various ways and forms, without modifications or applying additives to extend the useful life of the raw material (Almeida et al., 2021).

From a structural point of view, the structural engineer has advantages when choosing wood as element due to its sustainability, because it can be replaced in society, because it is renewable if treated responsibly, becoming a smart ecological option in comparison to non-renewable materials (Souza et al., 2021).

There are currently great architectural and sustainability possibilities for the structural use of wood and scientific and technological progress opens up opportunities to select the best solutions during an iterative design process, to replace elements and the use of wood in civil construction presents a series of advantages that must be considered in the planning and execution of projects (Zubizarreta et al., 2019).

The use of wood in civil construction brings a series of significant benefits, especially in terms of sustainability and the decision to use wood must take into account that it is closely linked to the concepts of sustainability and eco-efficiency, promoting practices that aim to reduce environmental impacts and optimize the use of resources (Tazmeen; Mir, 2024).

Wooden structures have good properties and require less energy compared to construction in concrete or steel, both in the production of materials and in the execution of the work,

leading to lower consumption of natural resources, being an element that contributes to biodiversity since projects that use wood from sustainable forests often include ecosystem conservation and recovery practices, promoting biodiversity and eco-efficiency, aligning construction with responsible and environmentally friendly practices conscious (Roque and Pierri, 2019).

By properly integrating wood into architectural designs, it is possible to create buildings that not only meet human needs, but also respect and protect the environment environment and sustainable development in the context of civil construction. The main points discussion include the various benefits of using wood, which range from a reduction remarkable in environmental impact and brings positive effects in reducing the carbon footprint and energy efficiency, ultimately leading to significant cost reductions over the long term. of useful life in civil construction (Almeida et al., 2021).

4 RESULTS AND DISCUSSIONS

The table below lists the studies as addressed in the methodology, containing among these, relationship with the keywords, dated from 2019 to 2024 and containing the theme informed:

The author and year, title of the study and its objective and results were listed below and conclusion, totaling 11 (eleven) studies for discussion of the table below, which were selected among the studies were those that dealt with the topic in a more consistent way with the objectives of this study.

Table 1: Summary table of included articles related to the topic (2019 to 2024).

Author (year)	Title	Objective	Results	Conclusions
Zubizarreta et al. (2019) (1)	Modeling the environmental sustainability of timber structures: A case study	This article describes the development of a evaluation model of sustainability environmental for structures of wood.	In the present study, the model of sustainability was applied to the largest and most tall residential building of several floors, built mainly in wood in the southwest of Europe.	Wood has characteristics unique as a material of versatile construction. Today in day, is seen, from the point of view environmental, as one real alternative to steel and concrete in medium structures size, which explains the use wood growing as main building material in many new constructions.
Kobayashi Jr. et al. (2020) (2)	Study comparative on consumption of wood in the construction of buildings	Make a comparison with regard to wood consumed in construction of buildings single-family ground floor	It was seen that in actions sustainable in systems constructive, practiced by professionals of engineering and architecture,	The use of wood in a way eco-efficient is fundamental to effective waste management from the resources natural.

	conventional and structural masonry	conventional and structural masonry with the help of the TQS@ software and Eberick@ using sustainability	sensitized with the objectives of development sustainable will provide benefits.	
Ruggerio (2021) (3)	Sustainability development sustainable: a review of principles and definitions	Highlight sustainability through of studies done on the theme.	The main results demonstrated a strong criticism of the concept of development sustainable due to its imprecise definition, to emergence of the concept of sustainability.	Knowledge must be encouraged new alternatives sustainable development, such as degrowth and sustainability.
Resende et al. (2021) (4)	Using the frame wood in construction civil in Brazil	The objective of this work is to present the advantages and disadvantages of system features constructive in houses of wood, addressing the main responsibilities sustainable and technical used.	Lack of information to public, lack of hand specialized oba problems of awareness population that thinks that this is a fragile system and not very durable.	Improving teaching on drywall, therefore, also about woodframe, it should be implemented in universities, the engineer should be the encourager and informer about new construction techniques, at least in Brazil.
Mota et al. (2021) (5)	Constructions sustainable, development economic engineering: resource optimization natural	Address the role of engineering in use and in the use of natural resources with focus in the question sustainable	The use of materials sustainable in the constructions and application of the principles sustainability demonstrated alternatives for development sustainable in the area of civil construction.	It should be taken into consideration concerns about the sector economic, social and environmental, aiming at the quality of life of society, contributing to the environmental sustainability environment and preserving it for present and future generations,
Severiano Jr (2021) (6)	Construction Green: use of resources renewables in construction civil.	Analyze opportunities and present contributions for sustainable practice in civil construction leave of resources renewables.	From the analysis were identified contributions to the sustainability renewable resources, which can be implemented by companies that operate in the construction sector	A construction that seeks to be sustainable uses local materials, recycled and reusable.
Tomio et al. (2021) (7)	Yield and quality from Eucalyptus wood benthamii Maiden et Rotational camber long in the process of unfold.	The aim of the study was evaluate the influence of diametric class and unfolding method in conversion yield log mechanics of E. benthamii, originating from of trees with cycle of long rotation (23 years), and	The use of E. benthamii, originating from of trees with rotation long, it proved viable node unfold, with yield equivalent to most species fast growing.	The use of E. wood. benthamii, brings more performance quality, meeting the standards of eco-efficiency necessary for project.

