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A FRAMEWORK FOR MANAGING CONTEXTUAL INFLUENCE ON HEALTH AND SAFETY IN CONSTRUCTION PROJECTS

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Abstract
This study examines the construction environment in developing countries towards developing a conceptual framework for managing contextual influence on health and safety (H&S) in construction projects. This is on the grounds that the solution to the challenging state of H&S in developing countries depends on understanding the internal and external environment that construction contractors operate in. While the contextual environments of construction contractors in developing countries continue to receive little attention, according to literature review; the little attention does not proffer process-based solutions for companies. In filling the above gap, an existing framework in literature is modified, demonstrating how contextual influence on H&S can be managed in construction activities. This framework will enable organisations to identify the contextual factors (CFs) that will impact on H&S and rank the perceived impact, degree of dynamism, influenceability, producing the outcome of calculated level of awareness for proportionate attention. While identifying the CFs could significantly challenge the use of the tool, the level of awareness it creates puts the organisation that adopts it at the forefront of H&S management.

Keywords: Construction, Contextual factors, Developing countries, Health and Safety, Projects, Toolkit

1 Introduction

Noteworthy, the construction industry is among the most hazardous, and continues to record a high fatality rate (Construction Industry Development Board (cidb) 2009; Health and Safety Executive (HSE) 2014). Typically, in 2013/2014, the British construction industry accounted for 42 fatal injuries (32%) (the highest across all industries) and 32,000 new cases of work-related ill health (HSE 2014). In South Africa, a cidb (2009) report based on Department of Labour records shows an increase in fatal injuries of 52 in 2004/5 to 162 in 2007/8, making the construction industry the third highest per 100,000 workers among others.

While issues such as fragmentation of the industry (Kheni et al., 2005), remain among the generic and inherent causes of the poor H&S record in the construction industry, authors (Kheni et al., 2010; Umeokafor, 2015) strongly contend that in developing countries, the solution is in gaining insight into the internal and external environment that the construction contractors operate in (cf. International Labour Organisations (ILO) 2009). Albeit, the growing emphasis on integrating the internal and external environment of organisations into H&S strategies (ILO, 2009; Kheni et al., 2010; Umeokafor, 2015), it still receives low attention in terms of H&S

issues (Nuwayhid (2004) cited in Kheni et al., 2010) and even outside H&S (Ploesser et al., 2009). Studies that have examined the aforesaid have done well in creating the awareness and demonstrating their influence on H&S (for example Kheni et al., 2010; Umeokafor, 2015) but have not offered the methodological solution(s) to companies for controlling the influence of the environment on H&S.

Consequently, the main objective of this study is to examine the construction environment in developing countries towards developing a tool, which integrates the management of contextual factors (CFs) into H&S management throughout the entire construction project life cycle. First of all, literature on the characteristics of construction and contextual issues will be synthesised, and an existing framework in business management will be modified to produce a tool tailored to construction H&S that meets the above objective. Thereafter, the developed framework will be presented with an exemplary application in a construction process.

2 Literature Review

2.1 Characteristics of the Construction Industry

The characteristics of the construction industry offer possible explanations to the H&S challenges in construction projects. For example, the issues below contribute to the fragmentation of construction activities, resulting to H&S challenges, thus: subcontracting (Mayhew & Quinlan 1997); difficulty in ensuring alliance between major parties in contracts, including subcontractors (Vilacini et al., 2012); differentiation in terms of technology, cultural, and organisational grounds (Lingard, 2013), and complexity or the uniqueness of construction projects (Kheni et al., 2005). Indeed, the use of subcontractors has been linked to unsafe construction practices, which may be due to lack of clarity in roles and responsibilities among subcontractors, *inter alia,* complexity in subcontracting relationships (Mayhew & Quinlan 1997). Such characteristics of construction (or the industry) are also challenges to construction and the industry. While the literature demonstration so far is generic to the industry, receiving adequate attention; the environment of organisations, especially in developing countries also explains the poor H&S record and remains under-examined.

