TOWARDS A FRAMEWORK FOR THE MANAGEMENT OF HEALTH, SAFETY AND WELL-BEING ON ADAPTIVE-RETROFIT PROJECTS IN GHANA

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Adaptive-Retrofit Projects (ARPs) face the challenge of wide-adoption due to health and safety (H&S) issues surrounding ARPs. In developing countries like Ghana, this challenge exists alongside other challenges such as outdated and inadequate H&S legislation which do not provide adequate guidance for the safe execution of new builds let alone ARPs. As ARPs are mostly executed in confined areas, are characterized by: uncertain structural integrity of the buildings or structures concerned; hazardous and toxic substances (which are difficult to observe and evaluate); and highly labour intensive activities, the health, safety and wellbeing of workers on ARPs generally tend to be more difficult to manage. In the context of the Ghanaian construction industry, safe management of ARPs is even more serious given the numerous problems and challenges the industry faces. As ARPs become common in Ghana, fatal and non-fatal accidents are likely to occur and even escalate further. Therefore, providing some guidance to help manage the H&S issues regarding ARPs will help to protect workers from accidents/injuries and thereby also encourage wider adaption of older buildings in Ghana. To this end, this study through a review of H&S literature makes the case for research to be undertaken to develop guidance framework for managing H&S on ARPs in Ghana. The study also proposes the Delphi method as being a suitable method of inquiry to be used in undertaking the research. It is envisaged that embarking on this research would help bridge the gap of the dearth of literature on H&S management on ARPs especially in the context of developing countries.

Keywords: adaptive, health & safety retrofit.

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INTRODUCTION

The issue of wide adoption of ARPs, under various themes such as economic, social and environmental viabilities, has been championed by many researchers such as Gallant and Blickle (2005), Bullen (2007), Langston et al. (2008), Adeyeye et al. (2010), Bullen and Love (2010), and Bullen and Love (2011) . Notably, one problem confronting wider adoption of ARPs has been the issue of health and safety (H&S). As part of achieving a wider aim of developing health and safety (H&S) guidance for safe execution of ARPs, this paper presents an overview of the research work. It starts with the research background which underscores the need for in-depth study into H&S on ARPs in the Ghanaian context. It then proceeds to argue for the need for a guidance framework to help manage health and safety on ARPs. This is followed by the key objectives of the study and the proposed research method.

RESEARCH BACKGROUND

ARPs is an area within the construction industry with a potentially viable benefit of increasing the functional life, quality and aesthetics of existing buildings, and reduction of pollution, carbon emissions, material use and cost (Balaras et al. 2007; Bullen 2007; Langston, Francis K W Wong, et al. 2008; Ravetz 2008; Bullen & Love 2011; Ma et al. 2012; Roper & Pope 2014). Regardless of these benefits, ARPs face the problem of wide adoption because of health and safety issues surrounding it (Bullen & Love 2010; Bullen & Love 2011).

Typically, ARPs involve old existing buildings being subjected to a range of activities including: partial demolishing and rebuilding; installation of new internal systems to replace outdated ones; introduction of new components, element or services which were not originally part of the existing old building; and extensions of parts or improvement of parts of existing buildings. Adeyeye et al. (2010), and Bullen & Love (2011a) classified those ranges of activities and called them the aggregation of refurbishment, renovation, rehabilitation and repairs and maintenance work (4R+M) being applied to old existing buildings to assume different functions other than their original use. Thus, Adeyeye et al (2010) and Bullen and Loves' (2011a) classification seems to suggest that refurbishment, renovation, rehabilitation and repairs and maintenance works are the key activities of ARPs.

Anumba et al. (2004) mentioned that, refurbishment works alone in the UK construction industry accounts for about 40.6% of the total number of construction fatalities. This huge percentage of fatalities has been linked to the fact that, the hazards during refurbishment are more uncertain and hence difficult to observe and evaluate (cf. Egbu, 1999; Anumba et al., 2006). Like refurbishment work, repairs and maintenance share similar attributes and are also hazardous operations responsible for 43% of construction accidents in the UK (Anumba et al., 2004). Indeed, as indicated by Hon et al. (2010), the accident ratio of 4R+M to the construction of new buildings (NB) has significantly increased from 17.9% in 1998 to 50.1% in 2007 in Hong Kong. Comparatively, fatal cases from 4R+M works in 2010 increased to 66.7%, while non-fatalities accounted for 44.7% in 2011 (Hon et al., 2014). The compelling factors accounting for these huge fatalities could be linked to the numerous constraints faced by ARPs. These include insufficient structural safety data, uncertain condition of

