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ABSTRACT

Purpose:

This study investigates the critical opportunities for design for safety (DFS), the potential statutory (and non-statutory) health and safety (H&S) responsibilities of designers including DFS and its workability in developing countries.

Design/Methodology/Approach

Interviews were conducted among 28 multi-designers including Architects, Civil Engineers and Builders and the data was analysed thematically.

Findings

The study revealed that the likelihood of designers, clients, etc. inclining to change because of the infancy stage of H&S in developing countries, making it 'fallow' for H&S was a barrier. The opportunities for DFS include the willingness of designers to develop DFS skills and knowledge, which results in a welcoming attitude towards DFS. Further, the success recorded by professional bodies on other regulatory matters and designers' greater inclination to comply with DFS when professional bodies are involved in the regulatory process of DFS remain key opportunities for DFS.

Originality/value

To the knowledge of the authors, this is the first study that examines the opportunities for DFS in developing countries when it is (or not) supported by statute and the need to advance the understanding of DFS in developing countries through qualitative enquiry.

Practical implications

For statutory-backed DFS to achieve the objective at the optimum level, the role of professional bodies in the regulatory and sensitisation processes, geographic differences in DFS legislation enforcement, nuanced and strategic design and enforcement of any legislation that will support DFS should be taken into consideration.

Social implication

A grassroots collaborative approach to developing and implementing DFS in the country and the exploitation of the zeal of designers to have DFS-related knowledge, is recommended.

Keywords: Architects, civil engineers, safety in design, design risk management, safe design, prevention through design.

INTRODUCTION

Globally, health and safety (H&S) has not performed to expectation (International Labour Organisation (ILO) 2020). In Great Britain, the construction industry records worse across other industries but second to agriculture, fishery and forestry (Health and Safety Executive (HSE) 2019). Typically, it has accounted for 30 fatalities in 2018/19, but an annual average of

36 fatalities from 2014/15 to 2018/19 (based on provisional data) (HSE 2019). In Australia, there were 4.26 fatalities per 100,000 workers, which is nearly twice the national fatalities rate of 2.23, and the construction industry accounted for 11 % of all serious compensation claims versus 9 % of employed Australian workforce (Yu et al., 2015). Despite the limited data in developing countries, the case is worse therein. In fact, developing countries record three times as much fatalities than developed countries (Okonkwo, 2019). For example, in Saudi Arabia, Gibson (2014) reports the death of 500 workers from India on construction sites between 2013 and 2014. In South Africa, construction related fatalities total about 150 a year and the industry suffers about 400 accidents a year (Okoro et al., 2016). The construction industry has the 3rd highest number of fatalities. In Nigeria, between 2014 and 2016, 1385 workers were injured in the construction industry, the highest across all industries, and 238 workers lost their lives in all sectors (ILO, 2017). This number could be however be underreported as poor H&S performance may indeed be more extensive than recorded in developing countries (Alkilani et al., 2013). Further, in Ghana, despite employing 7% of the total working population, the construction industry reports occupational injury frequency of 43 per 1,000,000 hours worked, an incidence rate of rate of 63 injuries per 1000 workers and severity rate of 418 days lost per 1,000,000 hours (Boadu et al., 2020). Likewise, Hamalainen et al. (2018) revealed that found that the occupational accident fatality rate in low and middle-income African countries is 21.1 fatalities per 100,000 workers. Therefore, continuous research on H&S performance improvement in the construction industry especially in developing countries, is warranted.

Efforts to improve H&S can be through advanced technology (Marks and Teizer 2013; Parn et al. 2019), regulatory tools (van Heerden et al., 2018; Othman et al., 2020), and supply chain influences (Diugwu et al. 2013). Priyadarshani et al. (2013) and Boadu et al. (2020) suggest that safety management techniques can improve safety culture and in turn performance in Sri Lanka and Ghana, respectively. On their part, Toole and Erger (2018) and Manu et al. (2018; 2019) opine that design for safety (DFS) can improve safety performance.

Although DFS has its own limitations, the current study will focus on DFS (also known as prevention through design, safety in design, safe design and design risk management) because it is one of the most effective ways of ensuring H&S throughout the life cycle of projects (Toole and Erger 2018). DFS entails designing out anticipated H&S hazards or risks associated with construction process, operation (including maintenance) and decommissioning of Architectural, Engineering and Construction products. Studies have shown a correlation between DFS and H&S improvement (Behm, 2005; Cooke et al., 2008). Specifically, Behm (2005) found that associated risks to 42% of the 224 fatal investigation in the United States (US) between 1990 and 2003 in his study were avoidable or minimizable if DFS concept was applied. Haslam et al. (2005) found that up to 50% of the 100 accidents examined in the United Kingdom (UK) could have been mitigated with DFS application. More recent studies indicate that predictive risk assessment (Sadeghi et al., 2020) and attention to the type of accident associated with the design (Sanni-Anibire et al., 2020) can improve safety performance.

However, there are still gaps in this area globally (Manu et al 2018) and in developing countries especially in relation to client motivation and attitude of designer towards DFS (Manu et al 2019; Poghosyan et al. 2019). Extant literature, for example, Manu et al. (2018; 2019) and Qusai et al. (2020) did not examine the subject from the interpretivism and/or constructivism perspective, a missed opportunity for in-depth and context-based understanding of the subject in the region. A good example is a study of architects in Nigeria on DFS, which show a disconnect between the high-level awareness of DFS concept and the low practice of DFS (Manu et al. 2019). Manu et al. (2019) acknowledged that other factors such as regulation and

attitude of designers may contribute to explaining this and recommended further research to provide a better understanding. Umeokafor and Windapo (2018) demonstrate the underrepresentation of qualitative approach research and implications for built environment research in Nigeria. Given the risk associated with DFS when designers have limited expertise on it (Toole and Erger 2018), the rationale for the current qualitative research was emphasised.

