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SUSTAINABLE ACTIONS FOR THE DISPOSAL OF WASTE WOOD IN THE CONSTRUCTION SITE: BUILDING CLEANER PRODUCTION TO IMPROVE PROCESSES

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Abstract: Waste from the Civil Construction Industry (ICC) constitutes more than 50% of the mass of solid urban waste; however, it had not been placed as an industry with sustainability problems until the mid-1990s. Civil construction needs to implement the concept of sustainable development as a way to reduce environmental consumption in the processes of its production chain, as the different construction sectors are not yet familiar with the amount of waste they produce. In the light of environmental issues integrated by the Cleaner Production (P + L) strategy, the article aims to propose sustainable actions in the destination of wood residues generated in the manufacture of forms for reinforced concrete structures. The bibliographic research was outlined by qualitative and quantitative approaches with the application of two field surveys. In field survey A, it was verified the destination of the pine wood box waste generated at the construction site and, in field survey B, it was determined the average monthly consumption of the same wood used in the manufacture of forms for structures of reinforced concrete. The analysis of the results made it possible to share information dealing with environmental aspects regarding the generation of residues and the consumption of natural resources in civil construction.
Keywords: Civil construction. Sustainability. Cleaner production. Wood.

INTRODUCTION

During the 20th century, Brazilian cities became stages of major economic, social and spatial transformations due to the accelerated process of industrialization and urbanization of the national territory (ROSA et al, 2015). Civil construction, according to Roth; Garcias (2009, apud GOMES; MAGALHÃES, 2018), in the way it has been practiced in Brazil, causes environmental degradation in three distinct stages of the process: during the extraction and manufacture of construction materials, in the execution phase of the works and, for lastly, in the final disposal of waste; as a proposal for mitigating degraded areas, the authors consider it inevitable that civil construction must adopt procedures suited to the principles of sustainable construction.

According to Agopyan and John (2011), civil construction consumes between 40% and 75% of the raw material produced on the planet. Currently, the consumption of cement is greater than that of food and that of concrete is second only to water. Passuelo et al. (2014), attest that among the construction materials traditionally used, Portland cement stands out with wide application, whose industry is recognized as one of the main sources of greenhouse gases today, accounting for approximately 7% of the total. of all anthropogenic activities. Bernstein et al. (2007), Müller; Harnish (2008) state that cement is essential for almost all the production of the built environment, consequently, it is the most used material in the world and represents 5% to 8% of the world production of CO2.

The industry in general, and the construction industry in particular, took a long time to address and face sustainability problems. Despite being the industry that most consumes natural resources and generates waste at construction sites, in addition to being historically considered a "dirty" activity, it had not been placed as an industry with sustainability problems until the mid-1990s. of Rio 92, this concept was consolidated and today it is being progressively applied to all human activities, with great emphasis on the production chain of civil construction (AGOPYAN; JOHN, 2011).

Nascimento (2012) argues that, with the perspective of ensuring sustainable development and facing industrial

competitiveness, the strategy of structuring an environmental management system in organizations can be considered a source of opportunities and not an obstacle. In the 1960s and 1970s, technological solutions known as end-of-pipe controlled and treated atmospheric emissions, liquid or solid, without altering production processes or products (OMETTO; GUELERE FILHO; PERES, 2013). In the 1980s, the United Nations Environment Program (UNEP) presented the concept of Cleaner Production (P+L) with the objective of "defining the continuous application of a preventive and integral environmental strategy that involves processes, products and services, so that short or long-term risks to humans and the environment are prevented or reduced" (DIAS, 2017, p. 153).

According to Silva and Silva (2017), in this contemporaneity, end-of-pipe technologies no longer correspond to the desires of society in search of sustainability, since traditional approaches are extremely costly and are no longer applied as the only strategy to improve performance. environmental; End-of-pipe actions are different from P+L actions: while the first addresses the treatment of waste generated, the second studies the causes and understanding of waste generation.

Bohana et al. (2016) corroborate that most companies in the construction industry operate the traditional mode of production, using corrective techniques to solve problems, whose practice called "end of tube" is not the most appropriate, as it allows the degradation of the environment and then mitigate the problem.