		the quality of the wood produced.		
Stora et al. (2022) (8)	Practices of sustainability in state schools of Guarapuava (PR)	Deal with practices of sustainability in state schools of Guarapuava (PR)	The results indicate that the schools perform good practices of sustainability, aligned with the Spreadsheet parameters A3P, although they are punctual and not continuous.	Such practices are in the delay in the formation of directors so that they can lead their institutions in compass with transformations environmental, social and economic contemporaneity.
Silva et al. (2023) (9)	Sustainability eco-efficiency: development of products with regional identity through the use of necromasses in reserve extractive.	Addresses the actions carried out in the Barreirinha community from Above, Auati-Paraná through the objective identify practices sustainable eco-efficiency.	It can be observed that the community has potential to development of new learning and being multipliers of knowledge community.	The project encourages the use of wood sustainably and takes into account the sustainable practices and eco-efficiency.
Lopes et al. (2024) (10)	Reuse of wood waste Amazonian through the design sustainable expanding horizons of riverside community.	Reuse of wood waste Amazonian through the design sustainable expanding horizons of riverside community.	The possibility was obtained factual that the training and application of breeding techniques jointly would result in economic growth and social appreciation.	It was seen how viable it is waste reuse of wood as a resource sustainable.
Zanete Silva (2024) (11)	Sustainable practices related to the materials of construction: an analysis of the aspects environmental by review systematic /	Analyze the materials of construction available market, considering its environmental aspects, to promote practices more sustainable in civil construction through of one revision systematic.	Sustainable materials identified offer viable alternatives and efficient to construction civil, contributing significantly for the reduction of impacts environmental and promoting sustainability.	Highlights the importance of the adoption of practices sustainable and the need for effective public policies and incentives economic to increase the use of these materials.

Source: Own research.

The discussion of the studies shows that wood, when used well, can be one of the pillars of a more sustainable civil construction, as long as technical barriers are overcome, cultural and institutional. Eco-efficiency in the use of wood involves not only the choice of appropriate materials and technologies, but also the valorization of social practices, waste reuse and sustainable planning of the forestry sector.

According to the data in the table above, Mota *et al.* (2021) highlight the relevance of promotion with the concern with implementing more sustainable constructions, improving the economy, employment and environmental impacts, highlighting that the construction industry must meet social demands and create and implement infrastructures in favor of this ecological demand. Likewise Ruggerio (2021) elevates the concepts of sustainability and sustainable development as relevant and that influence environmental issues, promoting policies linked to environmental management. Zubizarreta, et al. (2019) argue that in recent decades, different models have been developed to analyze the sustainability of different materials and components and should if three basic pillars of sustainability are implemented: economic and social components and environmental impact and the models mentioned in this study express eco-efficiency in the sense which is proving to be an increasingly promising alternative for civil construction contemporary.

Wood, as a renewable natural resource, when extracted responsibly and applied with appropriate technologies, satisfactorily meets the three pillars of sustainability: environmental, social and economic, therefore, the use of wood in structures constructive practices is, in itself, a practice that refers to sustainability. When coming from forests managed in a legal and controlled manner, the wood has low carbon emissions, high thermal insulation capacity and reduced environmental impact compared to materials such as steel and concrete (Silva et al., 2023).

Stora et al. (2022) in a study carried out in a school highlighted that the concept can be implemented of eco-efficiency in green areas for playing and socializing, generating a practical perspective of awareness for the maintenance and preservation of green areas and encouraging sustainability, focusing on the use of wooden structures linked to the concept of improvement of the environment.