There is evidence that the Labour Safety Health and Welfare Bill of 2012 in Nigeria (which has been revised following the passage by the Senate but awaiting presidential assent) would empower the making of construction specific regulations on H&S. Hence this will enable the inclusion of construction H&S regulations presented to the relevant persons alongside the bill. Also, it is expected that it will provide statutory backing for prevention through design (PtD) for designers, provide H&S obligations for stakeholders in project delivery and project team (which also include designers), and make provision for the regulation of H&S throughout the phases of construction including the pre-contract stage. However, the attitude of designers towards this is poorly understood, just as the opportunities and whether a DFS backed legislation will be workable. Attitude of designers and clients are main ingredients in PtD (Poghosyan et al. 2018; Manu et al. 2018) and the improvement of H&S in general. Also, Poghosyan et al. (2018) call for more research in relation to the legislation aspect of PtD because of the gaps in knowledge. Manu et al (2019) indicate opportunities for DFS [because of high interest in DFS training] among architects in Nigeria but engagement with this is low.

In view of this backdrop, using Nigeria as case study, this study aims to investigate DFS and other potential H&S responsibilities of designers in developing countries from the multi-designers perspective through qualitative research. The aim of the study is to advance the understanding of the critical opportunities for DFS (and prospective H&S responsibilities for designers including DFS) in the absence or presence of statutory backing for DFS. The objective of the study was to examine the workability of DFS when statutory-backed, by extension covering the attitude of designers towards DFS and any legislation-related issues. The following research questions guided the study: How workable is statutory-backed DFS and other H&S responsibilities for designers and what are the conditions and critical opportunities in the presence of statutory legislation? The remaining sections of the paper present an overview of literature on DFS and related legislation, especially in Nigeria. Thereafter, the methods adopted to undertake the study are presented, followed by the findings, discussion and conclusions.

LITERATURE REVIEW

Overview of design for safety

Design for construction safety is to explicitly consider construction site safety through optimised design in design phase (Yu et al., 2015). A code of practice published by Safe Work Australia (SWA) in 2012, which aimed to set guidance for "Safe Design of Structures", defined safe design as "the integration of control measures early in the design process to eliminate or minimise risks to health and safety throughout the life of the structure being designed" (Lingard et al., 2014). Various tools have been explored to improve construction H&S such as Design for Safety Toolbox and digital tools (including virtual reality) (Yu et al., 2015). However, there are still challenges including absent regulatory requirements, safety responsibility, narrow specialization of construction and design, limited tools and guidelines, limited pre-construction collaboration, limited education and training (Farooqui et al., 2008; Yu et al., 2015). This study focuses on the legislation and opportunities available for DFS in Nigeria.

Improving construction health and safety through design for safety and associated legislation

While the H&S record of developing countries remains poor, it has started to attract attention. Studies undertaken on construction safety indicate that H&S can be improved with continuous efforts. In developed countries, poor H&S performance spurred exploration and design of ways to reduce the numbers of injuries and fatalities. For example, Cooke et al (2008) investigated the impact of design and designers' choices on occupational health and safety and advanced that knowledge-based systems to identify inherent risks during design before they occur. Behm (2006) demonstrated the efficacy design-for-safety measures in a secondary analysis of construction worker deaths and disability injuries in the United States of America. Behm's study found that risks could have been eliminated or reduced with DFS measures. Other studies reveal that construction H&S legislations play a key role in designer's choice and willingness to improve and comply with the rules (van Heerden et al., 2018; Othman et al., 2020). However, this is yet to be seen in some developing countries.

Health and safety professionals in countries such as Nigeria have formed an informal network of an international professional body on H&S which has developed to cover the whole of West Africa, heralding its first conference in January 2020, and gaining its formal network status, Institution of Occupational Safety and Health West Africa Division. Minimal efforts of some governments in developing countries are evident. For example, in Ghana, Kwesi, Amponsah-Tawiah and Dartey-Baah (2012) claim that the Ministries of Manpower Youth & Employment, Health and Lands, Forestry & Mines developed a national policy on occupational safety and health in 2000 but was yet to be passed into law as at 2012. As at 2019 (Institution of Occupational Safety and Health 2019) and 2020 (Change.org 2020), it was yet to become law. Analogously, in Nigeria, while the National Policy on Occupational Safety and Health was developed in 2006, it has been revised; hence the 2020 version. Further in Nigeria, due to the limitations in the Factories Act 2004 which are not limited to the omission of construction promises and activities, Labour Safety Health and Welfare Bill of 2012 has been introduced to address such limitations and was signed by the senate in 2012. However, as of 2020, it is yet to receive presidential ascent. Understandably, additional improvement to it may explain the delay but this waiting duration has become unreasonable.

However, there is evidence to conclude that the above bill or the likes will have regulation that are specific to the construction industry which would have H&S responsibilities for designers at the design stage, H&S obligations for project stakeholders or project team members in the delivery of the project and regulation on H&S at the pre-contract stage. Arguments to assign H&S management responsibilities to quantity surveyors are in Diugwu et al. (2013) but this is not without significant limitation such as procurement arrangement constraints.

Opportunities for DFS in the construction industry

Therefore, there are opportunities for H&S. The attention and urge from various stakeholders is evident. If the regulation comes into place, designers and other project team members will have H&S responsibilities at the design stage. While there is overdependence on regulation of H&S to improve its poor state in Nigeria (Diugwu et al. 2013), hence the danger of practitioners being overly dependent on this, there is the need to examine the opportunities for DFS regulation and support and identify ways of increasing the attention in DFS among stakeholders in sub-Saharan Africa, an area in need for further research in the region (Manu et al. 2018).

Drawing on this premise, the case for the anticipated regulatory change in this study is supported.

Based on the knowledge gaps in DFS and client influence/motivation and legislation identified as key drivers of DFS, there are limited studies in this regard as they cover 23 per cent and 16 per cent respectively of the 164 papers in the review (Poghosyan et al. 2019). Other areas such as the attitude of designers toward DFS have also received little attention, 26 per cent of the 164 papers that Poghosyan et al. (2019) have reviewed. Hence, they call for research in DFS legislation and client influence/motivation in DFS. Also, there is no study on DFS in sub-Sahara Africa (Manu et al. 2018). Similar gaps are also supported by a similar extensive review of H&S research in construction management in Nigeria (Umeokafor 2018a). Therefore, research on the workability of DFS in Sub-Saharan Africa, possible opportunities for DFS in such complex H&S context, and the role of legislation, client, and designers' attitude toward DFS is warranted.