2.2 Integrating Contextual Factor Management into Health and Safety Management

2.2.1 Defining contextual factors

Although authors note the deficiency of an adequate definition of CFs in academic literature (Kronsbein et al., 2014), the conceptualisation of the concept in this study is informed by definitions in studies (for example Edwards & Steins 1999; Rosemann et al., 2006; Kronsbein et al., 2014; Umeokafor, 2015) or descriptions in studies such as Kheni et al. (2010). The definition that CFs are '…dynamic forces constituted in the user groups' social, cultural, economic, political, technological and institutional environment…' can be seen in Edwards and Steins (1999). According to Schmidt (2000) cited in Rosemann et al. (2006), the environment can be described as 'the combination of all implicit and explicit circumstances that impact the situation of a process … in which a business process is embedded'. This tends to be in agreement with other literature discussions of CFs in terms of H&S (Kheni et al., 2010; Umeokafor, 2015), but perhaps from an external context perspective. Therefore, adopting a broad conceptualisation of CFs, they are depicted in this study as dynamic forces within the internal and external environment of organisations influencing its activities, perception, beliefs and attitude. This is where the external environment includes the political, socio-cultural, socio-economic, technological, institutional, demographic, and legal context; and the internal environment relates to conditions or factors within an organisation such as organisational

culture, leadership approach. It is, however, possible that CFs correlate (see Banker and Natarajan, 2008; cited in Kronsbein et al., 2014; Rosemann et al., 2007).

2.2.2 Overview of previous studies on contextual factors

Despite the influence of the contextual environment on H&S in the construction industry, Nuwayhid (2004) cited in Kheni et al. (2010) decry the inadequate attention it receives. For instance, an author reports the adoption of H&S policies, *inter alia*, regulations from developed countries, but some are irrelevant or even impracticable in developing countries such as Nigeria (Aniekwu, 2007). This is because they have not been designed based on the contexts of these developing countries. Most of the imported regulations adopted are goal-based, but according to Umeokafor, (2015), developing countries such as Nigeria, lack the wherewithal.

In contrast to the premise of inadequate attention to CFs, studies have examined the contextual influence on businesses. For instance, while studies (Kronsbein et al., 2014; Ploesser et al., 2009; Rosemann et al., 2006, 2007) examine CFs from a non-construction perspective, Kheni et al. (2010) and Umeokafor (2015) examine CFs from a developing countries' construction industry perspective in terms of H&S. The latter two studies have mainly examined external CFs. For instance, Kheni et al. (2010) have identified the key contextual influences on H&S in Ghana and found that owners/managers of small firms in Ghana mainly engage in H&S practices due to their working relationship with their employees and not because of regulatory threats. In Nigeria, Umeokafor (2015) reports an appraisal of CFs where inadequate regulation ranks highest with relative importance index of 0.80, in addition to 43.5 percent of the participants opining that accidents are predestined.

However, while the studies above have created the awareness and made recommendations, they have not offered organisations practical guidance to managing contextual influences. Kheni et al., (2010) echo this while proffering solutions to the impact of contextual issues on H&S practices in Ghana's construction SMEs, recommending practical guidance for construction firms as one of the ways of overcoming the barriers. In other words, awareness of contextual influence or factors is not enough; therefore, to mitigate the effect of the CFs on H&S, organisations need practical guidance to controlling the factors. Thus, a step-by-step toolkit for managing the contextual influence on H&S is imperative. The framework in this study is developed to fill this gap, offering practical day-by-day or month-by-month solution and bridging the gap between theory and practice.

2.2.3 Context knowledge related studies

Models or frameworks relating to context-awareness in business process performance are significantly covered in literature but have some limitations. Saidani and Nurcan (2007) propose a four-step approach for supporting context related knowledge, consisting context elicitation, context categorisation, context adaptation and measure, and business process installation. Between the second and third steps is the context tree (CT), with which, in addition to a three-dimensional vector, context can be modelled and categorised. However, the complexity of constructing CT and valuing the context makes it arguably limited to only domain experts and a particular domain (Saidani and Nurcan, 2007), so its transferability to other domains is not possible (Kronsbein et al., 2014).

