The 6th International Conference on Engineering, Project, and Production Management (EPPM2015)
2-4 September 2015
Gold Coast, Australia.

Conceptualised Integrated Health and Safety Compliance Model for the Ghanaian Construction Industry

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Abstract

Lack of stringent measures in safety and construction laws has been attributed to poor performance in Health and Safety (H&S) in the construction industry. The review of literature in the existing body of knowledge becomes paramount in order to continue with the research on the subject matter. The review will enable the road map for the development of the conceptualised integrated H&S compliance model for the Ghanaian construction industry. The conceptualised model theory form the bases of the discussion in this paper. A total number of fifteen studies relevant to accident causation theories were selected out of the total number of thirty studies reviewed, through a rigorous process. The assessment of H&S compliance model for the study was carried out through the combination of objective and subjective attributes. The Domino Theory form the basis for theoretical and conceptual framework of this paper. The study adopted various constructs from Accident Root Causes Tracing Model (ARCTM) and Domino theory. The hypothesised integrated holistic H&S compliance model is presented in this paper based on an in-depth review of the previous models. Government support and contractor's organisational culture serve as variable constructs identified as gaps in H&S compliance research. Discussions also included the integrated holistic model and the variables of the model, identification of the model and justification for the selected variables. The paper presented the hypothesised integrated holistic H&S compliance model. The gaps identified in H&S compliance research served as the variable constructs. They are government support and contractor's organisational culture.

Keywords: Compliance model, construction industry, Ghana, integrated health and safety, variables.

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Introduction

The attitudes of construction companies towards H&S in Ghana as indicated by Kheni and Braimah (2014) have been affected by institutional structure responsible for H&S implementing standards at workplaces. They cited poor coordination of the activities of the many institutions responsible for implementing H&S standards, lack of specific H&S regulation and undesirable level of compliance with relevant H&S legislationas the major problems. It is necessary for construction companies to have a positive change in their attitudes to enable Occupational Health and Safety (OHS) to be implemented. This can be achieved by re-structuring OHS administration system in Ghana (Kheni & Braimah 2014). Attempts were made to substantiate whether compliance with H&S in construction industry will reduce rate of accidents at the construction sites and enhance their performances. Therefore, H&S compliance model for the Ghanaian construction industry is presented based on the in-depth review of the previous models from literature in order to have lasting solution. In relation to the models reviewed, four measurement variables were finally selected. Two other measurement variables were added. They are Government support and contractor's organisational culture. They are the gaps identified in literature. The detail discussions of the H&S compliance model is given in the preceding sections. The discussions of the H&S model are based the selection of the variables for H&S compliance. This is followed by the conceptual model latent features, specification and justification of the models, structural component of the model, H&S compliance model and measurement component.

Objectives of the Study

The purpose of the paper is to present how the conceptualised integrated H&S compliance model for the Ghanaian construction industry will be developed.
The following steps were followed to achieve the purpose of the paper
To determine suitable variables for selection in the H&S compliance model
To identify the conceptual model latent features
To specify and justify the selection of the variables for the model
To show what entails in the structural component of the model
To present the integrated H&S conceptualised model and provide its measurement levels.

Design/Methodology

A total number of fifteen studies relevant to accident causation theories were selected out of the total number of thirty studies reviewed, through a rigorous process. The assessment of H&S compliance model for the study was carried out through the combination of objective and subjective attributes. The Domino Theory form the basis for theoretical and conceptual framework of this paper. The study adopted various constructs from ARCTM and Domino theory. Variables were selected based on the theoretical framework built from literature review. The two basic components of the model in Heinrich (1959), Perterson (1971) and ARCTM are chosen: safe acts and safe condition. This is based on the fundamental underpinning of two models, and the incorporated theoretical perspectives, which has been adopted in other similar studies. The model to be conceptualised within the broad theoretical framework is based on the approach used by

Heinrich (1959), Perterson (1971) and ARCTM. Based on the fundamental factors and constructs associated with all the previous models reviewed, the present model or conceptual framework model looks at safe environment (SE), safe act of workers (SAW), safe work condition (SWC) and reaction of worker to safe condition (RWSC), government support (GV) and contractor's organisational culture (COC).This will in turn predict the construction industry Health and Safety Compliance (HSC). The structural components of the model are: SE, SAW, SWC, RWSC, GS and COC. The measurement component of the hypothesised model comprises of the following HSC factors: SE = 6 measurement variables; SAW = 20 measurement variables; SWC = 7 measurement variables; RWSC = 5 measurement variables; GS = 5 measurement variables; COC= 11 measurement variables and HSC = 7 measurement manifest variables.