METHODOLOGY

The study investigated the critical opportunities for DFS (and prospective H&S responsibilities for designers including DFS) in the absence or presence of statutory backing for DFS. It examined the workability of DFS when statutory-backed, the attitude of designers towards DFS and any legislation-related issues. Therefore, in-depth understanding using qualitative techniques was needed. Semi-structured interviews and electronic interviews (e-interviews) were used to provide in-depth understanding into the complex phenomena (Griffiths 1996). The adoption of e-interviews has been applied in a lot of studies not limited to Umeokafor and Windapo (2017). In e-interviews, open-ended questions are sent to the participants by email to provide the response just as questionnaires (Carter and Fortune 2004). The difference between questionnaires and semi-structured e-interview is that questionnaires are structured whereas e-interview are semi-structured, with the possibility of probing further via emails or interview if needed. This study therefore adopted the interview technique.

Data collection instrument

The questions were developed from literature review. To improve the trustworthiness of the research, the data collection instrument was refined with the four-phase interview protocol refinement framework developed by Castillo-Montayo (2016). These include: 1) Ensuring interview questions align with research questions, 2) Constructing an inquiry-based conversation, 3) Receiving feedback on interview protocols, and 4) Piloting the interview protocol. In particular, the output of the literature review on DFS, the opportunities, H&S responsibilities, legal responsibilities in H&S, and among many, the experiences of the authors informed the literature review. The questions were then informally discussed with selected designers in the industry and the interview tool was refined and piloted. Details of other steps taken to improve the trustworthiness of the research are presented in the section on 'Ensuring trustworthiness in the research'.

Section A explored the background of the respondents including their role in the industry, the scope and level of their experience. Second B examined if and how their role had implications of H&S and their responsibilities therein. Section C investigated if their relationship with other stakeholders (e.g. client, contractors, and other designers) had implications for improving DFS and other H&S responsibilities. Section D assessed the opportunities for DFS and other H&S responsibilities including acting as H&S promoter when they have opportunities in the

construction stage of the projects if the proposed new H&S legislation comes into play. It also examined the opportunities for DFS and other H&S responsibilities in the absence of the anticipated legislation. In addition, their views on statutory-based H&S responsibilities for designers, its workability and how and why it would or would work. Other questions include the legal-related opportunities, fragmentation of the supply chain, organisational culture and social, political and economic context.

Data collection

The population for the study was professionals in the Nigerian architectural, engineering and construction industry with work experience as a consultant (e.g., an architect, a builder, a civil engineer) and/or H&S consultant. Academics with industry experience in the field were also included. These were observed to have the relevant experience and skills and purposively approached to provide rich data. A total of 562 Architects registered with the Architect Registration Council of Nigeria (ARCON) 2013 register and 33 academics who had or currently have industrial experience were invited to participate. Snowball sampling was also used to enable access to more participants (Moser and Korstjens, 2018). Some of the participants approached at first made referrals that helped to identify 25 additional potential participants to be included in the study.

Adhering to research ethics, the introductory letter and invitations were sent to the participants. The aim of the study, their voluntary participation, anonymity, right to withdraw and data use for research only were stated. Permission to audio-record during the interview was obtained. The interview duration was between 35 minutes on average. In total, 28 interviews were used for the study. This sample size was deemed to be suitable for open-ended interviews where large amounts of data need to be analysed from in-depth interviews (Weller et al., 2018). In addition, saturation was reached. This is the point the amount of information contributed by each new respondent added little or no new information (Weller et al., 2018; Guest et al., 2020).

Data analysis and mapping of means to ensuring trustworthiness in the research during the analysis

The analysis was inductive and deductive with the aid of a software, NVivo for Mac. This enabled the production of thematic maps that showed the visual representation of the codes and categories and their relationships (Vaismoradi, Turnnen and Bondas 2013). The use of computer-aided analysis improved the quality of the research, reduced bias and contributed to methodological transparency (Danity et al. 2000). The entire data was easily managed and arranged for maximum use. The six-phase thematic analysis in Braun and Clarke (2006) was used. These included familiarisation with the data; generating initial codes; developing or searching for themes; reviewing themes; defining and naming themes; and writing up. Figure 1 presents selected activities in each phase of the analysis that contributed to ensuring trustworthiness in the research.

[Insert Figure 1]

Familiarisation with the data. In order to understand the data well and be immersed in it, the lead investigator read the e-interview and interview transcripts (which were transcribed verbatim and of naturalised transcription) over and over and noted ideas. Naturalised transcription was adopted over denaturalised transcription because as Meffo-jaffe (2011) noted, the former captures everything in more detail and context with little or nothing filtered and thus enabling the investigator make informed decision. The repeated reading of the data

(hence the immersion into it) contributed to the credibility of the research as it ensured prolonged engagement with the data and provided accuracy.

Generating initial codes. Initial codes were developed in a systematic way for refinement, modification or elimination (Braun and Clarke 2006). The line-by-line coding was adopted where the transcript, e-interview, and field notes were read word-for-word (phase 1). The coding was arranged and organised into hierarchy, parent node and child nodes. But to adequately manage the codes, the coding commenced with broad parent codes before the rest of the coding. While the analyst had preconceptions, a framework of analysis which was developed from literature review also aided the deductive approach. There was also inductive coding where the data guided the coding. The organisation of the data in hierarchy of nodes enabled the analyst to give equal attention to the data set and more than one reality was captured. This contributed to ensuring credibility in the research. The use of parent and child code to develop hierarchy of concepts and theme development contributed to dependability (Figure 2).

Developing and searching for themes. Here the codes were examined to see how, and which ones could be combined to form a potential theme; hence the use of visual representation with the help of the software, NVivo for Mac and tables, was adopted. The analysis generated the theme and sub-theme to ensure consistency, richness, etc. Some codes aligned to themes and sub-themes while others did not; hence new themes or subtheme were formed. The elimination of the codes to form themes enabled conformability and neutrality. The connection of themes and subthemes ensured dependability (Figure 2).

Reviewing themes. Potential themes and subthemes were combined or broken down to form more themes or deleted because they were too diverse or have limited data to exist as a theme. This phase, driven by the richness of data, was undertaken on two levels - internal homogeneity and external heterogeneity, where the data within the themes should be coherent but clearly different in identification from other themes (Braun and Clarke 2006). The data extract for each subtheme and theme were first read to ensure they formed a coherent pattern, and then the validity of each potential theme in relation to the entire data and whether they were fit for passing the meaning that the data intended to pass to achieve accurate representation was assessed. This afforded the opportunity to code the dataset accordingly to adequately address the research question and thus contributing to credibility. Another way was validating the themes against the entire data, which ensured dependability by showing interaction with the analysis (Figure 2).