For Fernandez et al. (2015), the civil construction sector is the largest generator of urban solid waste, representing about 62% of the total volume. The Brazilian Association of Public Cleaning and Special Waste Companies (2019), according to Panorama 2017, discloses that the generation of Urban Solid Waste (MSW) in 2016 and 2017, respectively, was 212,753 t/day and 214,868 t/day, while the collections of Construction and Demolition Waste (RCD), in 2016 and 2017, respectively, were 123,619 t/day and 123,421 t/day, that is, civil construction represented an average of 57.77% of the amount total in the period.

The civil construction sector is the largest consumer of tropical wood in the country (SILVA et al, 2016). In Brazil, the construction industry consumes about two thirds (2/3) of the country's natural wood (SOUZA, 2010). In civil construction, wood is used in the form of temporary elements, such as: in the installation of construction sites, boxes for reinforced concrete, scaffolding and shoring, and also definitively, for the execution of roof structures, frames, floors and ceilings (ZENID, 2011). According to Miranda; Angle; Careli (2009), wood waste in civil construction represents about 31% of the volume generated at the construction site, reaching 42% of the waste generated if considered the structural execution phase.

Based on the strategic concept of Cleaner Production, the article aims to propose sustainable actions in the destination of boxwood waste used in the manufacture of forms for reinforced concrete structures, in order to mitigate one of the biggest problems of civil construction: the high rate of environmental consumption of materials used in production processes.

In the methodology, bibliographic research was used to understand the proposed themes with the combination of two field surveys. In field survey A, 26 construction sites were visited to verify the destination of wood residues of the Pinus elliottii genus generated in the construction of single-family and multi-family residential buildings. In field survey B, 35 construction material stores were consulted to determine the average monthly consumption of the same wood used as box,

locking and shoring of forms for reinforced concrete structures. The two field surveys were carried out in the city square of Brusque/SC.

THEORETICAL REFERENCE

THE ENVIRONMENTAL CONSUMPTION OF THE CIVIL CONSTRUCTION INDUSTRY (ICC)

In the history of humanity, the idea of development is confused with the increasing dominance and transformation of nature, whose paradigm establishes natural resources as unlimited. The problems generated by consumerism and the unsustainable generation of waste have affected humanity for some decades; however, at the end of the last decade of the 20th century and at the beginning of the 21st century, the impact of the environment is recognized and debated by society (RIBEIRO; MORELLI, 2009).

According to Lintz et al. (2012), civil construction is one of the oldest activities that is known and since the dawn of humanity, it was used in an artisanal way, generating as a by-product of the processes, a large residual amount of different natures. The ICC is recognized as one of the most important industrial areas for economic and social development, however, it acts as the largest consumer of natural resources in any country in the world, whether through the consumption of natural inputs (environmental assets), by modifying the landscape or by the generation of waste (environmental liabilities) (MUNHOZ, 2008; SANTOS et al., 2012). Figure 1 shows how production processes in the ICC chain are interconnected and result from environmental impacts.

The civil construction sector is responsible for moving much of the Brazilian economy, even with the slowdown in economic growth. Even so, the segment remains a profitable activity, as it permeates the various social strata with the ideal of home ownership (MARCHI; BOHANA; FERNANDEZ, 2018). According to the Directorate of Statistics and Information (DIREI, 2018), the concept of housing deficit is linked to the limitations of the housing stock, considering housing without conditions to be inhabited due to precariousness or structural wear, rustic habitats or tenements, and cohabitation, when more than one family resides in the same household. The National Household Sampling Survey (PNAD) by the Brazilian Institute of Geography and Statistics (IBGE), as last measured in 2015, confirms a total absolute housing deficit of 6.355 million homes.

In Brazil, about 84% of the population lives in cities and, according to the Brazilian Institute of Geography and Statistics (IBGE), the forecast for 2020 is 90% (WORLDWATCH INSTITUTE, 2013). In view of the grandeur of consumption in the production chain of the Civil Construction Industry (ICC), it is clear that it will not be possible to achieve sustainable development without the sector itself also becoming sustainable (BRASILEIRO; MATOS, 2015). The chain of ICC production processes consumes between 14% and 50% of the entire planet's natural resources, according to Sjöström (1996 apud Santos et al. 2010); 40% and 75% of the raw material produced on the planet (AGOPYAN; JOHN, 2011). Table 1 depicts the state of the art of environmental consumption in civil construction.