Rosemann et al. (2008) focus on integrating context into a process model, where the CFs cover internal context, external context, and intermediate context, advancing our understanding of contexts and their impact on businesses. However, the model concentrates on the classification of the different general layers of CFs, overlooking the different subgroups within each layer (Kronsbein et al., 2014).

Using context-awareness puzzle, Ploesser et al. (2009) argue that the pieces of the puzzle should be incorporated into process management for context-awareness. The puzzle covering context mining and learning, context modelling, context taxonomies for industries, and context-aware process operations is to be applied in the order of appearance (*ibid*). However, it tends not to be fully transferable to construction H&S because of the characteristics of the construction industry. It does not factor in the degree of dynamism of CFs. Also, the ability of organisations to influence CFs tends not to be incorporated in the puzzle.

A more robust work is presented by Kronsbein et al. (2014), discussing the various ways that CFs can influence an organisation, covering contextual influence at entire organisational levels, organisational process levels, and organisational activity levels. The work of Kronsbein et al. (2014) involves: first, assessing the impact of CFs; then the ability of the organisation to influence the factors is also assessed. This will then determine the required level of awareness of the factors after which the 'degree of dynamism' will be assessed and then the frequency for reviewing the entire assessment is determined.

There are, however, limitations to the work of Kronsbein et al. (2014), of which they acknowledge. Firstly, they have not provided any guidance for identification of CFs, which is very crucial to the model. Secondly, the scale of measurement (low, medium and high) lacks a clear distinction. Thirdly, although not acknowledged by Kronsbein et al. (2014), the method used in factoring in the 'degree of dynamism' of the CFs can be considered as inadequate. It can be argued that it should have been factored in at the upper stage of the framework where alongside the perceived impact on the organisation, it informs the influenceability (see: Figures 1 & 2). Finally, no guidance for assessing the perceived impact of the CFs on the organisations has been provided.

From the above, the following intents form the proposed framework in the current study: mining of CFs; impact of CFs on H&S at various stages of the construction project, with adequate guidance; degree of dynamism of the CFs; influenceability of the CFs factored in after the evaluation of the latter two; the awareness level of the CFs.

3 Research Approach

This study investigates the contextual influence on H&S in the construction industry. Literature survey was undertaken to demonstrate the gaps in knowledge and practice, and in modifying a framework in business management (Kronsbein et al., 2014), identified limitations were tackled and the framework tailored to construction H&S. The tool practically guides construction firms in managing contextual influence on H&S. An exemplary practical application was also presented in this paper. As the study is mainly of qualitative paradigm, prompting quantification of some aspects of the tool, it is subject to bias and subjective. Thus, opinions of 28 construction H&S experts were sought in validating the framework, by sending a detailed application of the framework to them between the second week of September 2015 and third week of October 2015. However, none signified interest or was in the position then to take part in the validation process up until the time of writing this paper. The experts were made up of 26 construction H&S experts in South Africa, 2 in Nigeria. However, the academic scrutiny that this paper has gone through during the peer-review process has provided academic validation to the research (Manu 2012). This is because peer-review processes involve professionals querying the content of a paper so as to make an informed decision as to if the paper will be accepted for publication or rejected (Manu 2012).

4 Development of the Process Framework

4.1 Overview of the analytical design

Figure 1 shows the newly developed tool for managing the impact of CFs on H&S in construction projects. This is guided by: PI X DD - IF = LA. The CFs are identified and the perceived impact (PI) on H&S and the degree of dynamism (DD) are noted and evaluated [i.e. PI X DD). After the evaluation, the ability of the organisation to influence the contextual factor (influenceability (IF)] is then factored in to produce the level of awareness (LA). This will then determine the frequency of review and the action to take.