Define and name themes. This was done to ensure that each theme was simple fit for purpose. Adequate and equal attention was given to the data to capture many realities and provide accuracy and thus contributing to credibility (Figure 1).

Writing up. The last phase was the write-up and presentation using tables, quotations and diagrams. Effort was made to provide full details of the methodology and thus contributing to transferability. The use of quotations in the report (repeating the view of the respondents) contributed to dependability (Figure 2).

Additionally, peer-debriefing between the first two authors and other peers was used. The interview protocol refinement framework by Castillo-Montayo (2016) was also used to ensure that the data collection instrument was usable. The four phases entail ensuing that the interview questions align with the research questions; constructing an inquiry-based conversation with

the data collection instrument; receiving feedback on the interview protocol was applied; and piloting the data collection instrument. Triangulation was done in various ways, for example, for person triangulation; analysis groups were created, 'Arch' and 'BuildCivil'. The use of software (NVivo for Mac) and constant comparison of the data is another method of triangulation. This constant comparison, which is in line with Sand and Roerstrier (2006), are dissonant, complementary, convergence, illumination and providing unique information. Further, providing details of the methodology enhances the research as readers can make informed conclusion based on the information provided (Bowen, 2008).

FINDINGS

Description of sample

The respondents covered the six geopolitical zones of the country, South South, South West, South East, North West, North Central and North East. In total, 15 Architects, 9 Civil Engineers and 4 Builders participated in the research of which 6 were academics but hold or have held industry positions in the past 20 years. The practitioners were from public and private sectors (large, medium and small enterprises). The respondents' years of experience ranged from 3 to over 20 years in building and civil engineering and infrastructure projects. The classification of the group of analysis, 'Arch' (15 Architects) and 'BuildCivil' (2 Builders and 7 Civil Engineer), is based on their role and orientation in the industry. The academics all had postgraduate qualifications, 3 also have a doctorate degree and two were professors.

Workability of statutory-based Design for Safety and other H&S responsibilities in Nigeria

The respondents were asked questions on the optimum workability of statutory-backed DFS responsibilities for designers, by extension H&S responsibilities for the designers. Many respondents were in support of statutory-based H&S responsibilities including DFS for them and to work as H&S promoters at the post-design stage of projects. However, there are conditions that would need to be fulfilled to ensure that optimum DFS is achieved in the country. On the other hand, the respondents that disagreed with the statutory-based H&S responsibilities including DFS viewed that this puts them at risk of liability, among many, puts more burden on them and may make little difference in DFS because of enforcement and social issues like corruption.

<u>Involvement of professional institutions and/or professional regulatory councils in enforcement</u>

Few in both groups emphasised the need for subtle and nuanced strategies for enforcing the legislation with the professional bodies, a key stakeholder in enforcement. For example, three respondents stated:

'Yes, if enforced by professional bodies where penalties can include striking people's names off the register for years, to be reinstated when there is evidence of willingness to change, the outcome will be better. While the government has roles [in enforcement]*, the involvement of the professional bodies with responsibilities are inevitable. Only statutory laws are not enough, professional bodies must be involved'.* [Architect, South East]

'You know, these professional bodies …, they also look at the school curriculum. They also set exams for people who want to get their professional qualifications. But the other people who are not the professional bodies, when they start to enforce, they start to go to regulators that

will use EFCC [denotes a regulator of corruption crimes in Nigeria, not health and safety, that uses sting punitive measure] *style. In Nigeria enforcing things are not that easy. The professional bodies are doing very well. People, professional are more inclined to professional regulatory bodies*'. [Architect, South East]

'We know that not all designers are registered with professional bodies, but the council regulates the practices. So, whether you are a member of the professional body of not, the council who knows the in and out of the profession and how people cut corner will find you more than the any enforcer who may not have the local knowledge'. [Civil Engineer, Abuja]

Geographic location

Another point is the geographic location consideration in the development and enforcement of the legislation. A few respondents in both groups noted the difference in enforcement environment, attitude towards H&S and its awareness based on geographic locations. They viewed that the regulatory environment for architecture, engineering and construction-related regulations (for example building and planning approvals) undergoes thorough scrutiny in some states including Lagos, Port-Harcourt and Abuja. The same is applicable to the regulatory bodies of professionals. A respondent stated:

'*The Architects Registration Council of Nigeria, the regulatory body of architects in Nigeria, tends to be much more active in Abuja here and maybe Lagos and Port Harcourt. They try to minimize the issue of quackery in the profession at least in Abuja. Here, before your drawing goes out for approval, there are certain measures to make sure it is only drawings by registered architects that can get to the development council. If the law is in place, it will be easier to implement in Abuja here. For instance, I have also done some jobs in the east like Enugu and Anambra. You find that development authorities there do not follow up. The architects registration council of Nigeria is much more active in Abuja than it is down there. The issue of quackery will always come up in those other places*'. [Architect, Abuja]

This barrier emphasises the need for nuanced and robust regulatory strategies that will survive regional divide.

Additional H&S (including DFS) qualifications

While not all the respondents demonstrated the need for additional safety qualification for designers, majority agreed that additional sensitisation and training is needed, without which there will be little difference if there is a new law.

Client support

Many of the respondents highlighted the need for client support of which without, they can do little even if there are laws.

Opportunities for proposed statutory-based design for safety and other H&S responsibilities for designers

Table 1 presents findings on the opportunities for a statutory-based DFS and other responsibilities for designers. These include: the characteristics of construction, strategic position of designers, grassroots collaboration of stakeholders, and welcoming attitude and features (zeal to know more about DFS) are opportunities and thus indicating a positive outlook for the implementation of DFS for designers. The table shows that the relationship that the designers have with the client may be a platform for driving DFS and other H&S responsibilities for designers especially if backed by statute. However, there is no agreement

between the two groups of analysis and even within the groups. For example, some 'Archs' in the industry viewed that the relationship between them and the client is limited by any increase in cost while some BuildCivil viewed otherwise. One stated:

'*In my experience, the relationship I have with the client makes no difference in H&S. While some DFS would not entail an increase in cost, DFS that the cost cannot be justified is a 'no go areas' — money is their priority irrespective of your relationship with them so the relationship will not make any difference'* [Architect and Project manager]

[Insert Table 1]

Further, statements by other respondents offered a fuller picture and expanded the aforesaid. This suggests that while the clients may be sceptical or even refuse some changes to the drawing or building activity because it will increase the cost of time of construction, grassroots enforcement involving local planning departments and regulating councils such as the Architects Registration Council of Nigeria, would enable them to make a case for DFS or other H&S responsibilities to the client. This will give them more say especially if the client also has statutory H&S responsibility.

