

Ineffective Waste Management in Civil Works in Argentina: Global Perspectives on Effective Waste Disposal Regulation

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Abstract — Inadequate management of construction and demolition waste (CDW) is a significant environmental and social problem in Argentina. This paper investigates the disposal of CDW in developed countries to identify potential solutions that could be implemented in Argentina. The paper provides a classification of CDW and discusses the current legal vacuum in Argentina regarding CDW management. As well as this, the paper presents case studies of CDW management policies in China, the United States, the European Union, Germany, Korea, and Australia. In addition, the paper assesses the viability of implementing similar policies in Argentina and discusses the advantages and disadvantages of doing so. It is expected that this article may raise awareness about the pollution generated by CDW and provide possible paths to address it.

Keywords: Construction and Demolition Waste (CDW), waste management, sustainable development, environmental policy.

Resumen — La gestión inadecuada de los residuos de construcción y demolición (RCD) es un problema ambiental y social importante en Argentina. Este artículo investiga la eliminación de RCD en países desarrollados para identificar posibles soluciones que podrían implementarse en Argentina. El artículo proporciona una clasificación de los RCD y analiza el vacío legal actual en Argentina con respecto a la gestión de los RCD. Además, el artículo presenta estudios de caso de políticas de gestión de RCD en China, Estados Unidos, la Unión Europea, Alemania, Corea y Australia. Además, el artículo evalúa la viabilidad de implementar políticas similares en Argentina y analiza las ventajas y desventajas de hacerlo. Se espera que este artículo genere conciencia sobre la contaminación que generan los RCD y proporcionar posibles vías para abordarlo.

Palabras clave: Residuos de Construcción y Demolición (RCD), gestión de residuos, desarrollo sostenible, política ambiental.

I. INTRODUCTION

Many countries have advanced in the field of construction thanks to new technologies, but they do not seem to discuss the negative impacts on the environment that

they generate. One of the main causes of the negative impact generated is the construction and demolition waste (CDW). This is mainly due to inadequate waste management in civil works.

CDW is generated from the construction, renovation, repair, and demolition of civil structures. In recent years, construction has increased and, consequently, the generation of CDW. This type of waste has become a global environmental problem, which is why different countries have taken measures for its proper management. Argentina is not among the countries that have taken sustainable measures for the recycling or proper disposal of construction and demolition waste. Therefore, it is essential to investigate how some developed countries carry out this task so that Argentina can implement similar measures in the future.

The current project is related to the United Nations' Sustainable Development Goals (SDG), specifically with SDG #11, "Sustainable cities and communities" and SDG #13, "Climate action". This project is related to SDG #11 because it seeks to find construction site waste disposal methods carried out by countries that are developed in the subject, to put them into practice in the future in Argentina. SDG #13 is related to this work since delving into the process of waste management might contribute to an increase in proposals connected with climate action in our country in the future. Climate action is any program with the goal of reducing greenhouse gasses, building resilience to climate change, or supporting and financing those goals [1, p. 1].

Currently, Argentina faces a legal void [2, p.7] that makes the effective and sustainable management of CDW difficult. The aim of this paper is to investigate the disposal of CDW in developed countries. In order to achieve this goal, this article will be organized as follows. First, the problem in relation to the waste that is most usually generated in civil works is going to be described by providing a classification of CDW. Second, the different proposals offered by developed countries in the management of CDW are presented. Next, the viability assessment of the projects of the different countries in Argentina and the advantages and disadvantages of applying a new system in Argentina will be stated. It is expected that this article may raise awareness about the pollution generated by CDW.

II. CDW GENERATED IN CIVIL WORKS

The construction industry, due to its enormous activity and volume of materials used, has become one of the main

generators of waste worldwide. CDW is generated at every step of the process: raw material extraction, manufacturing, transportation, construction, and waste disposal. The type of waste generated in a construction site will depend on the type and phase of the project.

CDW is generated whenever any construction or demolition activity takes place, such as houses, roads, bridges, piers, and dams. An estimate is that between 15% and 20% of municipal solid waste comes from construction and demolition projects [3]. Below there are three different classifications of the different types of waste generated within civil works to have a clearer concept of what it is meant when the term construction and demolition waste is used.