equipments, unknown accumulated gases, and limited time required to convert old existing buildings to another use, and limited competing space within the old buildings during the activities of structural changes and the replacement or the changing of outmoded equipment (Sanvidoet et al 1991; Bullen, 2007; Adeyeye et al, 2010). Due to the large construction fatalities and numerous constrains associated with ARPs, ARPs are clearly more dangerous than new builds and this is partly responsible for the reluctance by some construction professionals, clients and constructors to fully embrace ARPs (Anumba et al 2004; Bullen and Love, 2010&11; Adeyeye et al, 2010; Zhenjun et al, 2012; Ray, 2014).

It is very significant to note the ARPs suffer from a dearth of literature on occupational health and safety (OH&S). In the main, the extant literature appear to only caution and highlight the significance of H&S on ARPs without providing much detailed analysis of key issues and guidelines on H&S for safe execution of ARPs. For example, Xu et al (2012) through fuzzy theory identified eight key performance indicators (including a health and safety indicator) that require consideration when adapting old hotel buildings in China. The performance indicator, comprising of the safety of the structure, construction workers and the occupants, was seen as a major key indicator. In order of importance, the H&S indicator ranked third ahead of other indicators such as energy consumption, resources saving, and stakeholders' satisfaction. A study into barriers to ARPs by Bullen and Love (2011) indicate that, the inherent structural risk and uncertainty are the key elements preventing the adaption of existing old buildings in Australia. Langston et al (2008) in their study on ARPs in Hong Kong investigated how adapted old buildings could comply with current H&S standards and legislations since ARPs sometimes involve heavy structural changes. Langston et al (2008) cautioned the importance of undertaking structural survey and construction quality checks during adaptive-retrofitting of old buildings to ensure the safety of workers, materials and plants on sites. Meanwhile, Hon et al. (2014) has also cautioned the urgent need of practitioners to develop an appropriate safety rules and clear practices for ARPs works to enhance safety performance of ARPs in Hong Kong. From the findings of these researchers, a conclusion can conveniently be drawn that health and safety is vital in ARPs.

Although comprehensive H&S measures exist for safe management of new work/construction, the H&S literature shows that these measures alone are not sufficient enough to safely manage ARPs. For example, Quah, (1988), asked 46 refurbishment contractors to compare the level of risk involved in executing refurbishment projects to new building projects. Quah, (1988) reported that 42 (91.3%) out of the 46 refurbishment contractors, were of the view that works involving refurbishment are of greater risk than new build projects. Following this, Egbu (1999) concludes that, special H&S knowledge and skills are required by refurbishment managers in other to undertake refurbishment work. Special H&S knowledge and skills are important to all managers of refurbishment works because, as noted by Egbu (1999), refurbishment works are dangerous and most often than not, involves demolition work and disposal of hazardous substances such as asbestos and lead which, certainly, are not found in new builds. Recent studies on the H&S impact of construction project features (cf. Manu, 2012; 2014) also provides insight of how demolition, refurbishment and new work potentially influence accident occurrence on construction sites. Manu et al., (2014) report demolition and refurbishment as having a higher potential to cause harm to workers. In terms of the likelihood of occurrence of

harm (i.e. the risk of harm), Manu (2012) also reported that demolition and refurbishment are associated with a higher risk than new builds/works. Given that H&S control measures are supposed to be proportionate to the extent of risks (HSE, 2000; 2007), it is then clear that the H&S control measures that are needed for ARPs cannot simply be exactly the same as the controls used on new works. Rather the controls that are used on ARPs should reflect the kinds of H&S risks/issues that workers are likely to be exposed to and thus ARPs will need some extra H&S guidance to deal with H&S issues.

In Ghana, just like many other countries , a significant number of old buildings exist waiting to be upgraded to assume different functions from their original use and to reduce energy use, pollution, carbon emissions, material use and cost (Farvacque-Vitkovic et al, 2008; Dauda, 2011). ARPs in Ghana is much more seen as inclusion of new buildings or parts of buildings to existing old buildings and the addition of components, elements and new systems to the existing old buildings which were originally not part of the design (Dauda, 2011). However, due to the numerous problems faced by the industry such as poor worksite safety management, the use of labour intensive construction methods, and inadequately trained workforce coupled with the inadequate and outdated health and safety legislation, the industry lacks specific guidance (Oppong & Masahudu, 2014) for the safe management of ARPs.