ICC is the human activity with the greatest impact on the environment (Karpinsk et al. 2009; GOMES; DE SÁ MAGALHÃES, 2018). The numbers demonstrate the importance of the topic and the need for actions aimed at reducing impacts on civil construction (SANTOS et al. 2010). Despite the alarming amount of waste generated, ICC is also one of the sectors that have the greatest potential to insert waste into its production process

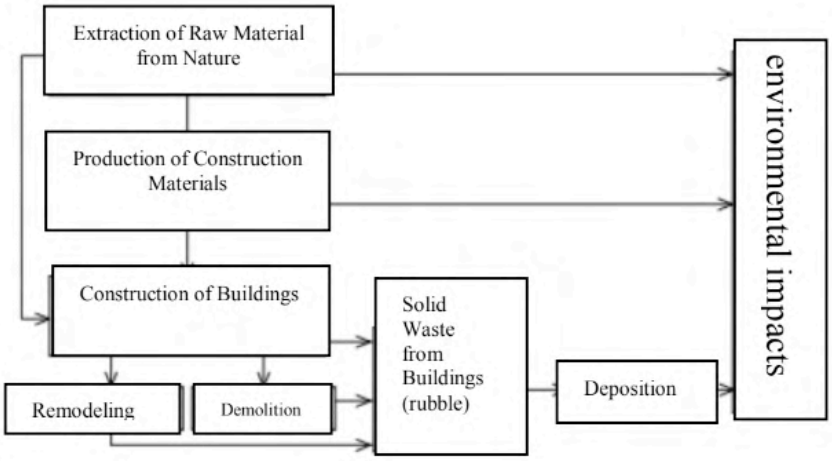


Figure 1 - Environmental impacts of the ICC

Source: Roth; Garcias (2009).

Author (year)	Environmental consumption
John; Agopyan (2000)	120% of loss of gypsum-based coatings
Uchoa; Hendrickson; Mathews (2002)	46% of economic activity 57% of atmospheric emissions 51% in the generation of hazardous waste
Araújo (2002)	30% of the raw material 42% of energy consumption 25% of water consumption
Marques Neto (2005)	50% to 70% of municipal solid waste 75% of the natural resources extracted from the planet
Souza (2005)	47,5 % of wood in general
Isaia (2007)	55% of wood for non-combustible purposes 40% energy for manufacturing building materials
Santos *et al.* (2011)	14% to 50% of natural resources consumed in the production chain
Laruccia (2014)	41% to 70% of the total mass of municipal solid waste (RSU)
John (2017)	50% loss in the splitting of wood

Table 1 - ICC environmental consumption

Source: Author (2020).

(RIBEIRO; MORELLI, 2009; LINTZ et al. 2012). According to Schneider (2004), 90% of civil construction waste can be recycled. John (2000) states that the recycling of civil construction waste, as it is the largest generator of final waste among economic macrosectors, is one of the basic conditions for achieving sustainable development.

ENVIRONMENTAL MANAGEMENT: CLEANER PRODUCTION

The construction of the concept of Sustainable Development constituted under the aegis of enabling the satisfaction of the needs of the present without compromising the possibilities of survival of future generations, was consolidated from three great emblematic milestones in the history of environmental management: the book A Primavera Silenciosa by Rachel Carson, published in 1962; the Brundtland Report of 1987 and the ECO-92 Conference in Rio de Janeiro (MOURA, 2002; NASCIMENTO, 2012; OLIVEIRA, 2012). Table 1 lists the authors and their publications:

According to Moura (2009), the book by biologist Rachel Carson was the first to denounce the residual action of pesticides in the environment, with the destruction and threat of extinction of wildlife, such as birds, fish and animals; in this context, Dias (2017) attests that the report produced by the Brundtland Commission is the first to present the most elaborate definition of Sustainable Development; Also, Pereira and Sant'anna (2018), complement saying that Agenda 21, one of the documents generated at the World Conference on Environment and Development in 1992, compiled throughout its 40 chapters the recommendations related to environmental management in organizations and also the specific actions of Cleaner Production (P+L).