In [3] a legal classification of waste is offered in relation to its type. According to this, there are two types of legal classifications: bulky waste and municipal solid waste. A way to classify the type of waste can be land clearing debris, demolition waste, construction waste, oversized CDW, and highway construction and demolition waste. The first two can be considered bulky waste, the third and the fourth are municipal solid waste and the last is both, bulky and municipal solid waste. This classification and some examples are illustrated in [3, Table 1].

Table I - Type of waste, legal classification and examples [3].

Type of Waste	Legal Classification In Connecticut	Examples
Landclearing debris	Bulky waste	Tree stumps, tree tops
Demolition waste (from buildings)	Bulky waste	Concrete, wood, brick, plaster, roofing materials, wallboard, metals, carpeting, insulation
Construction waste (from buildings)	Municipal solid waste	Pallets, wood scraps, wallboard, siding and roofing scraps, packaging, carpeting, Foam padding, insulation
Highway construction and demolition waste	Bulky waste, municipal solid waste	Asphalt, concrete, steel, related construction and demolition wastes, utility poles, railroad ties, brick, block, rock
Oversized MSW	Municipal Solid Waste	Furniture, furnishings, Carpeting, rugs

Another classification of CDWs is provided by [2, p. 2]. It can be classified in terms of origin and nature as described below. According to its origin and source of generation:

- Land clearing materials*: this category includes stumps, branches, and trees.
- Excavation materials*: this category encompassing inert, natural, or artificial waste, often contaminated, such as earth, excavation rocks, and granular materials.
- Waste from road works*: this category is composed of concrete slab fragments, asphalt waste, and materials from bridge renovations.
- Waste resulting from new construction, expansion, or repair*: this category includes waste from the construction process itself and from product packaging used on-site.

In relation to its nature, a possible classification is:

- Inert waste*: this category includes materials that pose no risk of polluting water, soil, or air and are environmentally compatible.
- Non-hazardous waste*: this category is composed of materials suitable for storage or treatment alongside household waste, commonly recycled in industrial facilities along with other waste.
- Special waste*: this category encompasses materials characterized by potential dangers, such as flammability, toxicity, corrosiveness, irritancy, or carcinogenic properties.

In Argentina there is a legal vacuum regarding the management of CDW. This results in inadequate waste management and this is an increasingly worrying challenge today.

As a consequence of this legal vacuum, Argentina faces significant environmental and social challenges stemming from the mismanagement of CDW. Environmentally, the unregulated disposal and inadequate treatment of CDW contribute to soil and water pollution, and the release of harmful substances into the environment, endangering both terrestrial and aquatic ecosystems. Moreover, the increase in uncontrolled CDW sites exacerbates health risks for nearby communities, as these areas often become a growing environment for disease. Socially, the lack of a structured approach to CDW management can lead to economic inefficiencies, including missed opportunities for recycling and job creation within the recycling sector. Addressing these environmental and social problems requires urgent policy measures to regulate and improve the management of CDW in Argentina [9].

III. CDW POLICIES AROUND THE WORLD

One way to start addressing the issue of CDW is to delve into the way developed countries deal with CDW around the world. In this section, the case of China, USA, the EU, Germany, Korea and Australia are presented.

A. China

According to [4, p.] China has established national-level policies and regulations to promote the reduction, reuse, and recycling of construction and demolition waste, and has encouraged the construction of waste treatment facilities. Additionally, China has established a certification system for companies engaged in the management of construction and demolition waste.

B. The United States

The United States has policies and regulations for the management of construction and demolition waste at the state level in accordance with [5, p. 8]. The US government has established economic and technical incentive programs to promote the reduction, reuse, and recycling of construction and demolition waste. However, the implementation of these policies and regulations remains a challenge in both countries due to the lack of resources in the USA and public awareness.

C. *European Union*

In the European Union, the management of construction and demolition waste is guided by protocols and guidelines that include waste classification conforming to [6], waste prevention, reuse and recycling of materials, and proper disposal. The Waste Framework Directive (2008/98/EC) sets out the waste concepts and introduces the five levels for the hierarchy of treatments of waste, with the following priorities: prevention, preparation for reuse, recycling, energy recovery, and final disposal. Additionally, the EU has established recycling targets for its member states.