In Ghana, statistical data on construction injuries (fatal and non-fatal) on ARPs barely exist. However, the reported construction injuries for new buildings/works (NB) are becoming alarming year on year. For example, it is on record that NB recorded 902 accident cases comprising 56 fatalities in 2000 and 846 non-fatal accidents (Laryea et al. 2010, Danso, 2005). According to Danso et al. (2010, 2011, 2012), Kumasi (the regional capital of Ashanti Region, Ghana) alone recorded 160 construction fatalities from 1998 to 2008 (see Figure 1). Judging from this, it is thus not surprising that there is the view that the application of 4R+M to existing old buildings in Ghana is likely to further worsen injury statistics unless adequate safety guidelines are provided. This is an urgent concern as ARPs are likely to become more common in Ghana due to the need for more construction activity in the country in order for it to bridge its longstanding infrastructure and housing deficits (Ahadzie et al., 2004; Bank of Ghana, 2007).

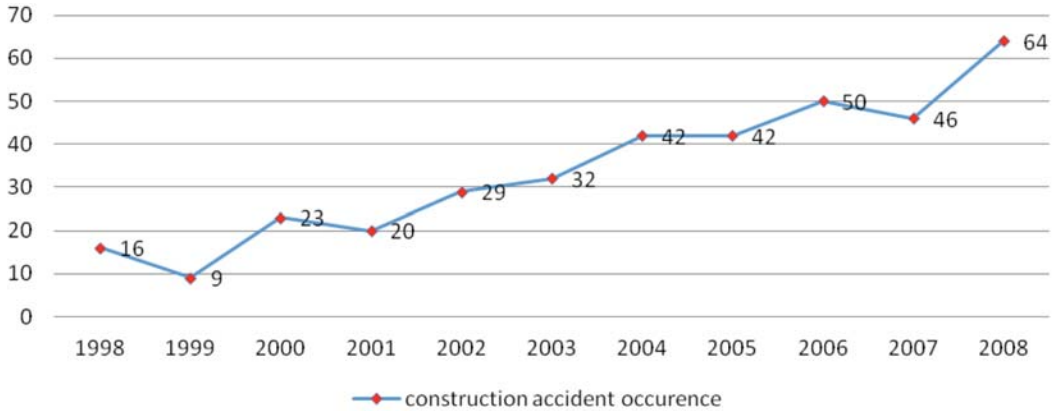

Figure 1: Number of Fatal Injuries in Kumasi (Danso, 2010)

TOWARDS A H&S MANAGEMENT FRAMEWORK FOR ARPS IN GHANA

In Ghana, a large number of old existing buildings are waiting to be upgraded to assume new functions or improve their existing functions. Unlike new builds, where safety guidelines and measures abound in literature, the same can generally not be said for ARPs (Hon et al. 2014; Bullen & Love 2010). This presents serious occupational H&S challenges for the industry as the industry is even struggling to keep up with H&S on new builds. As presented above, the different kinds and levels of H&S issues/risks that are associated with ARPs do not simply enable ARPs to use exactly the same H&S measures that are used on NB (Oloke, 2012; Adeyeye et al., 2010; Bullen & Love, 2010). There is thus the need for customisation or development of safety measures for ARPs to complement the existing measures that are used for NB.

Within the intense need for safe execution of ARPs, Hon et al. (2014) campaign for the development of measures or tools to enable safe management of ARPs. Such measures or tools, rather than being simply copied or transposed from practices in developed countries to the Ghanaian context, they have to be carefully developed or adapted in a joined-up way through research, such that they map unto the project life cycle to provide a coherent and a unified framework that offers guidance for dealing with the H&S issues associated with ARPs. Direct copying or transposing measures or tools from developed contexts will not be the way to go as there are some differences, for instance in the level of technological development between these contexts. As an example, whereas construction operations are highly mechanised in the developed contexts, in developing countries such as Ghana, construction operations are highly labour intensive and hence the degree of exposure of labour to H&S hazards (which are more common on ARPs) is far greater.

Central to developing a H&S management framework for ARPs in Ghana is firstly the identification and categorization of the relevant H&S issues or factors that come into play. Subsequently, the establishment of the relative importance of these issues or factors and the identification of adequate mitigation steps to be undertaken by relevant project parties at various phases of a project is also important. Collectively, these represent the cardinal points to be addressed by this research work. The key questions that need answering are thus:

What are the typical health and safety issues or factors relating to ARPs in Ghana?

What is the relative importance of these issues in terms of the extent of their potential impact on the H&S of workers on ARPs?

