***Reducing Waste to Landfill: A Need for Cultural Change in the UK Construction Industry.***


## Abstract

Owing to its contribution of largest portion of landfill wastes and consumption of about half of mineral resources excavated from nature, construction industry has been pressed to improve its sustainability. Despite an adoption of several waste management strategies, and introduction of various legislative measures, reducing waste generated by the industry remains challenging. In order to understand cultural factors contributing to waste intensiveness of the industry, as well as those preventing effectiveness of existing waste management strategies, this study examines cultural profile of construction industry. Drawing on four focus group discussions with industry experts, the study employs phenomenological approach to explore waste inducing cultural factors.

Combining findings from phenomenological research with extant literatures, the study suggests that in order to reduce waste intensiveness of the construction industry, five waste inducing cultural factors need to be changed. These include (i) "make-do" understanding that usually result in "make-do waste" (ii) non-collaborative culture, which results in reworks and other forms of wasteful activities (iii) blame culture, which encourages shifting of waste preventive responsibilities between designers and contractors, (iv) culture of waste behaviour, which encourages belief in waste inevitability, and (v) conservatism, which hinders diffusion of innovation across the industry. Changing these sets of cultural and behavioural activities is not only important for engendering waste management practices; they are requisite for effectiveness of existing strategies. Improvement in the identified areas is also required for overall improvement and general resource efficiency of the construction industry. Thus, this paper advocates cultural shift as a means of reducing waste landfilled by the construction industry, thereby enhancing sustainability and profitability of the industry.



***Keywords:*** *Construction waste; collaboration; make-do waste; waste behaviour; reworks; construction innovation; landfill; culture; innovation diffusion; procurement.*

## 1. Introduction

Construction industry contributes significant portion of the global economy and employs large population across the globe. It accounts for 13% of the global economy and contributes annual amount of $12trillion, which is projected to reach $15trillion in 2025, according to a year 2013 analysis by Global Construction Perspectives (GCP, 2013). As at the year 2008, the UK construction industry accounts for 8% of Gross Domestic Products (GDP), generates employment for over three million workers and contributes annual value of over £100billion (HM Government, 2008). However, the industry is highly fragmented as it seeks to meet demand of its customers within limited budget, resources and time-frame. As such, a typical project involves several numbers of drawings and different professional activities, whose successful coordination is important for completing the project within budget, expected time, and to the desired quality. Apart from the cultural profile of the industry, organisational culture within one business would not only have adverse effects on the others, it would also affect the collective outputs of the businesses (Hillebrant, 2000).

Meanwhile, apart from its consumption of more than half of mineral resources excavated from nature, construction industry contributes the largest portion of waste to landfill. For instance, the UK construction industry contributes about 44% of landfill waste, while the industry landfilled 44% waste in Australia, 29% in the US and 35% across the globe (Solís-Guzmán et al., 2009; DEFRA, 2013; Oyedele et al., 2014). It has often been stated that achievement of the global sustainability agenda and prevention of impending negative environmental impacts depends on how well the construction industry is able to reduce its $CO_2$ emission, virgin materials consumption and waste to landfill (Ajayi et al., 2015; Akinade et al., 2015). As a result of its environmental and financial benefits, several strategies for tackling construction waste have been developed. In addition to these, various fiscal and legislative provisions have been made to engender waste minimization practices within the construction industry.

Despite increasing waste management research, strategies and legislative provisions, landfilling of construction waste remains a common practice. While other industries have substantially reduced their waste to landfill, proportion of C&D waste landfilled remained alarming (DEFRA, 2013). According to Teo and Loosemore (2001), increasing waste intensiveness of the construction industry is not only as a result of ineffectiveness of the existing waste management strategies. Rather, waste intensiveness of the industry is enhanced by certain behavioural and cultural values that support construction waste generation (Teo and Loosemore, 2001). While it is clear that understanding such waste inducing

culture could engender solutions to construction waste mitigation, there is paucity of study that evaluates construction waste from cultural perspective hitherto. This represents a gap that this study seeks to fill. The overall aim of this study is to examine cultural profile of construction industry in order to enlighten waste inducing culture within the industry. The study fulfils its goals through the following objectives:

1. To determine behavioural and cultural factors that enhance construction waste generation.
2. To explore cultural factors that hinders effectiveness of existing waste management strategies.

In order to gain in-depth exploration of the concept as understood by the industry's expert, this study employs phenomenological approach as its methodological framework. As such, focus group discussions were used as a means of data collection. As a theoretical background to the study, the next section of the paper established relationship between organisational culture and its overall efficiency. This is followed by justification and description of the methodological approach to the study, which includes sampling, data collection and analytical procedures. The result of the findings are then presented and discussed before culminating the study with a conclusion and implications for practice. The study offers insights into the need for cultural change as a means of reducing waste landfilled by the construction industry.