D. *Germany*

In Germany as reported by [6], the management of construction and demolition waste is governed by the Life Cycle of Building Materials Act. This law mandates that construction and demolition waste should be recycled and reused to the greatest extent possible. Germany has also set recycling targets for different types of construction and demolition waste. The country promotes the separation of waste into different categories to facilitate recycling and reuse, and encourages the use of recycled materials in the construction of new buildings and public works.

E. *Korea*

In Korea the management of construction and demolition waste is an important issue due to limited landfill capacity and the need to maximize resource efficiency according to [7]. The government has established regulations and standards for waste management and has set targets to increase the recycling rate of these wastes. The government has also established an extended producer responsibility system for construction materials, which has encouraged innovation in the industry and improved waste management efficiency. Additionally, public education and awareness campaigns have been established to promote proper waste separation and the importance of waste management. Overall, the management of construction and demolition waste in Korea is a comprehensive approach that involves government regulation, producer responsibility, industry innovation, and public education to achieve more efficient and sustainable waste management.

F. *Australia*

In Australia a system of interregional mobility of Construction and Demolition Waste is used in keeping with [8]. The system is based on three steps: developing a conceptual model, quantifying and mapping the interregional mobility of CDWs in Australia. When the waste is already available, the system divides it into different sectors: recycling operations, organic operations, waste dumps, and a small percentage remains in illegal dumps. After waste recycling operations, the materials have different destinations:

- Masonry waste is recycled into aggregates, mainly for road base, concrete, etc.
- Metal, paper, glass and plastic are sorted and classified for further remanufacturing.
- Combustible waste such as organics (paper, cardboard, textiles, leather and rubber) are converted into alternative fuel for energy recovery

- Organic compositions (timber and garden waste) are transported to the organic processing operations where the waste will be made for land rehabilitation, soil improvement, and urban development
- Non-recyclable waste disposed of in landfills

IV. FEASIBILITY OF ASPECTS OF FOREIGN SYSTEMS OF CDW MANAGEMENT IN ARGENTINA

The application of these recycling systems for CDW in Argentina is a great challenge. Carrying out new systems would be a complex endeavor for construction companies, the government, as well as society, since all of these areas are involved at some stage of the CDW generation. However, without the commitment of these entities, the application of a new system in the country would be very difficult.

The implementation of a CDW management system would have both positive and negative sides. Among the advantages, the materials that remain as waste can be reused for different purposes: masonry waste can be converted into aggregates, combustible waste can become alternative fuel for energy recovery and non-recyclable waste (which is a smaller percentage) can be disposed of in municipal garbage dumps. A further advantage is that the creation of new recycling plants would generate a new field of competition within the sector and, consequently, generate new jobs and income. A final advantage that is directly connected with the previous actions is that there would be less environmental pollution, less global warming and less gas emissions. On the other hand, a major disadvantage is that the transportation of waste to the plants is carried out with trucks that pollute the air with their engines. Thus, this pollution can have an unwanted negative effect on the environment.

V. CONCLUSION

Nowadays, Argentina has a legal gap that makes it challenging to administer CDW in a way that is both efficient and long-lasting. This paper looks into how CDW is disposed of in industrialized nations and tries to find a solution to the management of CDW in Argentina.

Upon analysis of the different systems that are carried out in the developed countries, it can be deduced that it takes hard work to reach that level of organization in relation to CDWs management, since it involves part of the government, the construction companies and mainly society, because everybody should be aware of this issue. One aspect to highlight is that for these systems to work, governments adopt fines (in case of non-compliance) or benefits (in case of compliance) to motivate and promote these systems within each country. These systems were not consolidated from one day to the next.

If Argentina wants to reach a level of this magnitude, it must start from scratch and develop its own CDW management system. Carrying out the development and application of a new CDW organization system in Argentina would be a challenge for construction companies, the government and society. The implementation of an effective method in the organization of CDW would lead to growth at the country level, since we would reduce environmental pollution and would lead us to be a model for other developing nations.

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