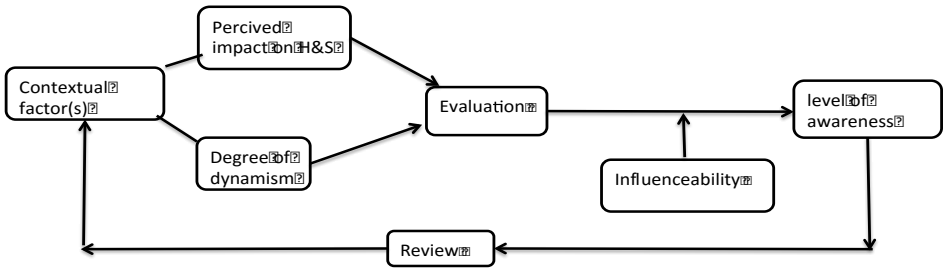

Figure 1. Overview of the framework (Source: Authors' conceptualization)

For this study, scales such as high (3), medium (2) and low (1), *inter alia,* have been adopted and a detailed guidance for measurement is presented. In H&S management, the tool can be applied at the various construction stages, construction processes and at various construction activities of the processes (Table 1). Table 1 details an exemplary application of the framework in an excavation process in a building project. It shows the identified context types, all in Figure 1 and how they are calculated. Figure 3 shows the application of the framework on a construction activity. The framework, however, is dependent on identifying the CFs, which may also be challenging but guidance is provided therein for the user.

4.2 Contextual factor(s): Mining of contextual factors

Although identifying CFs can be challenging (Edwards and Steins, 1999; Banker and Natarajan, 2008 as cited in Kronsbein et al., 2014) and its prediction difficult (Edwards and Steins, 1999), an attempt is made here to guide the users of the current framework on possible ways to identify CFs. A retrospective analysis in the case of contextual issues (Edwards & Steins 1999; Ploesser et al., 2009) on H&S data such as accident records, near miss records can outline the factors. This can also help predict possible outcomes in future events and behaviours of the factors (Edwards and Steins 1999) and even expose gaps in existing procedures (Ploesser et al., 2009). This is already commonplace in H&S for risk identification in areas such as risk assessment (see Windapo, 2013). However, what of the undocumented factors? This is where other ways of identifying CFs perhaps through the exchange of ideas among experts, consulting employees, employing the services of experts can come in. As earlier stated, these CFs can be framed under internal and external categories.

4.3 Perceived impact of contextual factor (PI)

After the mining of CFs in Figure 1, the perceived impact (PI) of the CFs will have to be ascertained. The PI of CFs on H&S is the implications of CF on H&S. Measuring the impact of CFs on H&S may be challenging, as there can be other contributory factors to the impact. However, it depends on the aspect of the impact that is considered. Going by the recommendation of HSE (2001) for measuring H&S performance, in the context of this study, the organisation should consider the following: the impact or contributory effects of the CFs on the hazardous activities of the organisations; the impact of the CFs on H&S management

systems; the impact of the CFs on ensuring positive H&S culture in the organisation, covering control, communication, competence and co-operation; and the contributory impact of the CFs to the accident, injury, ill health or fatality records.

From above, it is evident that the *PI* of *CF* on H&S can be based on lagging parameters such as accidents (see Sgourou et al., 2010). The PI of CF on H&S can also be based on leading parameters such as the impact on H&S management elements e.g. H&S audit (see Sgourou et al., 2010) ranking from high to low (Figure 2). For instance, for the lagging indicators such as injuries, the following scale can be used thus: high = fatality; medium = major injuries; low = minor injuries. For ill health, it can be high = more than 7 days out of work; medium = more than 3 days out of work, but below 7 days; and low if the days out of work is less than 3 days. For the PI in terms of leading indicators such as H&S management (e.g. H&S audit), which is subjective, the measurement below can be adopted. If the CF negatively impacts on H&S audit, resulting to no audit then the PI can rank high; if the audit is not thorough, the PI can rank medium; if the audit is good but with little limitations, the PI can be ranked low. This can be applied to the H&S culture context stated above.