## 2. Impacts of Culture on Organisations

Organisational culture is an important phenomenon that determines how members of that organisation relates with one another as well as the external community, in comparison with other organisations. It often encompasses common belief and share assumptions that guide appropriate response and actions for various occurrence (Ravasi and Schultz, 2006). It also determines disposition and belief of a group concerning a subject matter, and it distinguishes the members of one group from another (Hofstede, 1997). As it is usually taught or passed to new members through formal training or informal interaction, organisational culture shapes the way a group interact with one another, stakeholders, clients/customers and the general community (Sharifirad and Ataei, 2011).

Like other industries, construction industry is characterised by cultural differences across firm types, age and size (Oney-Yazici, et al., 2007). Understanding these cultural patterns could therefore assist in planning how to manage and improve the industry (Schein, 1992). With increasing awareness of the impacts of organisational culture on its success, substantial research efforts have been devoted to

empirical investigation of organisational culture across several industries and nations (cf. Cameron and Quinn, 1999; Oney-Yazici, et al., 2007). Evidence suggests that international construction firms often faced problems due to misunderstandings caused by cultural and behavioural differences across organisations (Oney-Yazici, et al., 2007).

Albeit paucity of studies linking construction industry's culture with its waste intensiveness, studies are rife on the relationship between culture and achievement of organisational goals and development. For instance, Naranjo-Valencia et al. (2011) investigate the relationship between organisational culture and openness to innovation. The study suggests that organisational culture does not only determine employees' readiness for innovation, it determines strategy and approach to innovation. Since culture affects employees' behaviour and their disposition to various aspects of their job, it also determines whether they would accept innovation as fundamental value of their organisation or not. Meanwhile, both direct and indirect relationship have been established between organisational culture and performance. According to Denison (1984), cultural factors related to organization of work and decision-making is strongly correlated with financial performance of a firm. This means that an organisation with the right culture of work organisation and decision-making process tends to out-perform its competitors in terms of financial turnover. On a similar note, Kotter and Heskett (1992) suggest that an organisation with adaptive values tends to have superior performance over a long period of time. Echoing similar position, Lee and Yu (2004) posit that in several cases, cultural elements that distinguish various organisations are related to performance.

Studies specifically addressing construction industry suggest that several cultural profiles, which varies with firm type, organizational size and age, exist within the industry. According to Oney-Yazici, et al. (2007), firms operating within architectural services and contracting cherished and emphasised culture of stability and team working much more than innovation and productivity. A study of construction waste also suggests that an underlying culture of waste inevitability within the industry is a major cause of waste intensiveness of the construction industry (Teo and Loosemore, 2001). By believing that waste is unavoidable, waste management is perceived as low priority, thereby receiving less attention and inadequate incentives. These further corroborate the fact that organisational culture within an industry is an important phenomenon that determines levels of importance attached to an activity.

While industry or organisational culture could be seen as indispensable norm within such industry, it could make or mar progress, sustainability and profitability of the industry (Cameron and Quinn,

1999). As such, it is important that organisations adequately evaluate their culture in a bid to determine their consequences on development. This is particularly important for the construction industry, which is large and complex, and covers a wide range of micro, small, medium sized and large business activities that are all united by their output (Hillebrant, 2000). In such case, organisational culture within one business would not only have effects on the others, it would also affect the collective outputs, which are usually buildings or other infrastructural facilities.

## 2.1. Culture within the construction industry

As a result of project-based nature of the construction industry, cultural profile of the industry is influenced by its transient working arrangement (Kanji and Wong, 1998). Unlike manufacturing industry whose culture is determined by company activities, culture within the construction industry is determined by the project (Riley and Clare-Brown, 2001). According to Dainty et al. (2007), cultural profile of the industry is not only influenced by its complexity and people intensive nature, it is also affected by its reliance on casualised employment. These make it difficult to have well-established organisational culture as could be found in manufacturing industry (Riley and Clare-Brown, 2001). This is further exacerbated by the lack of collaborative working environment over the project lifecycle, as designers and contractors usually work independent of one another, resulting in varying cultural approach within the industry.

Albeit the fragmented nature of the project based industry, literature suggests that certain cultural patterns do exist and influence activities of the construction industry. Coffey (2010) opined that despite the increasing outcry for cultural change within the construction industry, relatively little effort has been made to point out the culture that needs to be changed or improved. Rather, studies within the area has remained generally generic. As a result of its being characterised by wastage of materials, motion and human resources, most studies on organisational culture within the construction industry have been concentrated on the concept of “partnering”, team working and continuous professional development (Coffey, 2010). This is as a result of the notion that improving working environment and interdisciplinary collaboration is capable of improving construction project performance (Bresnen and Marshall, 2000). A report produced by “Rethinking Construction” in 1998 suggests that cultural and structural change, with respect to safe working condition and improved supervisory and management skills, are requisite to developing the construction industry.