The concept of P+L is different from the traditional approach, that is, from industrial processes that have control only in the final step, end-of-pipe in English, known as end-of-pipe. This methodology does not reduce contamination, but reduces toxicity by transferring it from one medium to another, as for example, in the installation of filters to retain pollutants, which will only be treated at the end of the process. P+L, on the contrary, claims to prevent the generation of pollution at the source, as opposed to control at the end of the process (DIAS, 2017). For Birth (2012); Pereira and Sant'Anna (2018), P+L can be incorporated into all production stages, from the choice of raw materials, to product development, to the concern to reduce inputs, waste and emissions.

P+L must be understood as a process of continuous improvement and not as an isolated or punctual activity, it is not limited to industries or companies of certain types or sizes, in addition to promoting growth, as long as it is ecologically sustainable, also working in the economic and social perspectives (UNIDO/UNEP, 2004).

CLEANER PRODUCTION IN CIVIL CONSTRUCTION

The National Environment Council (CONAMA) through resolution 307, of July 5, 2002, establishes guidelines, criteria and procedures for the management of civil construction waste, disciplining necessary actions in order to minimize environmental impacts. The resolution defines civil construction waste as debris from construction, renovations, repairs and demolition of civil construction works, and those resulting from the preparation and excavation of land, such as: bricks, ceramic blocks, concrete in general, soils, rocks, metals, resins, glues, paints, wood, ceilings, mortar, plaster, tiles, asphalt pavement, glass, plastics, pipes, electrical wiring, etc.

Civil construction is a major generator of waste. In Brazil, whose construction processes are essentially manual and carried out on construction sites, construction and demolition waste is potentially degrading to the environment, causing logistical problems and financial losses. The management of this waste aims to ensure the management of waste during the activities of execution of engineering works and services, consolidating strategies of non-generation, minimization, reuse, recycling and proper disposal of solid waste, prioritizing methodologies for reducing generation in the source (NAGALLI, 2014).

For Mattosinho and Pionório (2009), minimizing waste at source, the focus of P+L, must be the main alternative to be implemented in the ICC, due to its preventive action and the possibility of reducing production costs, it is possible to optimize consumption of inputs and raw materials. P+L aims to provide guidelines for the search for solutions to problems and limitations in civil construction, as it makes it possible to enhance the effectiveness of actions aimed at mitigating waste at source, meeting legal requirements, as well as consumer perception.

Excessive consumption of natural resources in civil construction is mostly due to low productivity due to lack of work planning, inefficiency in resource and raw material management, alteration of the architectural project, inadequate technology; lack of qualification and training of employees (OLIVEIRA; RIOS; LUCENA, 2007). The residues generated by the ICC originate from the waste of the production process, considering factors such as: insufficient definition of projects; lack of quality in materials and components; lack of procedures and execution control mechanisms, among which, loss in storage and transport, geometric recovery, leveling and flatness (PINTO, 1999 apud MATTOSINHO; PIONÓRIO, 2009).

Integrated solid waste management establishes a set of actions aimed at finding solutions for solid waste, in order to consider the political, economic, environmental, cultural and social dimensions, under the premise of sustainable development (CONAMA, 2002). Solutions for the management of civil construction waste must be made possible in order to integrate the municipal public body, responsible for control and inspection; waste generators, responsible for the final disposal of waste, and transporters, responsible for the licensed disposal of waste (PINTO, 2005).

According to Pinto and Gonzáles (2005), it is up to the municipalities, in accordance with article 6 of CONAMA Resolution No. of waste, determining that, at the local level, areas for waste management are defined and licensed in accordance with the resolution, establishing technical guidelines for the responsibilities of generators and registering waste carriers, integrating actions for the Construction Waste Management Project Civil, as shown in figure 2.

The set of actions of the management project is assigned the following objectives:

Easy arrangement for small volumes; improvement of cleanliness and urban landscape; environmental preservation; encouraging partnerships; incentives to reduce waste at source (P+L); reduction of municipal costs (PINTO; GONZÁLES, 2005).