When asked if their relationship with contractors would help enhance the DFS skills and knowledge and implementation, there was no agreement. Some viewed that the contractor has no 'say' hence there was no need to collaborate with them. Others viewed that the feedback from the contractors of how effective DFS was is a key source of learning. The respondents:

'*Contractors must have to follow the drawing and DFS information. The major onus of design safety is on the client to support, not contractors. Relationship with contractors makes little difference once the client approved the safety plan. Contractors are just there to build what they are given except in design and build hence the relationship with them do not matter*' [Architect, South South]

In contrast: a civil engineer said:
'*We find the feedback from the contractors helpful; we know what safety in design measures that worked or that did not work well. We know the once they are mostly to avoid complying with and those they are most likely to do. At the end of the day, they know the site better than use. All sites are not the same*'.

While people usually resist change, the welcoming attitude of some designers to the legal backing for H&S responsibilities offer optimism especially because of the understanding of the gap in the driving or influential effect of legislation. However, the workability of the legislation will depend on its ability to address some contextual issues. Without this, there is the view that it will end up like other legislation, on paper, with limited efficacy. This welcoming attitude does not resonate among all designers in both groups. Some viewed that a statutory-backed H&S responsibility may bring a burden on the designer, fear of liability, sanctions for non-compliance and adequate enforcement of such laws.

The strategic position of the designer equips them to drive the design-out of hazards (Table 1). This was acknowledged by most of the respondents. A few exhibited limited understanding of designer role in DFS. Further, the ability of professional institutions and the regulatory councils therein such as ARCON to drive changes to some extent and regulate the activities of

practitioners with the local knowledge makes them key stakeholders in driving DFS [Table 1]. The overconfidence of many of the respondents on this being a determining factor for the effectiveness of the professional institutions and the regulatory councils therein and DFS regulation is interesting but points to the need for more understanding on how this regulatory model will work. The proposed sanctions may work for registered members as opposed to the unregistered and those in the informal sector that cannot be reached. However, their ability to drive change through curricula changes and professional assessment sounds workable. There is also evidence of the self-efforts from the designer which manifest in terms of persuading the client, designing out hazards when it cost nothing and even when there is additional cost. However, this is met with resistance from the client if there is additional time or cost as a result.

In terms of welcoming attitude, specifically, the quest for H&S (including DFS) knowledge, the study shows the recognition for the need for improve the extant knowledge in the subject. There was also evidence of the question for increase in knowledge in H&S including DFS. There was the recognition from a few Archs that there is change in the younger generation and international influence. One stated:

I am aware that younger people do a lot on the internet. Last year, I was discussing with a much junior architect who showed me some material from the internet that he was using for his CPD where she was learning about safety, BIM and other technology. I know a lot there may not be possible in Nigeria, but this is good.

Opportunities for design for safety and other H&S responsibilities for designers in the absence of statutory backing for them

The views of the respondents show that H&S (including DFS) responsibilities for designers and other stakeholders such as clients are challenged in the absence of a local statutory backing, the current state of DFS. However, the key themes that emerged here are similar to a few in Table 1, centring on 'welcoming attitude for DFS' which is mainly evidenced by the quest for DFS knowledge and its benefits. The strategic position of designers also presents an opportunity here but is weak compared to if there is a statutory backing for DFS and other H&S responsibilities for designers. One evidence here focuses on the ability of designer to design out hazards based on their own according and ability. Another theme here relates to the use of media to pass the information of DFS to designer to increase awareness. However, while this is not limited to occurring in the absence of statutory backing for DFS and H&S responsibilities for designers, there was little focus on this in the preceding section hence not reported.

Possible causal relationship among themes and within themes

Figure 3 attempts to capture some possible causal relationship and links between the themes and within themes above. Figure 2 shows evidence that the opportunities depend on some factors. For example, filling the realised gap that the DFS-supported legislation seeks to address is dependent on adequate enforcement where professional institutions and the regulatory councils therein will take part in enforcement.

[Insert Figure 2]

The same enforcement will determine the workability of the relationship between the designer and the client and between the designer and the contractors. These relate to the findings on the workability or opportunities for the statutory-based design for safety and other H&S responsibilities in Nigeria.

DISCUSSION

The findings of the study show no agreement among the respondents on the introduction of statutory-based H&S responsibilities including DFS for designers and explanations for the lack of support for the discourse. While this is expected because studies such as Toole and Erger (2018) and Labo-Popoola et al. (2019) report the fear of liability as a key barrier to DFS, Labo-Popoola et al. (2019) found that it is the highest ranked barrier among civil engineers in Nigeria. Nevertheless, the support by many respondents for statutory-based H&S responsibilities is encouraging and an opportunity for DFS. This aligns with the findings of Manu et al (2019), which indicate opportunities for DFS where architects have a high interest in DFS training in Nigeria. However, this opportunity seems to be questionable as it was found that the high level of interest in DFS training is not supported or followed up with a proportionate level of engagement with DFS (Manu et al 2019). A lot of factors such as increase in project time and cost (Labo-Popoola et al. 2019), lack of adequate legislation (Diugwu et al. 2012), and that it may just be mere interest—not necessary translating into implementation of DFS may explain this non-corresponding implementation of DFS despite the high interest in it. However, the high level of interest indicates an opportunity, which if properly harnessed, can contribute to improving H&S through DFS.