Like other industries, literature have established relationship between culture and various activities and performance indicators of the construction industry. According to Dainty et al. (2007), its project-based structure, fragmentation and workforce hegemony enhance procurement system that hinders innovation. This is further buttressed by Blayse and Manley (2004) who posit that procurement systems and relationship between parties within the industry discourage innovation. Extensive use of casual and temporary staff does not only hinder workforce dedication to organisational improvement; its culture of temporary working arrangement affects relationship and communication within the industry (Emmit, 1999). Despite the understanding that trust is a key factor that enhance collaboration, evidence suggest that there is general lack of trust culture within the construction industry (Nifa and Ahmed, 2010). This point to the cause of risk shifting and non-collaborative culture within the industry (Bresnen and Marshall, 2000). Similarly, cultural change has been seen as means of engendering innovative solutions, diffusion of innovation, improved performance, rule of law, collaboration and lasting change within the construction industry (Coffey, 2010).

Apart from increasing importance of culture as a means of engendering overall performance improvement within the construction industry (Dainty et al., 2007), Teo and Loosemore (2001) suggest that increasing waste intensiveness of the industry is as a result of its culture of waste behaviour. This means that as cultural change is generally important for improving activities of the industry (Coffey, 2010; Dainty et al., 2007), it is particularly important for its waste mitigation. As such, in-depth exploration and understanding of waste inducing culture within the industry is requisite to reducing its waste intensiveness.

## 3. Methodology

This study is a part of an overall study seeking to develop holistic approach for minimizing waste generated by construction activities. It seeks to explore cultural factors that contribute to the waste intensiveness of the construction industry. In order to achieve this, phenomenological approach was employed in collecting data from industry practitioners. From epistemological point of view, the use of phenomenology enhance exploration of lived experience of research participants with respects to the concept under investigation (Creswell, 2013). This helps in exploring construction industry's culture that are capable of inducing waste generation or preventing effectiveness of existing waste management strategies. The approach assists in exploring new concepts, rather than limiting the research participants to ranking of predetermined factors that might not be exhaustive of waste

inducing culture within the industry. According to van Manen (1990), the tenet of phenomenology is based on the belief that a wrongly understood or widely neglected phenomenon could not be well understood until all presuppositions and researchers' understandings are bracketed out. A phenomenological research could be hermeneutics, which is based on lived experience of the researcher, or transcendental phenomenology that is based on common experience of the subjects of research (Creswell, 2013). Instead of researcher-centred hermeneutics phenomenology (Creswell, 2013), transcendental (psychological) phenomenology, which focuses on bracketing out researchers' experience (Moustakas, 1994) was adopted by the study. The wisdom behind the selection is to ensure that researchers' previous understanding is bracketed out of the study. The methodological approach therefore avail the opportunity of getting first-hand information from the industry practitioners, thereby preventing potential biasness of the researcher.

According to Creswell (2013), a phenomenological research could be carried out through in-depth interview with individual participants or interview with multiple participants (focus group discussions). In this study, focus group discussions have been preferred to interview as it allows the research participants to build on each other's opinion through intersubjective interaction (Kvale, 1996). For the purpose of this study, focus group discussion is held more relevant than interview where participants' responses are independent of one another. In order to get information-rich participants, purposive sampling was used for this study. This is in line with Merriam's (1998) position that purposive sampling is suitable in a situation whereby researchers seek to explore phenomenon. Selection criteria was therefore based on job position, interest in waste mitigation and years of experience within the construction industry, and the researchers' network of contact was used in reaching out to the participants. The snowball networking technique is a common practice in construction research as evident by Akintoye et al. (1998), Hodgson et al. (2011), Oyedele et al. (2013) and Ajayi et al. (2015). The purposely-sampled participants were then informed of the purpose of the study through an invitation letter.

Based on Polkinghorne's (1989) recommendation that between five and 25 participants are expected to participate in phenomenological research, a total of 24 participants were involved in the study. In order to get information that is generalizable to the wider construction industry, it was ensured that different professions within the construction industry are well represented. This involved architects, civil/structural engineers, construction project managers, site waste managers, materials suppliers and supply chain managers of small to large design and construction firms across the UK. Materials suppliers were particularly involved in the study as previous studies suggest that material procurement

process contributes to construction waste generation (Faniran and Caban, 1998; Dainty and Brooke, 2004; Saez et al., 2013). Selection of the materials suppliers was therefore based on their recommendation by construction experts, who vouch for the suppliers' support in waste management. As in this case, selecting members that are representative of a whole industry enhances logical generalization of a research finding to the industry (Creswell, 1998). In addition to two members of the research team, who moderated and documented the discussions, Table 1 shows the distribution of participants in the four focus group discussions used for the study.