How can these issues be resolved throughout the lifecycle phases of ARPs?

To answer the above questions, the following objectives are to be pursued by this research:

- identify, categorize and present health , safety and wellbeing issues or factors that affects workers on ARPs;
- identify potential control or mitigation measures for those factors or issues that influence the safety, health and wellbeing of ARPs workers;

- implement a suitable method for investigating the H&S issues that are relevant to Ghanaian context, their extent of impact and their relevant mitigation measures;
- integrate the findings from the above investigation into a H&S management framework for ARPs in Ghana; and
- evaluate the usefulness of the framework from the perspective of industry practitioners

OUTLINE OF PROPOSED RESEARCH METHOD

To meet the set objectives of this research, two research tasks are planned. The first is to review literature and the second is to apply a Delphi technique. This is diagrammatically presented in Figure 2. The research will begin by reviewing literature (see Figure 2) from academic journals, research reports, theses, etc. with the prime focus of:

- identifying and compiling a comprehensive list of H&S factor/issues that come into play on ARPs;
- identifying and compiling a comprehensive list of control/mitigation measures that correspond to the identified H&S factors/ issues; and
- Mapping the list of factor/issues and their corresponding control/mitigation measures onto the phases of project life cycle with an indication of the various project parties who are/should be concerned with addressing those H&S factor/issues.

The literature review will thus address objectives 1 and 2 of this research work. The third (3) objective will be achieved through the application of a Delphi method. The Delphi method is an iterative process used to collect and distill the judgments of experts using a series of questionnaires interspersed with feedback (Skulmoski et al., 2007). The method can also be used when there is incomplete knowledge about a problem that does not lend itself to precise analytical techniques but rather could benefit from the subjective judgments of individuals who have a wealth of expertise/knowledge about the problem area (Adler and Ziglio, 1996; Delbeq et al., 1975). As ARPs are relatively less common in Ghana compared to NB, fewer construction professionals are expected to have expertise or knowledge about their execution and hence the H&S issues involved. ARP execution in Ghana is thus expected to be characterized by limited knowledge and expertise amongst professionals. In view of this, it is prudent to use a Delphi method as this method enables the use of the collective judgment of experts in investigating such phenomena or problems (that are characterized by limited insight) and coming up with workable solutions (see Adler and Ziglio, 1996; Delbeq et al., 1975). The application of Delphi method in construction management research and more specifically H&S studies is not uncommon (see Chan et al. 2001; Yeung et al., 2007; Hallowell, 2009; Hallowell and Gambatese, 2010). This also reinforces the suitability of the Delphi method for this research.

In applying the Delphi method, a team of construction professional who have expertise regarding execution of ARPs in Ghana will be assembled to participate in two or more rounds of Delphi surveys. This is to obtain the opinion of these experts

towards the development of the framework for the management of health, safety and well-being of workers on ARPs in Ghana. The experts will ascertain the relevance of the H&S factors/issues and their mitigation measures (which will be identified from the literature review) to the Ghanaian context. Beyond that they will also contribute to the research process by identifying H&S factors/issues and mitigation measures which may not be apparent in the extant literature but are applicable to the Ghanaian context.

The Delphi method is thus to be applied in 2 main facets. In the first facet, the experts' judgement will be collected and distilled by the use of questionnaire interspersed with feedback to reach a reliable consensus of opinion on:

- The relevance/applicability of the identified H&S issues/factors to ARPs in the Ghanaian context; and
- The relative importance of the H&S factors/issues in terms of the extent of their H&S impact on workers.

In the second facet, experts will be required to judge the relevance/applicability of the mitigation/control measures identified from the literature to ARPs in Ghana. In both facets 1 and 2, the iterative nature of Delphi technique permits the generation of new information for re-examination and modification of judgments. By this, each expert is encouraged to review the anonymous judgments of the other experts and reconsider the previous response. The purpose during this process is to reduce the level of inconsistencies of responses to attain group consensus of opinion. The process will stop after the most reliable consensus of opinion is met and a statistical aggregation of the responses in the final round will determine the final results (Delbecq and Gustafson 1975; and Skulmoski et al., 2007; Hallowell & Gambatese, 2010).

To achieve the fourth objective, the filtered results of H&S factors/issues and mitigation measures for ARPs in Ghana will then be amalgamated into a framework for the management of the health, safety and wellbeing of workers on ARPs in Ghana. The framework will then be presented to practitioners to obtain an evaluation of its practical usefulness/relevance.