Nevertheless, there is the need to address other factors which the respondents have highlighted to facilitate the workability of statutory-based DFS and other H&S responsibilities for designers in Nigeria. One of these relate to enforcement issues which overall is a key determinant to achieving optimum DFS, as emphasised by the interaction of the themes in the study (Figure 2). This is consistent with extant literature such as Famuyiwa et al. (2011) that report the poor enforcement of legislation history of developing countries such as Nigeria. The regulation and compliance of H&S legislation is fundamental to improving H&S (Finneran and Gibb 2013). The respondents perceived solutions such as the involvement of professional institutions including the regulatory councils therein in the enforcement of DFS through ensuring that DFS is included in school curricula, professional institutions assessing DFS in the professional exams and consulting them on how the enforcement of H&S responsibilities for designers (including DFS) would be effective. This is consistent with Lingard et al. (2012), which revealed that external stakeholders such as insurance companies have positive and significant outcome on DFS outcome. While it can be argued that professional bodies are already consulted in H&S in Nigeria with some roles reported in the National Policy for Occupational Safety and Health (revised) 2020 (Federal Government of Nigeria 2020), the aforementioned level of involvement, responsibilities and authority are currently not implemented in the country. Based on the authors' experiences of the ability of professional institutions including the regulatory councils therein to enforce standards among members, the respondents' confidence on the ability of professional bodies to significantly contribute to improving the regulation of H&S due to the success record, the approach is logical and strategic. Understanding of the regulated and working with them at grassroots level can provide a different and unique dimension to regulating H&S in developing countries and improving H&S. Also, the scope of the ability of professional bodies would be limited to only the members.

Designers' knowledge as a condition for the workability of statutory-based DFS and other H&S responsibilities in the country, was noted. Knowledge requirement for H&S including DFS is reported in studies (Diugwu et al. 2012; Goh and Chua 2016). Specifically, Diugwu et al. (2012) found little evidence in their personal observation of construction sites in Nigeria that

supports the high perceived level of awareness of H&S regulation claims of the respondents. However, another suggestion by the respondents that professional councils such as ARCON can contribute to addressing designers' competence requirements by regulating it through examination would contribute to addressing this. Further, the responsibility of H&S promotion for designers stems from their strategic position in the supply chain because they can crusade for H&S where possible to make it a core part of project objective. The challenges relating to support from stakeholders are however acknowledged.

Equally important is the consideration of the influence of geographic location on the design and enforcement the legislation. This aligns with the findings of Umeokafor (2018b) where there is a relationship between H&S intervention by communities and urban area and rural areas viz-a-viz negotiating H&S measures, the degree of site inspection, appointment of local H&S representative to work with contractors, contextualising H&S, and enforcement of H&S. Understandably, the level of H&S knowledge and awareness, enforcement and attitude in South South is higher than what obtains in South East, probably due to incidences of oil spillage in the former necessitating the awareness. Analogously, South West has local H&S legislation and regulatory board unlike other zones.

The study found no agreement between the groups of analysis on whether the relationship with contractors would help enhance the DFS skills and knowledge and DFS implementation. This is revealing and disagrees with evidence in Pirzadeh et al. (2020) that allude to knowledge gap in DFS being bridged through collaboration between members of the project team in the design and construction because collaboration will catalyse and H&S knowledge and information sharing between the participants for example client and designers. The explanation for this discord in findings may include that Pirzadeh et al. (2020) focuses on a design and build procured project while the current study focused more on procurement methods. Also, the scope of Pirzadeh et al. (2020) is Australia with a better H&S record and regulatory environment than many developing countries such as Nigeria. Nevertheless, as there is evidence that collaboration can contribute to improving project indicators, that there are the respondents that disagree with this is worrying, prompting question of whether and to the extent that the adversary nature of construction supply chain accounts for this.

Further on relationship, there was no agreement between the groups of analysis on the relationship between the designer and the client being a platform for driving DFS. Given the positive implications of collaboration, which is a function of relationship between parties (example client and designers), the difference in view between the groups of analysis call for further research to understand this.

However, the evidence in the theme, grassroots collaboration of stakeholder, is encouraging and offers optimism. This is where, among many, professional institutions and councils and the building control bodies have higher or better success records on enforcement, than the state, and they occupy a strategic position in influencing DFS competence among designers. A critical examination of this suggests that these opportunities are limited to the ability of the professional institutions to regulating designers as individuals of design companies. By implication, this will mainly cover designing out hazards that the designers can do with little or no client support, and little or no increase in project duration and project cost. Given that the members of the professional institutions and the councils can also regulate cooperate design organisations, the scope has increased. This may also mean that the chances of design organisations getting client organisations in line to cooperate in terms of DFS is increased.

Nevertheless, this raises some questions. First, how exactly will the professional bodies be involved? Secondly, to what extent can they effectively enforce the DFS activities of the designers; they may not have full access to design documents. A possible response is that if they are empowered by statute (like building control authorities) to approve design documents including drawings but relation to the safety, then they would have access to any relevant documents. However, as the approval design documents including drawings is currently the responsibility of building control departments, should they work with professional bodies or have the said responsibilities added to the existing ones? How will the resourcing issues be handled as this would require more person-power? The point here is not to discard or debunk the involvement of professional bodies but to point out that there may be regulatory complexities hence further research is needed for the finer details and for the effective implementation.

The opportunity of H&S in the construction industry being at infancy indicates the likelihood of designers and clients inclining to change because the country may be 'fallow' in terms of H&S. While this can also be a barrier as they can resist change, it is triangulated and supported by the opportunity that many designers have a welcoming attitude for the statutory-backed H&S responsibility.

STUDY IMPLICATIONS

The implications of involving regulatory councils in the H&S regulatory environment in the regulatory and sensitisation process is crucial. This would mean that state-driven regulatory process where they mainly enforce the regulation would not be effective. Further implications include that more parties would be involved in the enforcement of the legislation which would present its own challenges such as complexity in the regulatory process. Involving professional institutions including the regulatory councils therein in the enforcement of the anticipated H&S legislation and in the regulation of the knowledge and awareness of DFS by using their powers to ensure that it is included in professional examinations and education curricula of higher institutions in the country have implications. For example, it would warrant additional training and/or education on DFS and H&S for professional institutions. More resources will also be involved. As developing countries have not recorded the level of success in enforcement of regulation and the relevant governmental support as developed countries, subtle ways of achieving the DFS are needed. Hence, the strategic position of designers should trigger focus on them to increase their self-efforts toward DFS. Yet again, professional bodies would have a key role to play.

The disagreement between the respondents on the relationship between the designer and the client being a platform for driving DFS calls for research to advance the understanding of whether the relationship between the two parties is able to contribute to driving DFS and explanations. Similarly, the disagreement between the groups on whether the relationship with contractors would help enhance the DFS skills, knowledge and implementation where the knowledge aspect does not agree with extant literature warrant further research.