*Table 1: Overview of the focus group discussions and the participants*

| *FG* | *Categories of the Participants* | *Total No of experts* | *Years of experience* |
|---|---|---|---|
| 1 | Architects and Design Managers<br>• 2 design architects<br>• 3 site architects<br>• 2 design managers | 7 | 7 – 18 |
| 2 | Materials Suppliers and Supply Chain Managers<br>• 4 materials suppliers<br>• 2 supply chain managers | 6 | 11 – 21 |
| 3 | Construction Project Managers | 6 | 10 – 19 |
| 4 | Civil and Structural Engineers<br>• 1 design engineer<br>• 4 site based engineers | 5 | 9 – 21 |
| | Total | 24 | |

As a ground rule for a phenomenology research, two broad questions are expected to be asked (Moustakas, 1994). These include the participants' experience of the concept under investigation, and the context and situation that have influenced the participants' experience. More specific to this study, the research participants were asked to evaluate cultural profile of the construction industry with respect to construction waste generation. They were also asked to explain the context that usually prevent or enhance the sets of identified waste inducing culture within the industry. These questions were aimed at determining the industry's culture contributing to its waste intensiveness. As part of a study seeking to explore the whole aspect of construction waste mitigation, each of the discussions lasted between 75 and 90 minutes and were all recorded with permission of the participants. The research methodological flow chart is shown in Figure 1.

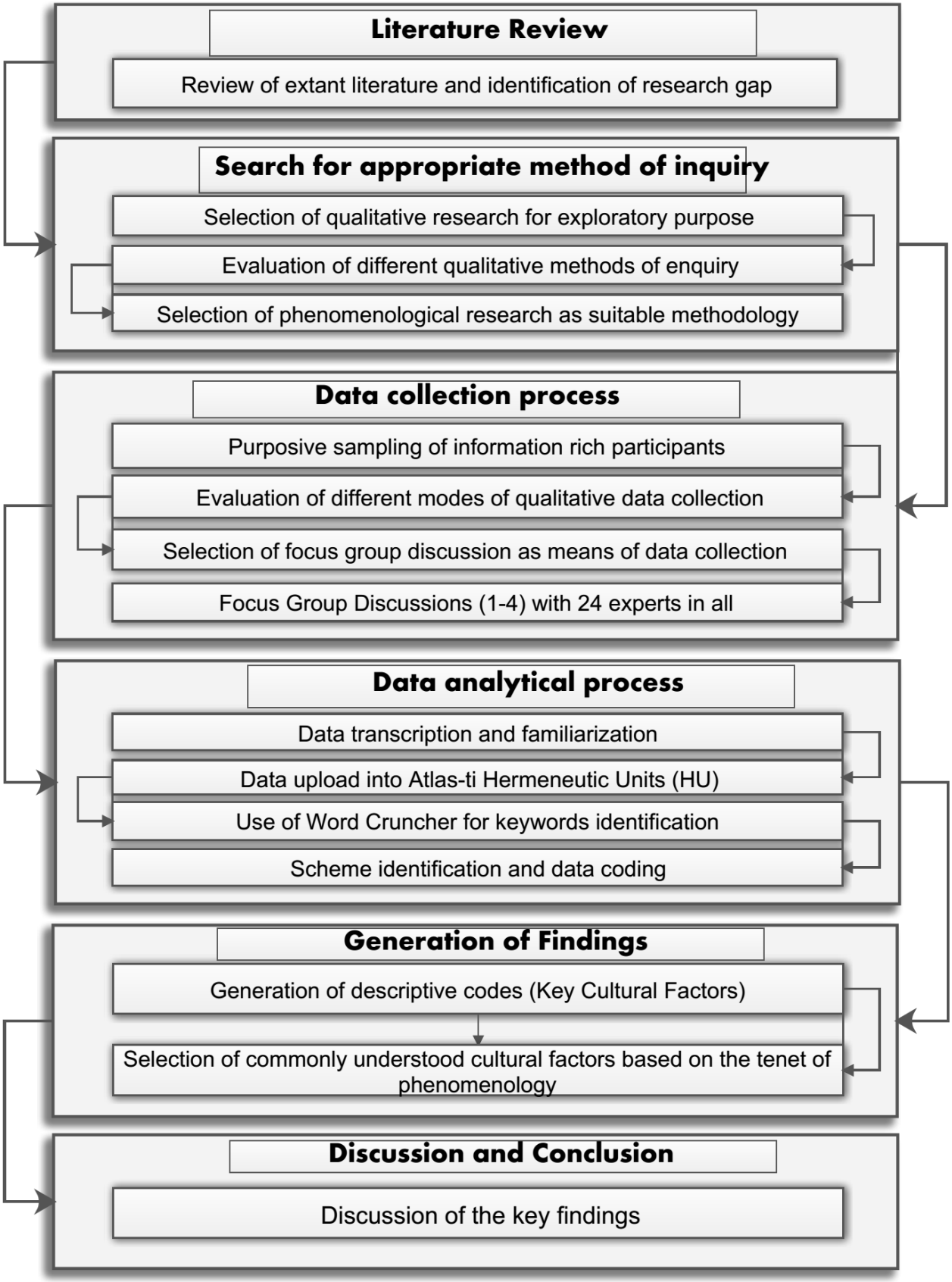


Figure 1: Research methodological flow chart

## 4. Analysis and Findings

Phenomenological data analysis usually follow a systematic process where analysis is done from narrow to broader unit of analysis (Creswell, 2013). In order to achieve this, the voice data was transcribed into a written script, which was read several times to identify significant themes that are commonly shared by the participants. This was achieved through a content driven thematic analysis that helped in exploring both implicit and explicit statements stemming from the data (Braun and Clarke, 2006). In this study, themes are identified as the cultural factors that are capable of increasing waste generated by construction activities.