According to Resende et al. (2021), contrary to common sense, wooden constructions are seen as sustainable and renewable, with low environmental impact and energy cost reduced, helping sustainability, adding aesthetic value, but which is still hindered due to obstacles such as misinformation among the public and engineering professionals, the shortage of qualified labor and the mistaken view that the system is fragile and of low durability.

The studies by Zubizarreta et al. (2019) and Kobayashi Jr. et al. (2020) highlight the potential of wood as a substitute for conventional materials such as steel and concrete, highlighting its environmental advantages. Zubizarreta highlights the versatility and environmental efficiency of wood in large constructions, while Kobayashi Jr. emphasizes that its rational use can generate

economic, social and environmental benefits, and both point to wood as an element central to sustainable construction.

In a more critical approach, Ruggerio (2021) reinforces the need to rethink the own concept of sustainable development, proposing alternative paths such as degrowth. This point of view invites us to reflect on the limits of consumption, even materials considered sustainable such as wood, defending a logic that goes beyond simple replacement of materials.

In the Brazilian context, Resende et al. (2021) bring to light cultural and structural barriers to adoption of the wooden construction system, such as the population's lack of information and the lack of qualified labor. In this sense, they advocate greater investment in training technique and awareness about the benefits of *woodframe and drywall*, positioning the engineer as an agent of transformation.

Mota et al. (2021) and Severiano Jr (2021) address the role of engineering in sustainable management of natural resources, emphasizing the importance of local, recyclable and reusable materials.

Such studies reinforce that the adoption of wood within an eco-sufficient logic involves strategic planning that considers the social, environmental and economic impacts of constructions.

In turn, Tomio et al. (2021) reinforce the value of long rotation wood, such as *Eucalyptus benthamii*, demonstrating that the use of this species offers high yield and quality, with gains in eco-efficiency. This highlights the importance of forest management adequate in the choice of species and in production cycles.

The studies by Silva et al. (2023) and Lopes et al. (2024) reveal the relevance of reuse of wood waste, either through the use of necromass in extractive reserves, or with sustainable design in riverside communities. Both show that wood can be vector of socioeconomic transformation, promoting autonomy and cultural appreciation, by at the same time as it contributes to reducing environmental impacts.

Finally, Zanete Silva (2024) reinforces that sustainable construction materials, including wood, depend not only on technological innovation, but also on the implementation of effective public policies and economic incentives to expand their adoption in the market.

5. FINAL CONSIDERATIONS

The use of wooden structures in civil construction, when associated with the principles of sustainability and eco-efficiency, represents a strategic and promising alternative in the face of contemporary environmental and social challenges. Wood, being a natural resource renewable and with low environmental impact, when managed properly, contributes significantly to the reduction of carbon emissions, the rationalization of the use of materials and the generation of less waste in the construction production chain.

Furthermore, the adoption of wood in architectural and structural projects is aligned with the search for cleaner, more durable and more accessible construction solutions, favoring not only the environmental preservation, but also the development of sustainable technologies and the valuing socially responsible practices. Eco-efficiency, in this context, manifests itself for the ability to produce more with less impact, optimizing resources and promoting reuse of waste and innovation in construction methods.

In this context, the search for solutions that promote sustainability and eco-efficiency has intensified, with emphasis on the use of materials that have low impact environmental throughout its life cycle. Wood, one of the oldest and most traditional materials used in construction, appears as a promising alternative, especially when from responsible and sustainably managed sources.

Therefore, this work sought to explore the potential of using wood in construction civil, focusing especially on its contribution to eco-efficiency. When analyzing the advantages environmental, social and economic aspects of this material, we intend to demonstrate the viability and importance of its adoption in more sustainable construction projects, contributing to the development of a more responsible civil construction in harmony with the environment environment.

However, for this model to be effectively implemented on a large scale, it is essential overcome technical, cultural and institutional barriers, through the training of professionals, encouraging research, formulating public policies and raising awareness in society about the benefits of sustainable wood use.

In this way, the importance of incorporating sustainable and eco-efficient practices is reinforced, such as central axis of planning and execution of works, allowing civil construction to evolve from in a harmonious way with the environment, contributing to improving the quality of life of present and future generations. Focusing on public policies, technical training and

social awareness are fundamental to consolidate the eco-sufficient use of wood as viable and lasting strategy for facing contemporary environmental challenges.

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