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# Use of recycled products in UK construction industry: An empirical investigation into critical impediments and strategies for improvement

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## ABSTRACT

Construction industry consumes about half of all material resources taken from nature, and generates a large portion of waste to landfill. A way of tackling negative environmental impacts impending from continuous material extraction and waste generation is the use of recycled materials for construction projects. However, the use of recycled materials is yet to become a commonplace in construction industry. This study evaluates the factors hampering the use of recycled products in UK construction industry as well as strategies that could be adopted to enhance its use in the industry. In order to identify the impediments and critical strategies, a two-fold methodical approach was used. An unstructured interview preceded a quantitative questionnaire survey which was used to elicit broader industry practitioners' opinion.

The study shows that designers rarely specify recycled products. This is due to lack of adequate information about quality and market availability of the products, negative perception from clients, and unexpectedly high cost of the products, despite its perceived low quality. The study suggests that a number of strategies could be adopted to promote the use of the products. These include allocation of points to the use of recycled products in sustainable design appraisal tools, governments legislative measures, improved collaboration between designers, contractors and materials suppliers, contractors involvement at earlier stage of design, improved education of the professionals about the products, and the use of tax break to influence the cost of the products. The findings of this study would therefore help policy makers, manufacturers and construction professionals to identify the factors hampering the use of recycled products for construction projects as well as the strategies that could be adopted in order to create market for the products.

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## 1. Introduction

All over the world, construction industry consumes up to 50% of all material resources taken from nature (Anink et al., 1996); and in developed nations, construction industry is the largest consumer of material resources (WRAP, 2009). Continuous extraction of these natural resources among other human's negative environmental activities have far reaching impacts not only on materials depletion (WRAP, 2009), it also affects environmental biodiversity, increases the tendencies of greenhouse effects and CO<sub>2</sub> emission

among other environmental hazards (Treolar et al., 2003; Shen and Tam, 2002).

Various studies confirmed that excavation, transportation and processing of the natural resources used in producing virgin construction materials and products consume highest portion of energy, next to operational energy, over the entire lifecycle of buildings (Utama et al., 2012; Sartori and Hestnes, 2007; Ramesh et al., 2010; Anink et al., 1996). Similarly, construction industry accounts for the largest portion of global waste and pollution (Faniran and Caban, 1998; Ibrahim et al., 2010), up to 30% of global waste (Begum et al., 2009). For instance, UK Construction and Demolition Waste (CDEW) amounts to about 110 million tonnes, which is over 60% of national waste generated (Paine and Dhir, 2010). Construction related waste is up to 40% in Brazil (Saraiva et al., 2012), 27% in Canada (Yeheyis et al., 2013), 44% in Australia (Shen and Tam, 2002), 25% in Hong Kong (Lu and Tam, 2013), and up to 29% in the US

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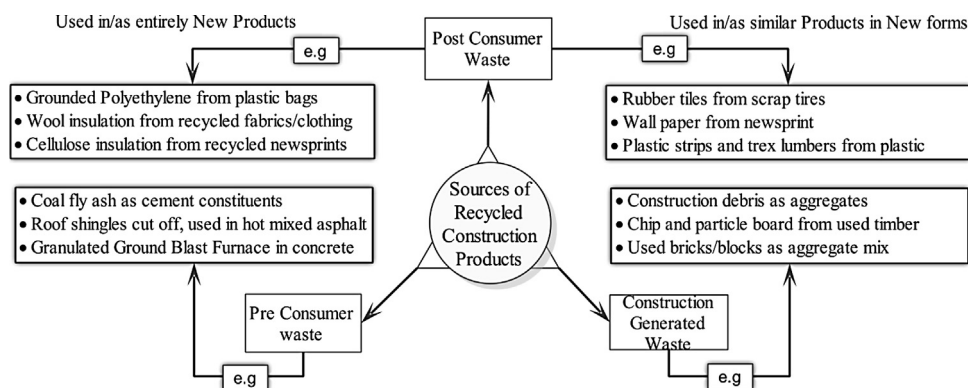


Fig. 1. Classification of recycled construction materials.

(Yu et al., 2013). These worrying figures did not only give more justification for EU government's target of 70% recycling of CDEW and 50% recycling of household waste in the year 2020 (Department for Environment, 2011; Saez et al., 2012), it also suggest that the need for the construction industry to reduce its consumption of virgin materials and waste to landfill is indispensable to the global sustainable development agenda.