WOOD IN CIVIL CONSTRUCTION

EXTRACTION

Our ancestors, thousands of years ago, discovered the possibility of overcoming obstacles, whose mechanisms consisted of tree trunks supported on the edges of the gaps (CALIL JUNIOR et al., 2012). The use of wood in the production of tools and in the execution of constructions occurred from the Paleolithic period, with records of its use by Homo

Erectus who developed carving techniques for the production of axes (NAVARRO, 2006). Throughout history, use and manipulation techniques have developed, resulting in a large mix of products, construction systems and applications (SHIGUE, 2018). "Wood is probably the oldest building material given its availability in nature and its relative ease of handling" (PFEIL; PFEIL, 2015, p. 1).

Forests today occupy an area of approximately 4027 million hectares worldwide, about 30% of the land area (CACHIM, 2014). The Brazilian Amazon is home to more than 356 million hectares of natural forest, corresponding to 84.7% of the total volume of native wood in the country's biomes, according to information from the Brazilian Forest Service (ADEODATO et al. 2011). According to estimates, the rate of illegal timber production in the Amazon region is between 43% and 80%, coming from deforested areas or exploited in a predatory and unsustainable way; however, in the Legal Amazon, 80% of the properties located in forest areas must remain with native and original coverage, called Legal Reserve (ZENID, 2009). The Legal Amazon was created in 1953 through the Brazilian Forest Code and comprises the states of Acre, Amapá, Amazonas, Mato Grosso, Pará, Rondônia, Roraima, Tocantins and Maranhão (SUDAM, 2010).

RESIDUE

According to the Brazilian Forest Service (2010), Brazil is a forest country with approximately 60.7% of natural and planted forests. The Brazilian Amazon is one of the main tropical wood producing regions in the world. Graph 1 represents the processed wood market in Brazil.

In 2009, 2226 timber companies were identified in the Legal Amazon, supplying 62% of the national market, 21% for the foreign market and 17% for the Legal Amazon itself (SFB, 2010). Although it is one of the few renewable materials, most wood extraction is done in a non-sustainable way; it is estimated that between 26% and 50% of the wood extracted in the world is consumed as construction material (JOHN, 2000). "[...] the construction industry consumes about 66% of the wood produced, and most of the product does not come from environmentally managed forests (JOHN, 2010 apud PIOVEZAN JUNIOR, 2007, p. 18).

Wood in civil construction stands out in the application of roof structures, rural constructions, scaffolding of concrete structures, overcoming obstacles such as walkways, port works, etc. (CALIL JUNIOR et al. 20192). The use of wood in works, whether in the form of temporary elements (forms, shoring and scaffolding), or in the form of definitive elements (roofing, floors and finishes), generates a large amount of waste, considering that all temporary elements will be discarded. (TÉCHNE, 2013).

Wood waste represents about 31% of the volume of construction waste in a multifamily residential building and, specifically in the structural execution phase, can reach 42% of the waste generated during the construction process (MIRANDA; ÂNGULO; CARELI, 2009).

The high energy content of wood waste makes it possible to use it as a fuel for generating thermal energy, with a significant reduction in the volume of waste after incineration. However, in the burning of wood, gases such as carbon dioxide (CO2) and nitrogen oxide (NOx) are released, which are atmospheric pollutants (SILVA et al. 2016).

Wood waste must not be landfilled, as the decomposition without oxygen generates methane gas, which is even more harmful than CO2 in terms of effects related to climate change (SINDUSCON, 2015). Also according

Author/Institution	Work	Goal
Rachel Carson	Primavera Silenciosa	Report aggression to the environment and poisoning in humans caused by pesticides
Gro Haalen Brundtland /ONU	Relatório Brundtland ou Relatório Nosso Futuro Comum	Propose a global agenda to tackle the planet's environmental problems and ensure humanity's progress
Conferência do Rio de Janeiro, Eco-92 / ONU	Carta da Terra e Agenda 21	Formulate guidelines on the environmental issue based on Sustainable Development

Table 1 - Authors and regulatory works on Sustainable Development

Source: Author (2020).