Selection of Variables for Health and Safety Compliance

Both objective and subjective attributes have been combined in the H&S study models for the assessment of H&S compliance. The Domino Theory by Heinrich (1959) and that of Adams (1976) had similar concept but, the elements were different (Heinrich et al., 1980). Weaver (1971) had similar concepts of elements or factors as Henrich's (Heinrich et al., 1980). Petersen's model developed in the 1971 had different concept with the Domino Theory (1959) that influenced many researchers during Heinrich time. The surrounding factors to the accident would be revealed by applying the multiple causation model. It is believed that the contributing factors, causes, and sub-causes are the main culprits in an accident scenario as inspired by the model (Abdelhamid & Everett, 2000). Behavior model, human factor model, and Ferrel theory relate to human error theory (Hosseinian & Torghabeh, 2012; Hughes & Ferrett, 2007; Taylor et al., 2004; Abdul Hamid, Yusuf & Singh, 2003). Rigby (1970) was of the view that human error is 'anyone set of human actions that exceed some limit of acceptability.

Most of these theories address the human (worker) as the main problem that makes an accident happen such as permanent characteristic of human, the combination of extreme environment and overload of human capability and conditions that make human tends to make mistake" (Abdelhamid & Everett, 2000). Abdelhamid (2000) indicated that there is every tendency of humans to make error under various conditions and situations but, the blame will fall on human most often (unsafe). Many important rules of the ARCTM have been derived from the effort of Heinrich (1959), Petersen (1971), Bird (1974), Ferrell (Heinrich et al., 1980) and Petersen (1982). ARCTM insist on specific issues such as worker training, worker attitude and management procedure problems should be recognised and modified in order to avoid reoccurrence of accident. Research conducted by Abdelhamid and Everett (2000) in identifying root causes of construction accidents concluded that the application of ARCTM should serve as a complement to accident investigation process and should be able to give solutions to accident occurrence and preventive measures in the construction industry. The three constructs proposed by ARCTM in addition to the two construct from Heinrich (1959) are supported and adopted for this paper. Both models have one construct in common. This paper considers the HSC bundle in a typical construction industry to contain SE with 6 variables; SAW with 20 variables; SWC with 7 variables; RWSC with 5 variables. Almost all the H&S compliance studies have these constructs conceptualised on frequent basis. However, the current paper brings into focus GS with 5 variables and COC with 11 variables. The gaps identified in the literature review are these two addition constructs and were found to be peculiar to Ghana as a developing country.

Safe Environment (SE)

The International Labour Organisation (ILO) (in The National Occupational Health and Safety Policy of South Africa (2003) indicated that safe work creates no obstacles to being competitive and successful. In fact, no country or industry has been able to jump to a high level of productivity without making sure that the work environment is safe. H&S in the workplace is about preventing work-related injury and disease, and designing an environment that promotes well-being for everyone at work (Safe work Australia, 2013; Heinrich, 1959). Knowledge is the key ingredient in providing a safe work environment - if everyone knows the correct procedures then, accidents and injuries can be kept to a minimum. The employer can achieve safe working environment through the provision of safe and healthy work environment, safe equipment and safe storage and transportation of dangerous substances. Both recklessness and undesirable traits leading to accident can be prevented by providing safe work environment in order to achieve H&S compliance in the construction industry. The current paper looks at safe environment which has been hypothesised for the development of a holistic H&S compliance model. Jamal Khan (in Mat Zin & Ismail, 2012:743) opined that ignorant behaviour and attitude of employers and employees contribute to issue on behavioural safety non - compliance to requirements of Occupational Safety and Health Act (OSHA) 1994". "Safety behaviour describes the behaviour that support safety practices and activities such as, providing safety training and safety compliance explains the core activities that need to be carried by employees according to OHS requirements in order to prevent workplace accidents" as indicated by Mahmood (in Mat Zin & Ismail (2012:743)."Most of the accident causation theories addressed the human (worker) as the main problem that makes an accident happen such as permanent characteristic of human, the combination of extreme environment and overload of human capability and conditions that make human tends to make mistake" (Abdelhamid & Everett, 2000).Safety behaviour or acts can be achieved by working with safety devices such as, personal protective equipment**,** use of equipment that are in good condition, follow the correct work procedure at any time work is to be carried out, employees should have good knowledge level of work and they should also obey work procedures whenever they are carrying out any activity.