4.4 Degree of dynamism (DD)

This stems from the constantly changing or developing phenomenon of the CFs (Edwards and Steins, 1999; Kronsbein et al., 2014). Highly contributory to determining the frequency of review, the points below indicate that this may be challenging to H&S, requiring adequate attention. Typically, as Figure 2 shows, it can rank from high to low. When it is ranked high, it poses a higher level of uncertainty and the likelihood of negatively impacting on H&S; thus, it requires constant attention. For instance, the inconsistency in the language of the casual workforce can be ranked high. However, when it ranks low, it does not pose the same level of concern, as it can be predicted to some extent. Additionally, a daily change in law is not possible so it can be ranked low. Any other CF of DD between the two examples above can be ranked medium. More importantly, the co-relationship among the factors and the continuum of the factors should be considered here.

4.5 Evaluation

This involves factoring in the PI of the CFs on H&S and the DD of the CFs before the 'influenceability' to make an informed decision (Figures 1 & 2). This is against Kronsbein et al., (2014) who consider the DD at the last stage to determine the frequency of review. The evaluation in the current tool stems from the premise that the DD of the CFs determines their criticality, as the likelihood of incidents is increased or decreased. As such, multiplying it with the perceived impact of the CFs before 'influenceability' (Figures 1 & 2) means factoring it in to present a better picture of the CFs (and their implications) to the organisation prior to considering their ability to influence the CFs.

4.6 Influenceability (IF)

The outcome of the above evaluation (in 4.5 and Figures 1 and 2) will inform the incorporation of the ability of organisations to influence the CFs (that is *IF*), providing the adequate level of awareness. For instance, the example in 4.4 (i.e. the inconsistency in the language of the causal workforce) may mean that the organisation can have a recruitment procedure where only workers that can communicate in the main language of most of the workers are employed. This means that they have influence power on the factor. As the DD is factored in before this stage, an informed decision can be made. The influenceability ranks from 1 to 3 with 3 being the highest. The instance above means that *IF* can be ranked 3 if the aforesaid recruitment strategy upholds across all potential workers. It can then be ranked 2 if the recruitment strategy is not applicable to all potential workers such as casual workers, perhaps, because of skills shortage

and/or that the available workforce is mainly of workers of different languages. Lastly, *IF* can be ranked 1 if it is not within the powers of the organisation to implement the aforesaid recruitment strategy, leaving it to fate. This will then inform the level of awareness.