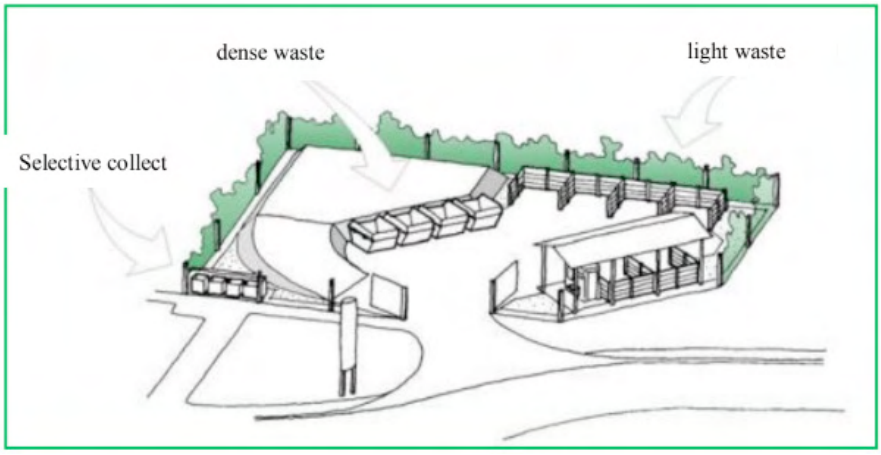
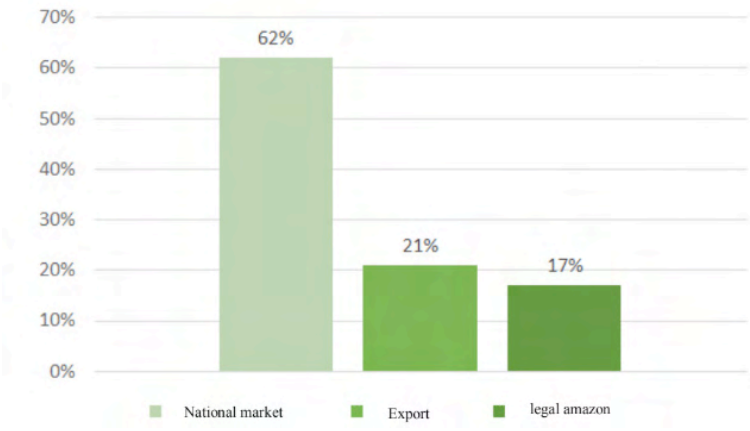


Figure 2 - Delivery point for small volumes

Source: Adapted from (PINTO; GONZÁLES, 2005).



Graph 1 - Consumption of processed wood

Source: Adapted from the Brazilian Forest Service (2010).

to the same author, the wood residues generated in the works must be concentrated in transshipment and sorting areas (ATT) that distribute them to the recycling companies, producing chips as fuel; also, as in a reverse logistics process, they can be used as raw material for the manufacture of industrialized wood panels for civil construction. Figure 3 represents the destination of wood waste generated in the works.

METHODOLOGICAL PROCEDURES

The research is designed based on the organization of three parameters: data approach, type of objectives and technical procedure.

As for the data approach, the research is characterized as quali-quanti: qualitative, as it allows the understanding of the definitions presented by the theoretical and subjective description of the concepts inherent to the study developed, and quantitative by the percentage numerical representation of the information collected regarding the residual provisions of the study object.

According to the objectives, the research is classified as exploratory, as it makes it possible to detail an overview of the proposed theme, proving information extracted from the field in which the population sample was contained.

As for the technical procedures for collecting and operationalizing information, the study integrates the bibliographic research and two field surveys, with the application of two technical sheets for recording and analyzing data. Thus, two studies were planned to fulfill the research objectives.

The first stage of the research, called field survey A, was carried out from February/2019 to August/2019, with 26 single-family and multi-family residential construction sites in the city of Brusque/SC being visited, in order to verify the destination of waste of pine wood, used provisionally as a box formwork for reinforced concrete structures, bracings and scaffolding; During the approach to the foreman or foreman at the time of the technical visit, the objective of the research was explained and the disposition given to the residual wood was noted, through a technical sheet for in situ records of the information collected.