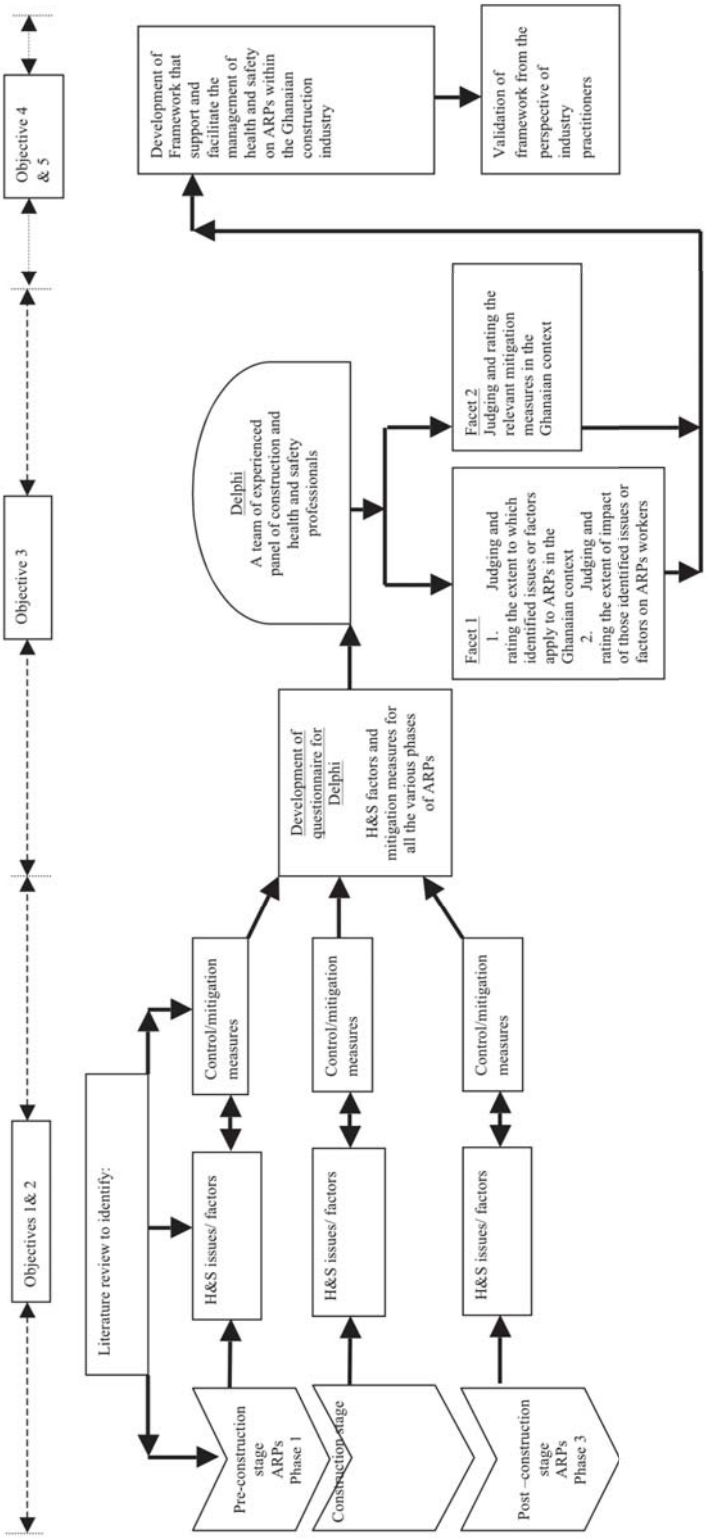

Figure 2 A diagrammatic presentation of a proposed research method

CONCLUSIONS

It is clear that quite apart from the derived benefits, ARPs is challenged with wider adoption. Inference is that the H&S issues surrounding ARPs have not been wholly addressed. In Ghana, just like other developing countries, this challenge is present alongside outdated and inadequate H&S legislation which do not provide adequate guidance for the safe execution of new buildings let alone ARPs. Within the Ghanaian context, the application of 4R+M to existing old building is likely to further aggravate the injury statistics especially when Ghana is bridging its infrastructure and housing deficits. Through research, rather than copying practices from developed contexts, this paper argues for the development and provision of coherent and unified safety guidelines in the form of a framework for the safe execution of ARPs in the Ghanaian construction industry. Delphi method has been proposed as the way to go for such a research. It is envisaged that embarking on this research would help bridge the gap of the dearth of literature on H&S management on ARPs especially in the context of developing countries like Ghana.

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