Furthermore, the study has theoretical implications not limited to the interpretivist/constructivist insight into context-based opportunities for DFS in Nigeria. For example, the involvement of professional institutions in the regulation of DFS due to their influence on designers and their records in regulatory activities presents the risk of regulatory compilations in H&S in Nigeria (and possible other developing countries that share the complex regulatory environment as Nigeria as noted in Umeokafor 2018a). Furthermore, the

geographic location differences in H&S regulation and enforcement, awareness and attitudes in the country implies that the workability and efficacy of statutory-backed DFS responsibilities are dependent on pragmatic approaches/solutions.

CONCLUSION AND RECOMMENDATIONS

The study investigated DFS and potential H&S responsibilities for designers in Nigeria to advance the understanding of the critical opportunities therein and its workability with statutory backing for H&S responsibilities for designers. In the study, while there is evidence of opportunities for DFS including that the infancy stage of H&S in the country may make designers and clients inclined to change, this can also be a barrier as they can resist change. Also, it was found that designers have a high level of confidence in professional institutions' ability to regulate and/or influence H&S including DFS through various ways including testing it in professional exams and penalising designers who do not implement it. However, given the current complex nature of H&S regulation in Nigeria, this may further complicate the regulatory environment; hence should be carefully considered with adequate research. There is evidence that many designers welcome the introduction of DFS responsibilities that is supported by law. However, there are fears of liability and burden hence scepticism for statutory-backed DFS responsibilities. For statutory-backed DFS responsibilities to optimally support DFS, the geographic location difference in H&S regulation and enforcement, awareness and attitude and more involvement of professional institutions and councils are important. However, the findings of the study could be applicable to other countries that have similar regulatory environment.

The study recommends the involvement of professional institutions including the regulatory councils therein in H&S (including DFS) education regulation as they are already being consulted in H&S matters in the country. Professional institutions and employers should make efforts to increase the self-efforts among designers to design out hazards, just as they should be encouraged to do it. Further research on the relationship between members of the projects (designers and clients), the involvement of professional bodies and building control authorities and the implications for DFS (for example, enhancing DFS skills, knowledge and implementation) are recommended. The data is limited to Nigeria hence there is the need to carry out country-specific studies in other developing countries. Also, possible relationships may be tested using quantitative research.

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Figures

Figure 1: A graphic presentation of the selected means of establishing trustworthiness in each phase of the thematic analysis (Authors' creation)

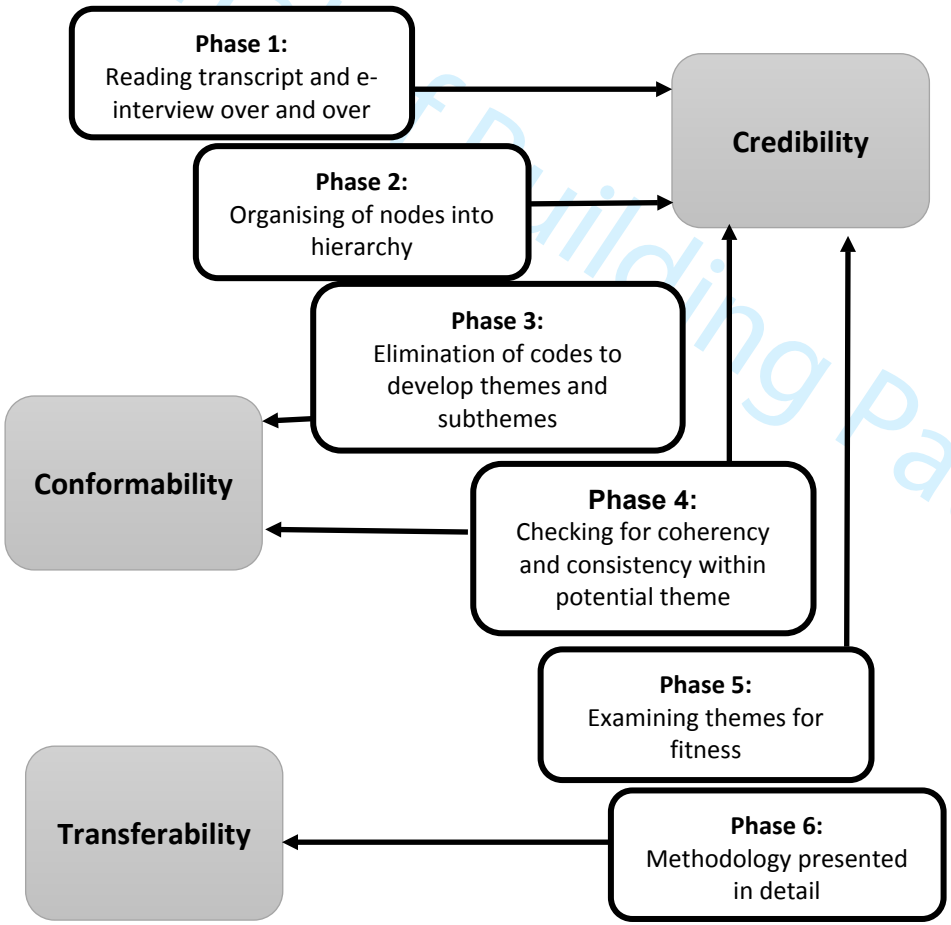


Figure 2: Application of dependability at different phases in the analysis process