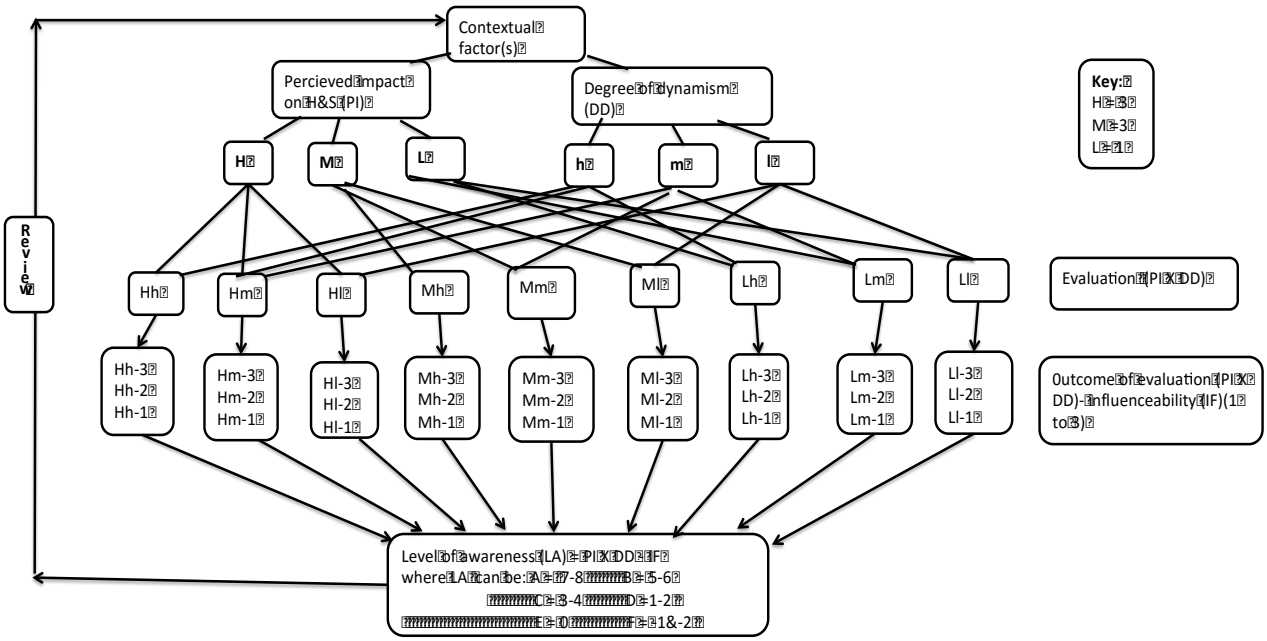

Figure 2. Detailed diagram of framework (Source: Modified from Kronsbein et al., 2014)

4.7 Level of awareness (LA)

As stated above, *PI X DD - IF = LA* is applied here, giving values ranking: A (7-8), B (5-6), C (3-4), D (1-2), E (0), and F (-1 & -2). 'A' shows the highest level of criticality and F the lowest. The value zero does not mean that the factor will be ignored, as it can still impact on H&S. Rather, it means that the level of attention it will receive will be lower than others that rank higher. When LA is E, it is negligible. LA throws the spotlight on the CFs as critical to achieving optimum H&S in construction projects. This provides a platform for organisations to channel adequate attention and resources to managing the CFs.

4.8 Review

This involves going through the entire process from the mining of CFs (Figure 2). This is highly informed by the LA, but DD may also be considered. Additionally, the characteristics of the construction industry make a case for constant review of the framework. Just as it obtains in the risk assessment exercise, a review of the framework may be conducted in events of, *inter alia,* a change of employee and/or work machinery.

5 Application of the Framework

5.1 Exemplary application of the tool to one construction project process

While Figure 3 shows a ground excavation process during the construction phase of a building project by a small and medium-scale enterprise in a developing country, Table 1 details the exemplary application of the framework in terms of Figure 3. It should be noted that the list of CFs in Table 1 is not exhaustive.

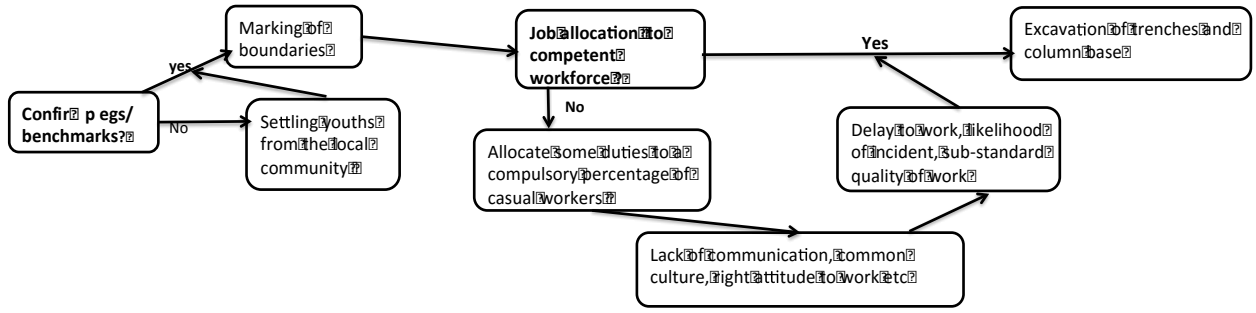

Figure 3. Selected activities in an excavation process in a building construction (Source: Authors' conceptualization)

