Restructuring Construction Thinking for Urban Material Reuse

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Abstract

Construction and demolition waste (CDW) is a significant contributor to global waste. CDW accounts for nearly 1/3 of the total waste worldwide. Much of this is concrete, brick, and wood and is disposed in landfills or incinerated, resulting in environmental pollution and greenhouse gas emissions. Upcycling CDW is increasingly important for a sustainable waste management approach. Digitalization can play a significant role in promoting reuse of construction waste by enabling effective and efficient tracking, sorting, and processing of materials, through Building Information Modeling (BIM). BIM can help identify reusable components and provide real-time data on the quantity and quality of materials available for reuse. This paper proposes the architecture of a digital platform to facilitate the CDW upcycling by connecting construction companies, material suppliers, and waste management firms.

Keywords: Construction; Demolition; Waste; Upcycling; Reuse; Repurpose.

1 Introduction

According to the International Energy Agency, the built environment generates 40% of annual global CO2 emissions. Of those total emissions, building operations are responsible for 27% annually, while building and infrastructure materials and construction (typically referred to as embodied carbon) are responsible for an additional 13% [1] excluding material transport. By 2050, around 2.5 billion more people will be living in cities [2] which will require vast amounts of building materials, and enough energy to build the necessary urban environments. Buildings have very high embodied carbon emissions and a carbon-heavy footprint. For example, producing each ton of cement (as one of the fundamental building materials) releases nearly one ton of CO2 into the atmosphere. The production of cement is responsible for 7% of total emissions [3] and its production is projected to considerably increase by 2030. The same holds true for other building carbon intensive building materials like steel, aluminum, bricks and glass.

To limit the temperature rise to 1.5oc (the goal of the Paris Agreement, 2015), GHG emissions need to be cut by 7% per year according to the UN Environment Program [4]. This means that the emissions should be reduced to 3.5 tons per capita in 2030 and below 2 tons in 2040 which are way below the 'current' emission rate of 6.71 tons per capita per year [5].

The production of construction materials has a range of negative impacts on the environment,

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