### 4.1. Coding and Scheme Categorization

After reading through the transcribed script, there was a general overview of the common words used by the respondents. In addition to this, the data was input into Hermeneutic Units of an Atlas-ti qualitative data analytic tool to facilitate its analysis. Using "Word Cruncher" functionality of the tool, commonly used words were further identified. This helped in generating keywords that facilitate identification of cultural factors that are responsible for construction waste generation. As recommended by Braun and Clarke (2006), the analytical process followed a data driven thematic analysis procedure, which ensures that only meanings emanating from the data are considered.

In line with Gu and London (2010), coding system in the data analysis was facilitated through four categories of elements that were used in labelling the data. These include keywords, discussions, comments and cultural factors. Keywords refers to the commonly used words that assisted in identifying key statements from the transcribed data. The discussion was used in labelling the focus group discussion from which a comment was made. This helped in confirming the number of discussion from which a particular factor was established, as exemplified in table 3. Comments refer to the actual statement made by the focus group discussants during the encounter. Cultural factor are the descriptive codes that summarises the intention of the quotation in forms of the industry culture that are responsible for waste intensiveness of the construction industry. These sets of cultural factors are grounded in waste management literatures and general knowledge of construction management. The key cultural factors are then collated across the focus group discussions as shown in table 3.

To demonstrate the use of the coding scheme and categories, Table 2 shows example of coded segment. As an illustration, line 3, column 1 of the Table 2 shows the keyword (collaboration) that helped in extracting the comments in line 3 column 3 from the manuscript of Focus Group discussion 1. The

whole comment was summarised into line 3, column 4 (Non-collaborative culture and over-the-wall syndrome) as recommended by Saldana (2009).

*Table 2: Examples of coding data segment*

| *Keywords* | *Discussions* | *Comments (extracted from the data with the aid of keywords)* | *Cultural factors* |
|---|---|---|---|
| Incomplete document | FG2 | *It is a common practice to start construction with **incomplete document**. This has to change if at all we are going to reduce construction waste. This could not happen in manufacturing industry, and that is why they are much more efficient than we are.* | Make-do understanding |
| Collaboration | FG1 | *In most projects, architect do their design and pass it to engineers without adequate **collaboration**. The design is passed to contractor who is expected to create the drawing on scale 1:1 on the site. It means that if there is any problem with the design, it might not be detected until the mistake is made.* | Non-collaborative culture and over-the-wall syndrome. |
| Waste allowance | FG4 | *One of the deep-rooted culture of waste behaviour is the issue of **waste allowance**, which is usually like 10%. Why must we give such a big proportion to waste in the first place?* | Provision for waste allowance |
| Reduce waste | FG4 | *As a project team, if you use one technique that **reduces waste** in a project, you might not be able to use it in another project.* | Conservatism and difficulty in diffusing innovation |
| Incomplete | FG3 | *A major practice that usually result in waste is to start construction when design or contract documents are **incomplete*** | Make-do understanding |
| Blame | FG1 | *We seem to like litigation and shifting of **blame** as everyone like to outsmart the other* | Blame culture |
| Belief | FG3 | *Because the client paid for the wasted materials and the cost of managing its waste, there is a deep-rooted **belief** that waste is inevitable* | Culture of waste behaviour |
| Innovation | FG2 | *If you **innovate** a waste efficient technique in a project, it may not be possible to replicate it in another project. Our poor diffusion of **innovation** is contributing to our inability to control waste.* | Conservatism and difficulty in diffusing innovation |

In all, a total of seven waste inducing cultural factors emanated from the analytical processes. However, based on the philosophical position that a phenomenological research focuses on describing only what is commonly experienced and believed by the research participants – universal experience Creswell, 2013), only five of the seven themes were further explored and discussed. Two factors, "culture of formalised contract agreement" and "provision for waste allowance within the industry" were excluded from further consideration and discussion, as they do not emanate from all the focus group discussions. Table 3 itemised the waste inducing cultural factors and mapped them to the focus group discussions where they emanated.