Table 1. Tabular presentation of the application of the framework in Figure 3

Context layers	Context type	Example of contextual factor	Perceived impact of contextual factors on H&S (PI)	Degree of dynamism of contextual factor (DD)	Outcome of evaluation of PI X DD	PI X DD - Influenceability	Level of awareness
Internal	Organisational	Organisational structure	High	Medium	3 x 2 = 6	6 - 1 = 5	B
	Resource related	Training & skills of the workforce	High	High	3 x 3 = 9	9 - 1 = 8	A
External	Political	Inadequate governmental policies	Medium	Low	2 x 1 = 2	2 - 1 = 1	D
	Economic	Implication of incident and delay in work	High	High	3 x 3 =9	9 - 1 = 8	A
	Cultural	Owner/manager and workforce relationship	High	Medium	3 x 2 = 6	6 - 3 = 3	C
	Social	Complusory requests from community	High	High	3 x 3 = 9	9 - 1 = 8	A
	Technological	Unavailability of alternative equipment	High	low	3 x 1 = 3	3 - 1 = 2	D
	Environmental	Extreme weather	Low	Low	1 x 1 = 1	1 - 1 = 0	E
	Legal/institutional	Inadequate regulation of H&S and laws	High	Low	3 x 1 = 3	3 - 1 = 2	D
	Industry related	Lack of cohesion among workers	High	Medium	3 x 2 = 6	6 - 2 = 4	C

Source: Template modified from Kronsbein et al. (2014)

If not for the challenges of settling the youths and allocating some of the duties to the percentage of compulsory casual workers as specified by the community/contract, the excavation (Figure 1) would have been without any problems. Indeed, a site engineer on arrival on site to confirm the pegs and benchmarks of the already conducted setting-out activity before the commencement of work finds that there are youths of the community waiting for some unofficial apparent customs to be performed (see Figure 3). The youths were later paid off, thus increasing the project cost, delaying the work, in turn, affecting the allocated funds to H&S.

If there were adequate functional governmental policies protecting construction activities, such may not have happened. In this case, it is ranked 'medium' as it does not directly impact on H&S and ranked 'low' in terms of DD, as it is unlikely to change (Table 1). Its degree of influenceability is low (Table 1), as the organisation cannot influence the inadequate governmental policies. It also has a 'D' level of awareness, which is not critical. Internal factors such as skills of the casual workforce are considered to impact highly and directly on H&S; the

DD for the excavation process is also ranked high because of the inconsistency in the workforce (Table 1). Its influenceability is then ranked 'medium', as the organisation cannot afford to employ the workers permanently. In addition, they can negotiate with the community on the percentage of compulsory casual workers to employ. This is an instance of correlation with other factors, as it is influenced by the social factor in Table 1 that also ranks high. This is as a result of the community insisting that a certain percentage of the workforce be employed from the community, prompting differentiations in workforce attitude, language, culture to work, causing, *inter alia*, incidents, and delay in work (Figure 3). This, in turn, impacts on the organisation economically, ranking high in terms of the PI and high in terms of DD, as it varies depending on the cost due to the delay or incident (Table 1). The organisation can train the workforce on H&S and even try to instil common work culture, but all depends on the constituency of the workforce. Thus, it is ranked low with 'A' level of awareness, which is critical. The LA and the points in the 'review' subsection (4.8) inform the frequency of review.

6 Conclusion

A framework for managing CFs throughout the project lifecycle of construction projects is developed and applied in a construction process in the reported study. This stems from the premise that the impact of contextual issues on H&S remains highly underexamined, leaving organisations with no guidance to managing the contextual impact on H&S. The framework is made up of mining of CFs, then the perceived impact of the factors and the degree of dynamism are ranked. This is followed by factoring in the latter two in an evaluation process before the ability of the organisations to control the factors is considered. This takes us to the level of awareness enabling the organisation to channel adequate attention and resources to the factors. The review process is the last activity. Efforts are made in this study to guide the users of the tool to make a clear distinction in the scale of measurement of the tool. Identifying CFs may limit the efficacy of the tool, but the guidance in this paper can help overcome it. While this study may be subjective requiring a real life application, steps such as the academic validation of this paper reduces the level of subjectivity. It also, however, provides a stepping-stone to managing contextual influence on H&S on construction projects. As such, this framework can be validated in future studies based on a case study research approach. Also, areas such as the impact of the interaction among the CFs and their impact on H&S can be examined in further studies.

7 References

Aniekwu, N. (2007). Accidents and safety violations in the Nigerian construction industry. *Journal of Science and Technology*, 27(1), 81 – 89.