In the second stage of the research, called field survey B, the average monthly consumption of boxwood of the pine genus, sold in 35 construction material stores in the city of Brusque/SC, representing 100% of the sampling, was analyzed in the period between May 6, 2019 to July 1, 2019, with the objective of quantifying the average monthly consumption sold in the city, defining as a reference the months of February/2019, March/2019 and April/2019; methodologically, the purpose of the research was explained to the store manager, explaining how to fill in the technical sheet for metric notes of the monthly values sold and scheduling the collection of the document (technical sheet) for the following week. The average monthly consumption was determined by the arithmetic mean quotient, adding the partial consumption of the three analyzed months and dividing the total value by 3 (three).

ANALYSIS OF RESULTS

According to field survey A, the disposal of wood residues was verified at three different levels, as shown in table 2, which relates the collection method with the destination of residual wood after the manufacturing, shoring and locking processes of the forms.

In field survey B, the average monthly consumption of box wood sold in construction material stores was evaluated, referring to the competences of February/2019, March/2019 and April/2019. From the information

researched, an average monthly consumption of 2309.85 dozen boxwood was recorded. In the field of the researched square, the entire population of 35 stores was considered, obtaining a distribution of the sample universe as shown in Table 3.

RESULTS AND DISCUSSIONS

In field survey A, the informal collection method was called level 1, in which third parties collected the waste at the construction site, and the wood was destined as firewood for the production of thermal energy in ovens of commercial facilities, such as pizzerias, pottery, among others, with an occurrence of 30.77% of the cases. According to Silva et al (2016), the wood burning process is harmful when polluting gases such as carbon dioxide (CO2) and nitrogen oxide (NOx) are released in cases of waste with nitrogen-based glues. Luchezzi (2017) also adds that wood residues contaminated by metals, such as nails and wires, as well as concrete, mortar and chemicals can be found.

At level 2, collection is formal and non-selective, that is, the wood is deposited in stationary buckets of companies hired to collect limestone, with subsequent disposal in dumps or sanitary landfills, which represented 32.70% of the total, constituting if it is an environmental crime, as it does not have legal support as recommended by Conama Resolution 307 (2002); In addition, according to SINDUSCON (2015), decomposition without the presence of oxygen produces methane gas, potentially more harmful than CO2, considering the effects related to greenhouse gases.

At level 3, the formal and selective collection of wood at the construction site was intended for the production of wood chips, with 36.53% of the occurrences surveyed, and represented the most sustainable disposal for wood waste, adding to the sorting process, the crushing all the material and separating the nails by magnetism. According to Ramos et al. (2017), the chip with a variable diameter between 5 and 50 mm, allows the condition of improving moisture control and increases the thermal efficiency of boilers, featuring economic and environmental gains. SINDUSCON (2015) also states that burning wood under controlled conditions above 800 ^{0}C is safer from an environmental point of view. In the set of construction companies surveyed, all responded that they support the practice of reusing larger cuts for application in other constructive stages of the work itself or in subsequent works.

In field survey B, from the analysis of data collection evaluated in 21 stores that provided the requested information, an average monthly consumption of 2309.85 dozen pine box wood was determined, equivalent to 415.77 m^3 of wood. The condition of temporary use in which the pine wood used as formwork for reinforced concrete structures is intended, allows us to affirm that at some point, after the reuse of the larger cuts, this entire volume will be discarded. Thus, considering the bibliography researched, it was found that only 50% of the raw wood extracted is transformed into a finished product, that is, sawn wood, in this case, approximately 623.65 m^3 of raw wood are needed to meet the current demand. Analyzing it in an equivalent way and taking as a reference a tree with a diameter of 30 cm and a trunk height of 6 m, an expressive amount of 1961.64 trees per month is necessary.