As such, various governments across the world – especially in the developed nations – are continuously setting targets towards reducing the environmental impacts as a result of their construction activities. Among these means of reducing environmental impacts due to construction activities are various government led campaign, legislation and initiatives such as the use of BREEAM and Code for Sustainable Homes (CfSH) for sustainable building appraisal, Site Waste Management Plan (SWMP), Aggregate Levy, and the imposition of landfill tax to discourage waste to landfill, and to promote materials re-use and recycling.

One of the proven means through which waste have been diverted from landfill is through recycling of the waste products (Dunster, 2012). Construction industry does not only have the potential of using its own waste for further construction activities, several domestic waste and post-consumer materials have been used in the production of construction materials. Although, it is argued that recycling operations are not without environmental problems due to materials transportation and actual recycling processes (Saraiva et al., 2012), it still remains a preferable option to landfilling (Benjamin, 2010; Chong and Hermreck, 2011). Use of recycled materials helps in reducing the need for materials extraction which would have resulted into material depletion and other environmental problems (WRAP, 2009; Halliday, 2008).

Despite the environmental benefit that accrue to recycling of construction, post-consumer and industrial waste and its ultimate use in construction, studies show that recycled materials have been under-utilised in construction projects while its acceptance is still low within the construction industry (WRAP, 2010; Mansikkasalo et al., 2014). Although there is well established market for recycled concrete as a construction materials (Watts and Partners, 2008), Addis (2006) points out that less progress has been made regarding integration of other recycled products into large projects being undertaken by mainstream contractors, design engineers and architects. Similarly, it is clear that despite the availability of recycled products in construction market, its specification, adoption and market growth is relatively slow (WRAP, 2010; Chick and Micklethwaite, 2004).

Meanwhile, along with studies regarding importance and environmental benefits of waste recycling (Tiemstra, 2002; Chen et al., 2003; EEA, 2012), several studies have been carried out on minimization of waste to landfill (Oyedele et al., 2013; Tam et al., 2007; Corvellec and Hultman, 2012). Recent studies on recycling have

also focussed on the use of recycled aggregates in various construction activities (Cavalline and Weggel, 2013; Richardson et al., 2009; Nassar and Soroushian, 2012; Kanellopoulos et al., 2014). Concurrently, several other studies have focused on recycling behaviour among people of varying background (Ramayah and Rahbar, 2013; Bezzina and Dimech, 2011; Pike et al., 2003). Unfortunately, apart from those with limited theoretical knowledge on the subject area (e.g. Treolar et al., 2003; Chick and Micklethwaite, 2004), no research efforts has been made to determine the impediments to the use of recycled materials in construction projects.

Similarly, despite the low adoption of recycling product across construction projects, government have only set target for waste recycling, without any research efforts to evaluate the barriers to the use of recycled products as well as strategies for improving its use by construction professionals. This represents a gap in knowledge which this study is set to fill.

As such, this study is aimed at investigating the impediments to the use of recycled materials and products in construction projects, and strategies that could improve its wide adoption in construction industry. Therefore, the objectives of the study are to evaluate the perspectives of construction professionals (designers and contractors) on impediments to wide adoption of recycled materials in the industry, as well as strategies that could be adopted to improve the use of recycled products in construction projects. The study would help policy makers in providing the right platforms to enhance the use of recycled products in construction projects, thereby creating markets for the products, especially as policies continuously enhance waste recycling.

## 2. Recycled construction materials and its market

### 2.1. Recycled waste as construction materials

Waste from different origins (see Fig. 1) have become sources of various construction products. For instance, post-consumer waste generated from commercial, households, institution or industrial uses is recycled for use in construction. Examples of such materials include newsprint for cellulose insulation, wall paper, asphalt road surfacing and colour board; plastic bags for plastic strip usually added to soil embankments, grounded polyethylene, and as a constituent of Trex and plastic lumber (Bolden et al., 2013; Woolley et al., 1997; Graettinger et al., 2005). Other recycled products of post-consumer origin include wool insulation made from recycled fabrics, ceiling boards made from recycled plastics, carpet and carpet pad made from recycled post-consumer fabrics, rubber tiles made from scrap tires, and so on.

Industrial waste, otherwise known as pre-consumer materials refers to those materials that are diverted from waste stream during industrial manufacturing process (WRAP, 2009). More common in

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