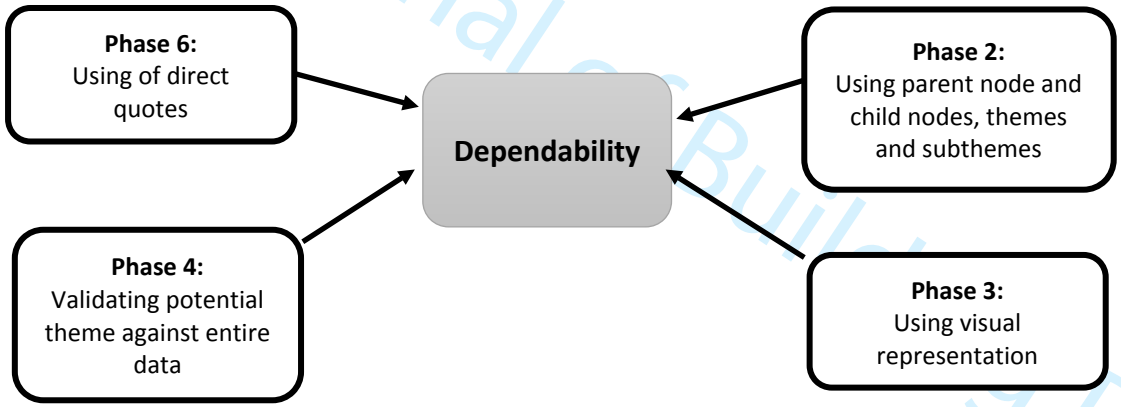
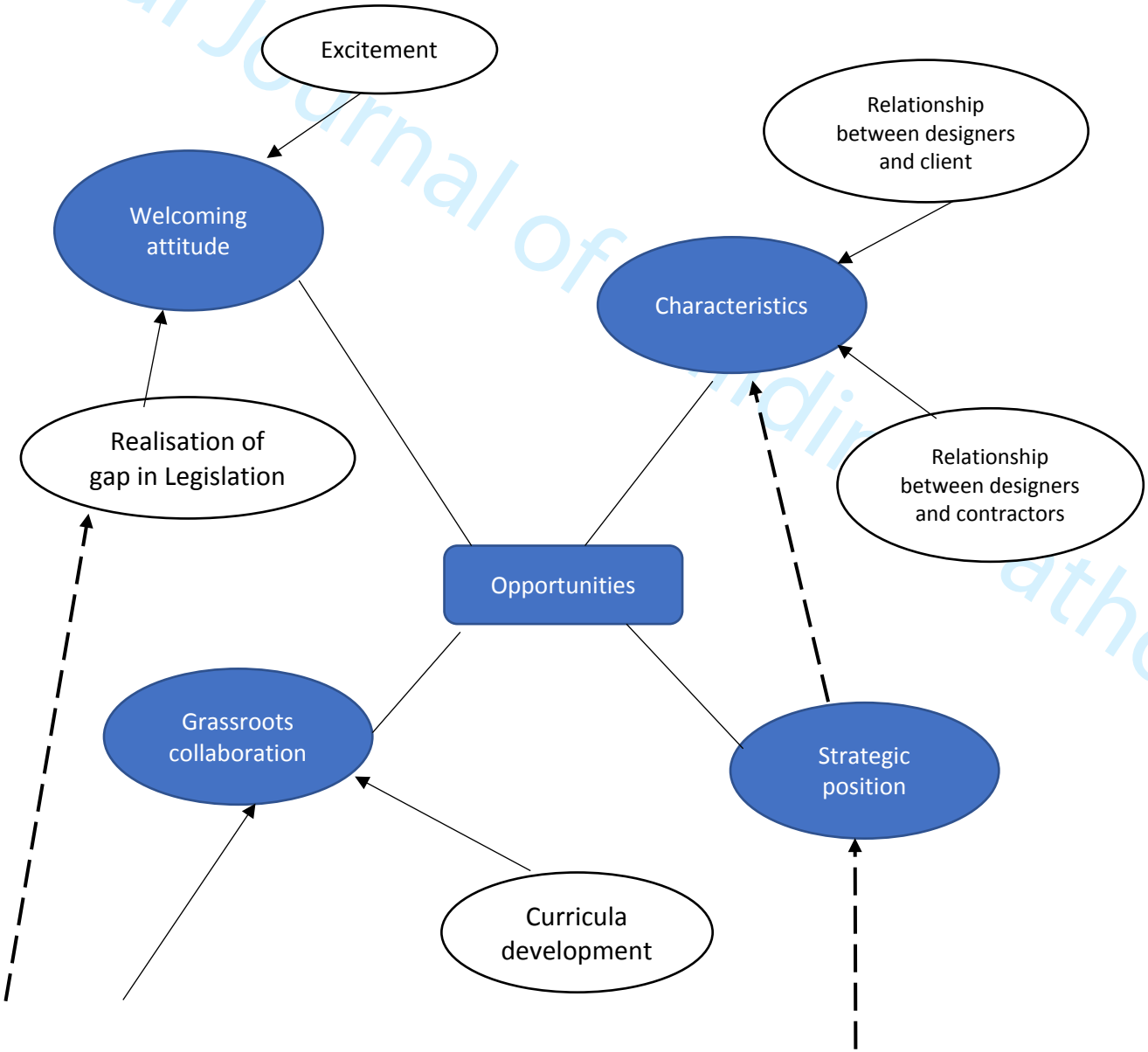
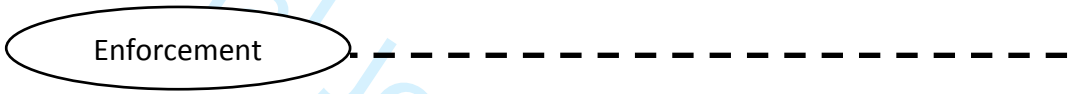


Figure 3: A section of possible causal relationship among themes and within themes.





Keys

Theme

Evidence

Dependent factor

Connection

Emerging link

Tables

Table 1: Summary of the opportunities for proposed statutory-based design for safety and other H&S responsibilities for designers

Themes	**Evidence**
Characteristics of construction	Types of client determine architects ability to drive H&S: some give you the liberty. Relationship with contractors and other designers. Use of integrated procurement. The industry is still virgin and naïve hence some may incline to change.
Strategic position of designers	Strategic position of designers: Ability to issues instructions at the design stage which will be influence in precontract stage. The strategic position of the Architect to drive what is built. The initiating role in design that the architect plays, a platform to design out hazards and influence other designs such as mechanical and electrical engineers; collaboration. Self-efforts: pressure on client for safety
Grassroots collaboration of stakeholders	Involvement of professional bodies in enforcement irrespective of how the enforcement is done. The perception that professional institutions and the regulatory councils therein are better enforcer than the state. Strategic position of professional bodies: professional are more inclined to them; they contribute to university curricula development and test people's toward professional qualifications. Submission that the building control body should be involved in regulation of DFS. The impression by building control body in some regions that high standards for design are a must for approval.
Welcoming attitude and features	Welcoming attitude: excitement on statutory H&S responsibilities. Willingness to develop DFS skills and knowledge more; quest for knowledge. Law on H&S to provide the much-needed legal backing for DFS and other H&S responsibilities for the designers.