
Construction and demolition waste recycling plants revisited: management issues

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Abstract

Today, recycling of construction and demolition waste (C&DW) by plants is a reasonable alternative to the existing unsustainable disposal methods such as landfilling and fly tipping. Therefore, this study aims to report current management issues of these plants in the literature. As a result, it was seen that these management issues investigated in past researches can be classified under four main groups such as economics, environment, location, and administration. Their pros and cons were also revealed in a covering manner. As these issues have not been addressed together up to date and each one of them has been investigated separately, the present study is the first attempt to give a full picture of management issues of the recycling plants. Thus, it can fill the gap in the literature. As a research implication, this study may help researchers who will investigate C&DW recycling plants from different perspectives. In terms of the practical implication, it may attract attention of industrial practitioners and entrepreneurs in public authorities and the private sector to benefit from such wastes through plants. Finally, as a social implication, better management of C&DW recycling plants can save and enhance the sustainability of the overall environment and affect society positively.

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1. Introduction

In general terms, construction and demolition waste (C&DW) is divided into two types: inert materials (i.e., sand, bricks, and concrete) and non-inert materials (i.e., plastic, glass, paper, wood, vegetation, and other organic materials). In this regard, bulk excavations are not classified as C&DW. According to a different classification, 30% of the C&DW input may be considered to be separate while the rest of 70% is the mixed C&DW of which average density is 1,400 kg/m³ [1]. This is because the on-site waste sorting is considered to be time and labor demanding. Owing to the nature of production methods and conditions, activities of the construction industry will never reach zero-waste status and a certain level of the waste generation is unavoidable. The European Commission considers C&DW as a priority waste stream due to large amounts generated [2]. The building debris typically represents 10-20% of the total weight of building materials delivered to a building site while the building demolition waste is 10-20 times by weight as much as waste generated from the construction of new buildings [3]. In general, the demolition waste of construction works accounts for 70% of C&DW [4]. Overall, C&DW amounts to more than a quarter of the municipal household waste stream and the total solid waste [5,6]. However, the share of C&DW in the total waste generation differ considerably between countries worldwide from Japan (16%) and Germany (19%) to USA (29%), EU (30%), China (30-40%), Hong Kong (38%), Australia (42%), the UK (50%), and Spain (70%) [7-9]. Per capita C&DW generation in ton also shows large variations with low values in Norway (0.2), Poland (0.5), Spain (1), intermediate values in Germany and the UK (2), Hong Kong (3), France and Ireland (4), and high values in Luxembourg (15) [10,7]. However, C&DW generation statistics are not rigorously tracked in countries, and thus, the corresponding predictions seem to vary dramatically.

In many countries, especially developing ones, there are two popular practices to poorly handle C&DW: landfilling and fly tipping. As a covering ratio, C&DW currently makes up 25-45% of waste that goes to landfills [11-13]. In particular, more than 90% of C&DW is landfilled in Kuwait [14]. Similarly, in Hong Kong, much of C&DW go to landfills [15]. On the other hand, C&DW is undesirable for disposal in landfills. In the Netherlands, Germany, Belgium, and Switzerland, there is a landfill ban for the unsorted waste and recyclable materials [16]. In USA, many landfills do not accept C&DW [17]. In Hong Kong, an administrative rule specifies that C&DW containing more than 20% inert material by volume (or 30% by weight) cannot be disposed of at landfills [3]. This is because C&DW (i) consumes a huge space, (ii) is recognized to produce harmful chemical leachate, anaerobic degradation that leads to air pollution, landfills gas generated from organic waste materials, and other contaminants, all of which contribute to acidification and toxic impact on ground and surface water and soil by putrefaction [18,19]. Therefore, landfilling of C&DW can only be permitted at higher costs. Fly tipping is more frequently used another option to landfilling. In fact, it is the usual practice to handle C&DW in many countries as in Turkey. In this regard, especially in the last two decades, recycling of C&DW by plants has been a reasonable alternative to such unsustainable disposal methods (i.e., landfilling and fly tipping) as chronologically cited in Table 1. In the light of the requirement of such plants, this study aims to report current management issues of these facilities in the literature from financial, environmental, locational, and administrative points of view. This is because, in previous works depicted in Table 1, these management issues have not been addressed together up to date and each one of them has been investigated separately. Hence, the present study is the first attempt to give a full picture of management issues of the recycling plants. Thus, it can fill the gap in the literature.

2. Recycling of C&DW

In some regions of USA and Europe, where resources for concrete are scarce, recycling of C&DW was first introduced in early 1970s. In 1980s, due to the scarcity of landfills and the growing awareness of the pollution and resource potential of C&DW, several plants for sorting and recycling went into operation [20]. Today, in terms of the global warming potential, the most environmentally friendly treatment is the recycling of C&DW, followed respectively by landfilling and incineration [21]. However, in most of European countries, recycling is a relatively new industry with origins reaching back no farther than 1990s [22]. In Turkey, the first recycling plant was established in 2006.

As the target of EU in terms of C&DW, Directive 2008/98/EC [23] has set up a minimum target of reuse, recycling, and material recovery of the non-hazardous C&DW at 70% by weight until 2020. Up to date, this target
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