*Table 3: Waste inducing cultural factors that emanated from phenomenological interaction*

| *Waste Inducing Cultural Factors* | *Focus Groups* | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 1. Make-do understanding that usually result in make-do waste | ✓ | ✓ | ✓ | ✓ |
| 2. Non-collaborative culture | ✓ | ✓ | ✓ | ✓ |
| 3. Culture of formalised contract agreement | | ✓ | ✓ | |
| 4. Blame culture, which encourages shifting of waste preventive roles between parties | ✓ | ✓ | ✓ | ✓ |
| 5. Culture of waste behaviour | ✓ | ✓ | ✓ | ✓ |
| 6. Conservatism and difficulty in diffusing innovation across the industry | ✓ | ✓ | ✓ | ✓ |
| 7. Provision for waste allowance within the industry | | | ✓ | ✓ |

As itemised in Table 3, the research participants mutually agreed on five of the seven culture enhancing waste generation within the construction industry. The research participants posit that in order to reduce waste intensiveness of the construction industry, the five cultural beliefs and features characterising the industry should be addressed.

## 5. Discussion

Based on the findings from focus group discussions, as enumerated above, this section focuses on the common experience of the research participants concerning waste inducing culture. With respects to the five mutually identified waste inducing culture, the discussion considers both essential and invariant structures that emanated from the data collection process. As earlier itemised, the industry's culture that enhances waste generation are discussed under five headings.

### 5.1. Make-do Understanding

Unlike manufacturing industry where manufacturing, assembly and disassembly processes are carried out with the aid of carefully and completely prepared design, construction activities often start with incomplete design information (Koskela, 2004). According to the focus group discussants, construction procurement routes often allow commencement of construction activities before completion of design documents. This means that those that should carry out the construction work lack adequate information or have wrong information to do the job, thereby resulting in waste due to reworks (Alarcon and Mardones, 1998). A respondent stressed that:

> *"A major practice that usually result in waste is to start construction when design or contract documents are incomplete….in most cases, there might be constructability issues that are supposed to be resolved….as the construction progresses, some errors are identified…and there would be need for reworks, which will definitely result into waste".*

> *"It is a common practice to start construction with incomplete document. This has to change if at all we are going to reduce construction waste…because it usually lead to reworks, waste, cost over-run and even delays".*

This echoed findings by Dainty and Brooke (2004), which suggests that most error at construction stage is usually due to incomplete design document or contractors' poor knowledge of the design and its documentation. The kind of waste generated as a result of such process is what Koskela (2004) referred to as make-do waste. As such, the overall process and provisions that allows construction activities with incomplete documentation is termed make-do understanding. This occurs as a result of construction activities that is commenced while design, construction documents and specifications are yet to be completed or when there are unresolved design issues. Apart from being a potential cause of reworks and subsequent waste generation, incomplete design and contract documents at the time of construction or contract award increase the risks of cost and time over-run in construction projects.

In order to prevent waste generation, cost over-run and project delays that could be caused by the make-do understanding, the focus group participants recommended a more collaborative project delivery process. It was stressed that:

*"Instead of working with incomplete document, involvement of contractors during the design and involvement of designers during construction could solve the problem….I think we need to adopt procurement routes that enhance collaboration".*

This could be achieved through early involvement of contractors during the design process, use of Integrated Project Delivery (IPD) and collaborative BIM environment. Owing to involvement of all major stakeholders in the design process (Isikdag and Underwood, 2010), the use of IPD as a procurement route is capable of preventing errors that could be due to information delay and make-do understanding.

### 5.2. Non-collaborative Culture and Over-the-wall Syndrome

Inadequate collaboration between designers, procurement team and contractors is a key feature that compromises profitability and effectiveness of the construction industry (Hughes et al., 2012). Traditionally, a client commissions the design team, which will subsequently involve engineers and building service consultants. As a result of fragmented nature of the industry, the drawings are passed from one trade to another, without necessarily working collaboratively. The design documents are then passed to the contractor who undertakes the actual work onsite. This results in what is regarded as over-the-wall syndrome, which is a difficulty that arise when different professionals are working independent of one another towards the same goal. It therefore results in late detection of errors and the need for reworks that subsequently result in construction waste generation.

The focus group participants opined that:

*"In most projects, architect do their design and pass it to engineers without adequate collaboration. The design is passed to contractor who is expected to create the drawing on scale 1:1 on the site. It means that if there is any problem with the design, it might not be detected until the mistake is made. In that case, there is no alternative to reworks and waste generation".*

*"In manufacturing industry, the designer and people in production unit work collaboratively…but in construction, the case is different. That is why manufacturing industry produces lesser waste than the construction industry".*

It has often been evident that the major causes of construction waste are ineffective project communication and coordination, inconsistent procurement documentation, unclear allocation of

responsibilities (Osmani, 2012), document delay, and non-involvement of contractors in design decisions (Arain et al., 2004). All these occur as a result of poor collaboration among the project team.

In a bid to reduce construction waste due to rework, the focus group discussants suggest that there is need for increasing collaboration throughout project lifecycle stages – design to completion.

> *"I think the industry is about to get it right…currently, there are procurement routes that requires more collaboration between all parties involved. It is expected that designers are involved in construction process and contractors could contribute to design process".*

> *"If we improve collaboration among all the stakeholders, as it is being driven by BIM and IPD for example, all activities that usually lead to waste would be resolved before actual construction start".*

This requires an environment for effective communication, information sharing, early warning system and early contribution of expertise by all parties (Hughes et al., 2012). As such, every ambiguity and inaccuracies would have been resolved before design completion, thereby preventing construction errors, reworks and waste. Similarly, collaborative working between the designers and contractors would assist in addressing constructability of the design, which could otherwise result in error and waste.