Construction Industry Development Board (2009). *Construction health and safety in South Africa.* Retrieved on 12-12-14 from http://www.cidb.org.za/documents/kc/cidb_publications/ind_reps_other/ind_reps_construction_h_s_in_sa_status_recommendations.pdf

Edwards, R. D. J., Davey, J. and Armstrong, K. A. (2014). Profiling contextual factors Which Influence Safety in Heavy Duty Vehicle Industries. *Accident Analysis and Prevention* 73, 340-350.

Health and Safety Executive (HSE, 2001) *A guide to measuring health and safety performance*. Retrieved on 22-09-15 from http://www.hse.gov.uk/opsunit/perfmeas.pdf

Health and Safety Executive (HSE, 2014) *Health and safety in construction in Great Britain, 2014.* Retrieved on 22-04-15 fromhttp://www.hse.gov.uk/statistics/industry/construction/construction.pdf

International Labour Organisation (ILO) (2009). *World day for safety and health at work 2009: Facts on safety and health at work*, ILO, Geneva. Retrieved on 23-08-15 from http://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/documents/publication/wcms_105146.pdf

Kheni, N. A., Dainty, A. R. J. and Gibb, A. G. F. (2005) Health and safety management practices of small subcontractors. In: *Khosrowshahi, F (Ed.), 21st Annual ARCOM Conference, 7-9 September 2005, SOAS,* University of London. ARCOM, Vol. 1, 105-114.

Kheni, N. A, Gibb A. G. F, Andrew, R. J. and Dainty, M (2010) Health and safety within Small- and medium-sized enterprises (SMEs) in developing countries: study of contextual influence. *Journal of Construction Engineering and Management* 135 (10), 1104 – 1115.

Kronsbein, D., Meiser, D. and Leyer, M. (2014) Conceptualisation of Contextual Factors for Business Process Performance. *Proc.:International MultiConference of Engineers and Computer Scientists, IMECS,* 12 - 14 March 2014, Hong Kong, Vol II.

Lingard, H. (2013). Occupational health and safety in the construction industry. *Construction Management and Economics*, 31 (6), 505 - 514.

Manu, P. (2012). *An Investigation into the accident causal influence of construction project features (*Doctoral Thesis University of Wolverhampton). Retrieved from http://wlv.openrepository.com

Mayhew, C. and Quinlan, M. (1997) Subcontracting and occupational health and safety in the residential building industry. *Industrial Relations Journal*, 28 (3), 192-205.

Ploesser , K., Peleg, M. Soffer, P. Rosemann, M. and Recker, J. (2009). Learning from context to improve business process. *BPTrends* 6(1),1-7.Retrieved on 30-8-15 from http://eprints.qut.edu.au/

Rosemann, M., Recker, J. Flender, C. and Ansell, P. (2006). Understanding Context-Awareness in Business Process Design. Proc.: *17th Australasian Conference on Info Systems (ACIS)* Paper 79.

Rosemann, M., Recker, J. and Flender, C. (2007). Contextualisation of business processes. *International Journal of Business Process Integration and Management* 3(1), 47-60.

Saidani, O. and Nurcan, S. (2007). Towards context aware business process modeling. Proc.: 8th workshop on *Business Process Modeling Development and Support*, Trondheim, BPMDS

Sgourou, E., Katsakiori, P., Goutsos, S. and Manatakis, Em. (2010). Assessment of selected safety performance evaluation methods in regards to their conceptual, methodological and practical characteristics. *Safety Science*, 48(8), 1019-1025.

Umeokafor, N. I (2015). An assessment of the influence of contextual environment on health and safety practices in the Nigerian construction industry. In Behm, M and McAleenan (Ed.), Proc.: *CIB W099 International Health and safety Conference,* 10– 11 Sept. 2015, Northern Ireland, UK.

Vilasini, N., Neitzert, T. R., Rotimi, J. O. B., and Windapo, A. O. (2012). A framework for subcontractor integration in alliance contracts. *International Journal of Construction Supply Chain Management*, 2(1), 17-33

Windapo, A. O. (2013). Relationship between degree of risk, cost and level of compliance to occupational health and safety regulations in construction. *Construction Economics and Building*, *13*(2), 67-82.