Safe Act of Workers (SAW)

Smallwood (2010) identified workers attitude as one of the factors leading to unsafe act of workers. Workers safety behaviour will contribute to safety practices. A worker will conduct safe act under the condition that he has undergone safety training and has been provided with Personal Protective Equipment (PPE) to protect him from any harm. Hosseinian and Torghabeh (2012: 59), Fang et al., (2006), Abdul Hamid, Yusuf and Singh (2003) were of the view that a worker must perform safe acts and this should be in relation to safety standards: by working with PPE and should have enough rest before the day's work in order to prevent any accident occurring. The resultant of unsafe acts or unsafe conditions is accident (Heinrich et al. 1980). Heinrich (in Abdelhamid & Everett, 2000) argued that accident prevention is an integral programme, a series of coordinate activities, directed to the control of unsafe personal performance and unsafe mechanical conditions, based on certain knowledge, attitudes, and abilities. Occurrence of accident can be prevented if the chain of sequence in the Domino Theory is disturbed (Hosseinian & Torghabeh, 2012; Abdul Hamid, Yusuf & Singh, 2003). People (Human) are the main reasons of accident and management has the responsibility of preventing the accident (having the power and authority). It is therefore, mandatory to provide employees with safe work condition to enable them abide by H&S regulations and perform well at their respective work places.

Safe Work Condition (SWC)

According to Heinrich et al., (1980), "the carelessness or fault of a person is the negative features of a person's personality". Although, these unwanted characteristics might be acquired but, can be corrected. Errors and technical failures as a result of unsafe acts or mechanical or physical conditions can also be corrected to prevent accident occurring, by performing safe acts and under safe conditions (Hosseinian & Torghabeh, 2012; Abdul Hamid, Yusuf & Singh, 2003). According to Heinrich (in Abdelhamid & Everett, 2000) "accident prevention is an integral programme, a series of coordinated activities, directed to the control of unsafe personal performance and unsafe mechanical conditions, and based on certain knowledge, attitudes, and abilities". It is therefore, mandatory to provide employees with safe work condition to enable them abide by H&S regulations and perform well at their respective work places.

Reaction of Worker to Safe Condition (RWSC)

The ARCTM derived most of its important rules from the efforts of Heinrich (1959), Peterson (1971), Bird (1974), Ferrell (in Heinrich et al., (1980) and Peterson (1982) (Hosseinian & Torghabeh, 2012: 59); Jha (2011); Fang, Choudhry & Hinze (2006). ARCTM indicates that the unsafe condition contributes to the occurrence of accident, due to employees' inability to identify the existence of the unsafe condition before the activity is carried out. This can be prevented if employees' actions are performed under safe condition. Reaction of the employee to safe conditions depends on the fact that the employees identify the safe condition before any activity is carried out (Fang et al., 2006; Abdulhamid & Everett, 2000). An employee should be able to identify a safe work condition and conduct his activities under the H&S regulations (Fang et al., 2006; Abdul Hamid, Yusuf & Singh, 2003).

Table 1. Conceptual Model Latent Features

Latent Variable Construct	Measurement Variables	Label
Safe Environment (SE)	Safe and healthy work environment. Safe storage of equipment. Safe storage of formwork and false work Safe transportation of formwork and false work Safe transport of equipment. Provision of warning system.	SE 1 - SE 6
Safe Act of Worker (SAW)	Work with an authority on the job. Work at proper speeds. Inspect workplace before commencing any activity. Tidy up workplace at the end of any activity. Use appropriate tools/equipment. Ensure equipment /tools are in good condition before usage.	SAW 1 - SAW 20

	Ensue proper lifting, handling or moving of objects. Ensure proper stacking of objects or materials in safe locations. Avoid annoyance and horseplay at the workplace. Ensure the use of personal protective equipment (PPE). Do not remove safety guards from the workplace or equipment. Do not smoke where flammable materials are stored. Do not leave nails or other sharp objects protrudingfrom timber. Do not throw or accidentally drop objects from high levels. Do not work under the effects of alcohol and other drugs. Ensure proper positioning of tasks. Ensure proper posture tasks. Do not service equipment which is in operation. Concentrate on the task at hand. Work in good physical conditions	
Safe Working Condition (SWC)	Provision of Training. Provision of good inspection programme. Provision of insensitive to workers. Provision of safety regulation. Provision of good company safety policies. Provision of good salaries. Payment of Social Security and National Insurance Trust (SSNIT).	SWC 1 - SWC 7
Reaction of Worker to Safe Condition (RWSC)	Attend safety education programme. Attend safety training programme. Adhere to warning signs and notices. Follow safety regulations. Adhere to company safety policies	RWSC 1 - RWSC 5
Government Support (GS)	Formulate H&S policy of construction. Implementation of H&S policy by government representatives. Monitoring of H&S policy implementation by the government representatives. Provision of H&S training by government representatives. Provision of H&S policy update by government representatives.	GS 1 - GS 5
	Provision of PPE.	