### 5.3. Blame Culture

Construction industry is known for its inadequate interdisciplinary communication. Although the designers do the design, they do not necessarily think about construction methodology and they are not prepared to take responsibility for problems regarding buildability or errors in design. On the other hand, cost saving achieved through innovative design is not necessarily shared with the designers in the same way as they do not share in problems emanating from buildability of their design. Rather, the whole process is interested in passing blame to another party (Fewings, 2013). It was raised that:

> *"If we are to overcome the issues of waste in construction…., as wished by the government anyway…., we need to adopt no blame culture and work more collaboratively. Designers do not believe that waste management is part of their job…and contractors believe that designers are expected to take precautionary measures. This is not even limited to waste management…we seem to like litigation and shifting of blame*

*as everyone like to outsmart the other….There is need for both risk and profit sharing among stakeholders in the industry"*

This shifting of blame is one of the major factor contributing to ineffectiveness of construction waste management strategies. While the contractors believe that designers contribute to waste generation, designers posit that their activities have nothing to do with waste (Osmani et al., 2008). This hinders likelihood of collaborative waste management effort among all parties involved in project delivery processes. With the industry being characterised by blame culture as in this case, collaborative working environment could not be more important.

## 5.4. Culture of Waste Behaviour

This study found that a deep-rooted wasteful culture exists within the construction industry. The focus group discussants argued that it is a widely held belief within the industry that since the client paid for waste management, it is better to generate waste than allowing waste management to delay further construction activities. An expert stressed that:

*"Because the client paid for the wasted materials and the cost of managing its waste, there is a deep-rooted belief that waste is inevitable…..Instead of preventing the waste, some of us prefer to focus more on delivery period because they believe that waste could not be totally prevented….such belief prevents implementation of strategies that are capable of reducing waste".*

The belief in waste inevitability is evident in the concept of waste allowance, which is the potential proportion of waste that is added to the required quantity of materials. According to Buchan et al. (1991), this allowance is usually in the range of 2.5 to 10% of the quantity of materials. It is usually believed that a certain proportion of waste is inevitable in construction due to current working practices.

In line with this study, Teo and Loosemore (2001) illuminated the prevailing culture of waste inevitability that characterised the construction industry. The study stressed that construction operatives usually believe that since waste is inevitable, there is no need for excessive preventive efforts. In addition, since the cost of wasted materials and the cost of landfilling the waste is already paid by the client, little effort is usually made by the site management. The same opinion was echoed by Ikau et al. (2013) and Osmani et al. (2008) who reiterated that a major reason for seemingly insurmountable waste intensiveness of the construction industry is that workers believe that waste is

inevitable thereby giving less attention to waste management. Waste management effort is rather driven by environmental policies and various fiscal measures that are usually put in place by the government (Al-Hajj and Hamani, 2011). In order to drive the necessary cultural change in the industry, there is need for more dedication on the part of workers, clearly defined and communicated waste management approach and top management's commitment to waste management (Teo and Loosemore, 2001).

### 5.5. Conservatism and Difficulty in Diffusing Innovation across the Industry

The study suggests that project-based nature of the construction industry and its temporary working relationship makes it difficult to get innovation across to the industry. Although, it is usually claimed that little innovation occurs within the construction industry (Blayse and Manley, 2004), it is clear that innovation occurs within projects but there are problems with institutional learning required to capture them for future projects (Tatum, 1989; Fairclough, 2002). This is further exacerbated by the industry's focus on individual project concerning financial control and decentralised decision-making (Dubois and Gadde, 2002). In addition, temporary work relationship among parties hinders further exploration or repetition of innovative approach in other projects (Fairclough, 2002). It is better captured by the respondents who opined that:

> *"Lots of innovation occur within the construction industry….the only problem is that if you agree to adopt an innovative technique in one project, you are dealing with another set of people in another project. They cannot think the way you think…they might have never experienced the method you are suggesting…what do you do?.....you will have to go back to the common understanding…..I'm afraid, that could be the end of your innovation".*

> "*As a project team, if you use one technique that reduces waste in a project, you might not be able to use it in another project…If waste management is an issue within a team, you can work with another team that are less worried about waste".*

The short-term perspective of the industry does not only hamper its use of innovative techniques, it prevents overall technical development and general efficiency of the industry (Dubois and Gadde, 2000). This was similarly echoed by Dainty et al. (2007) who opined that the major hindrance to operational efficiency of the industry is its culture of project-based working relationship that ends with projects. In such case, innovative technique used in one project as well as lesson learnt as a team would

be difficult to replicate while working with another team, as lesson learnt are different across teams and project.