FINAL CONSIDERATIONS

The analysis of field surveys allowed us to formulate some considerations. In field survey A, although the highest index represents the best option among the residual dispositions mentioned, the values are very close to each other, showing that there is no convergence of sustainable actions among professionals

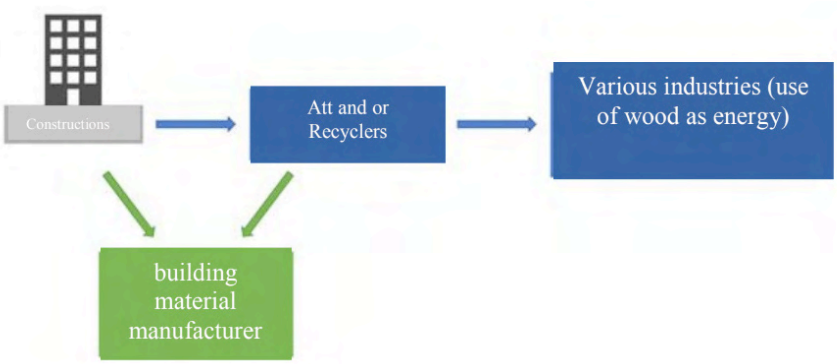


Figure 3 - Organizational chart of wood waste

Source: Adapted from Sinduscon (2015).

Level	Collection method	Destination of waste
1	Informal	Firewood for generating thermal energy
2	non-selective formal	Accommodation in stationary wedge buckets
3	selective formal	chip production

Table 2 - Disposal of waste

Source: Author (2021).

Sample volume (stores)	Sample participation
21	Wood of the *pinnus* genre was not sold
5	Wood was not sold.
5	No information provided
4	Closed

Table 3 - Sampling distribution

Source: Author (2021).

involved in the process, that is, people are not aware of the importance of solving the environmental problems generated by civil construction. There is a weakness, a general ignorance of the sector in the adoption of measures that can mitigate the environmental damage caused by the ICC production chain. In field survey B, the gross consumption of wood analogous to 1961.64 trees per month borders on the unimaginable. Although pinnus wood originates from planted forests and is designed for this purpose, natural resources such as water, soil and energy are subtracted from the consumption of future generations, a premise of sustainable development. The inefficiency of the production processes and the lack of commitment of professionals to legitimize an environmental management, corroborate with an important share in the consumption and deterioration of natural resources.

The adoption of the strategic concept of Cleaner Production for the gradual understanding of measures in the continuous improvement of the production processes of civil construction, has a reducing effect both for environmental consumption and for waste of materials, and can act as a legal reference guiding policies environmental, contemplating a technical approach in the consolidation of learning in formal and informal education programs.

In compliance with the article's objective of proposing sustainable actions for the destination of wood waste generated in the manufacture of forms for reinforced concrete structures, the insertion of professional learning strategies integrating disruptive actions is pointed out, in order to add new knowledge and break the resistance imposed by the productive workforce, imperative parameters for a structuring modification capable of providing a new ecological paradigm.

It is also proposed as a sustainable action, the concept of acting locally in the creation of sorting and transshipment areas (ATT) as a collection point for small volumes by municipal governments, as already recommended by Conama Resolution 307/2002, representing an action that provides the population with the opportunity to create a culture with the perception of ecological and sustainable bias, avoiding the irregular disposal of wood on public roads, irregular burning, contamination in environmental preservation areas or on land without improvements, assigning the correct destination selection of the materials deposited there.

In support of the research data, it is attested that the destination of wood as firewood cannot be considered as a sustainable process in itself, and is far from being environmentally correct, as the generalization of dimensions does not encourage the recycling of pieces of wood. larger, which would prolong the life cycle of the material in other construction processes. The burning of wood in conventional ovens in commercial establishments is only justified when there is no other plausible alternative. Meanwhile, selective collection aimed at the production of wood chips provides awareness of sorting in the work itself, and the transformation of wood, initially residual, into a new product in another industry, strengthening the practice of industrial symbiosis, a process that values the waste material, reducing the exploitation of natural resources.

Technical professionals who work in civil construction activities need to acquire adherence by environmental principles to construction processes and in the practice performed by the productive workforce, which is apart from the current demand for sustainable practices, adopting preventive measures that avoid the waste of wood, how to use the pieces according to the project and with the planning of the work, specify in

technical plans parallel to the architectural project the reuse of the pieces more than once, avoiding unnecessary cuts.

Finally, the construction industry, given the relativism with which it treats all waste generated in the production chain indistinctly, needs to deconstruct the current operational matrix based on the consumption of non-renewable resources from a systemic view, implementing the execution of projects whose requirement of environmental sustainability is guided by materials from recyclable sources, enabling a balance between the built environment and the natural environment.

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