Notwithstanding frequent criticism of the construction industry and its alleged technological stagnation, the industry produces several examples of successful innovation (Tatum, 1989). However, the procurement system within the industry discourages adoption of non-traditional technique, product and processes (Blayse and Manley, 2004). Where a new technique is proposed in the industry, it is usually judged based on initial cost of implementing such technique (Kumaraswamy and Dulaimi, 2001). In such case, environmental benefits, long-term profits and overall organisational efficiency become insignificant. This generally hinders diffusion of innovation across the industry and particularly affects the use innovative approach for construction waste management. For instance, despite the evidence that the use of modern methods of construction, such as offsite technologies, improves construction waste efficiency (Tam et al., 2005; Jaillon et al., 2009; Lu and Yuan, 2013), there has been a general slow rate of its adoption. This scepticism has been due to its perceived higher cost, delayed planning process and its complex interface, which requires effective collaboration among the team (Pan et al., 2007).

Within the construction industry, every construction project is different, every project team is unique and every singular site is a distinct prototype. Like other innovations, waste management innovations are undertaken on one-off basis and overall impacts of such technique might be difficult to benchmark against other projects. Adoption of such techniques in other projects is difficult, as collaboration and continuous stream of changes are required for driving innovative ideas and technologies (Tatum, 1989). This is unlike the manufacturing industry, where innovation is usually adopted at organisational level. As the difficulty in diffusing innovation prevents innovative and collaborative waste management efforts, more collaborative working environment and openness to innovation is requisite to reducing waste generated by construction activities.

## 6. Conclusion

Construction industry has remained a major target for achieving global sustainability, as it consumes about half of mineral resources, and contributes largest portion of landfill wastes. Despite an adoption of several waste management strategies and introduction of various legislative measures, reducing waste generated by the industry remains challenging. This suggests that there are underlying culture

that enhance waste intensiveness of the industry. Using phenomenological approach, this study examines cultural profile of construction industry in order to understand cultural factors contributing to waste generation, as well as those preventing effectiveness of existing waste management strategies.

The study suggests that a non-collaborative culture within the industry is a major factor contributing to waste intensiveness of the industry. This is usually as a result of over-the-wall syndrome, which is a difficulty that arise when design and construction professionals lack collaboration, resulting in late detection of errors and the need for reworks that subsequently result in construction waste generation. Similarly, the culture of "make-do" that allows commencement of construction activities with incomplete design document is another organisational culture that contribute to waste intensiveness of the industry. To effectively mitigate construction waste, it is not only required that design and contract documents are completed before the construction process, early involvement of contractors during design stage is expected of the industry. By involving all parties in design and construction decision in more collaborative system, the blame culture that enhances shifting of waste mitigation responsibility would be prevented. Albeit poor collaboration across projects, interdisciplinary relationships, communication and information sharing usually end with projects. Extension of collaboration beyond project level is requisite to diffusing innovative waste efficient techniques, among other innovations, across the industry. In addition, this study suggests that a major factor contributing to waste generation in the industry is the belief of waste inevitability. It prevents implementation of effective waste management strategies and encourages waste causative activities such as lack of management support of waste management efforts, excess waste allowance and over ordering of materials, among others.

This study implies that apart from change in the way waste is managed within the industry, there is need for improved collaboration within the industry. The study evident that the blame culture, make-do understanding and poor diffusion of innovation are as a result of non-collaborative culture within the industry. By shifting from the traditional procurement route to a more collaborative system, such as Integrated Project Delivery (IPD), more interdisciplinary relationship and communication would be enhanced in the industry. This requires early involvement of key stakeholders, use of BIM, free sharing of project information, risks and rewards sharing, among others. Rather than shifting blame and risk, performance based rewards and penalties would enhance waste effectiveness, productivity and overall profitability of the industry. By encouraging long-life and more permanent team collaboration across projects, lesson learnt from one project would improve outcome of subsequent projects. In addition, there is tendency of exploring more waste efficient techniques with familiar team members.

Although, seven waste inducing cultural factors have been pinpointed by the research participants, five of the identified cultural patterns have been further explored by the study, as they are those that emanated from all the participants. This was based on phenomenological position that a phenomenon is deemed to be important if it is a lived experience of all the participants. Further studies could therefore explore the impacts of formalised contract agreement and provision for waste allowance on waste generation. As a result of paucity of study examining impacts of industry's culture on construction waste, this study has been limited to exploration of factor through qualitative approach. Other studies employing quantitative approach could determine generalizability of the findings of this study by using larger sample. This would assist in studying at length rather than depth that is investigated in this study. In addition, as this study has been carried out within the UK context, transferability of its findings to other regions could also be investigated. As the industry's culture varies across nations, impacts of culture in construction waste generation could be investigated within other culturally different nations, particularly in non-western culture. With organisational culture recognised as a key driver of work ethics and relationship, it is important that cultural profile of the construction industry is investigated for its impacts on time and cost over-run, which are rife in the industry.

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## 8. References


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