Contractor's Organisational Culture (COC)	Provision of Signs/Notices on sites. Training of Workers on H&S. Involve workers in H&S programmes. H&S staffing. H&S inspection. H&S policy. Communication on H&S information to workers. Assessment of hazard identification and risk. Management commitment in H&S. Consultation on H&S information to workers	COC 1 - COC 11
Health and Safety Compliance (HSC)	Accident on sites will be minimised. Compensations paid on accident victims will be reduced. Reduce cost of training on H&S. Limited number of H&S education by government representatives. Limited number of H&S monitoring by government representatives. Improved in H&S performance. Increased in productivity.	HSC 1 - HSC 7

Model Specification and Justification

The theoretical conceptual framework for the current paper is built on the work of Heinrich (1959) and ARCTM which was also built on the previous accident models. Heinrich (1959) conceptualised that ancestry and social environment, fault of a person, unsafe acts and condition lead to accident. The reason for the cause of accident is people and management is responsible for the prevention of accident. Majority of accidents are due to human error and the accident can only be prevented if management provides conducive environment for the employees to work. Heinrich et al., (1980) indicated that five elements were in both Heinrich (1959) and Adams (1976). Both authors have similar concept but, the elements were different (Heinrich et al, 1980). Weaver (1971) stressed on the importance to recognise the root of unsafe acts or conditions, even though he had similar concepts of elements or factors as of Heinrich's. The role of management in accident prevention was also emphasised in a broader sense taking into consideration the root of unsafe acts or conditions (Heinrich et al. 1980).

ARCTM conceptualised that unsafe condition, reaction of worker to unsafe condition and unsafe acts of worker lead to accident. Peterson (1971) also conceptualised that accident are due to unsafe acts and unsafe condition. The non-compliance level of H&S in the construction industry are related to the environment, unsafe acts, unsafe condition, reaction of worker to unsafe condition and unsafe acts of worker. Both Heinrich (1959) and Perterson (1971) as well as ARCTM emphasised on unsafe acts and unsafe condition as the main causes of accident in the construction industry. The two basic components of the model are: safe acts and safe condition. Based on the fundamental underpinning of two models and the incorporated theoretical perspectives, which have been adopted in other similar studies. The models are therefore useful for conceptualising the present paper as a variety of H&S studies and H&S compliance being conceptualised within the broad theoretical framework. Therefore, the conceptual framework for this paper is primarily based on the approach used by Heinrich (1959) and ARCTM. The present model or conceptual framework for this paper looks at the safe environment, safe act of workers, safe work condition and reaction of worker to safe condition. These factors have been measured in most of the previous studies but, consideration has not been given to government support and contractor's organisational culture; which have been classified as the exogenous variables and their role in predicting overall HSC which is the endogenous variable. These will in turn, predict the construction industry HSC. This paper takes into account the needs of the construction industry and their compliance with the Policy and codes in Ghana as indicated in the other frameworks. It is apparent that some of the variables discussed in Table 1 will be measured by objective means, some by subjective means and some will include both forms of measurements. The reason for combining both objective and subjective indicators within the proposed model is supported by Campbell, Converse and Rogers, (1976), Falah, Al-Abed and Stan, (1995). The conceptual model theorises that HSC is established by the relationship that exists between the exogenous variables, which include the basic elements by which the subjective and objective measurements are linked. The variables identified from the review of literature are considered the major determinants of HSC. The determinants identified have been adopted to fit with HSC in the Ghanaian construction industry.

Structural Component of the Model

The integrated HSC model for the Ghanaian construction industry in the case of developing countries, is derived from safe environment (SE), safe act of workers (SAW), safe work condition (SWC), reaction of worker to safe condition (RWSC), government support (GS) and contractor's organisational culture (COC) in the process of achieving H&S in the construction industry. The postulated model is presented in Figure 1 (Model 1.0). The theorised model was derived from the works of Heinrich (1959) and ARCTM. The conceptualised model is based on the notion that compliance with H&S is related to the evaluation of many variables., such as SE, SAW, SWC, RWSC, GS and COC. It is difficult to discuss the principal variable without reference to variables of government support and contractor's organisational culture and inclusion of the other exogenous variables. The evaluation will depend on the compliance assessment of several indicator variables under each of the exogenous variables. The objective evaluation of HSC in this paper will be assessed by measuring the actual condition of the construction industry which is an exogenous variable in the model as shown in Figure1.

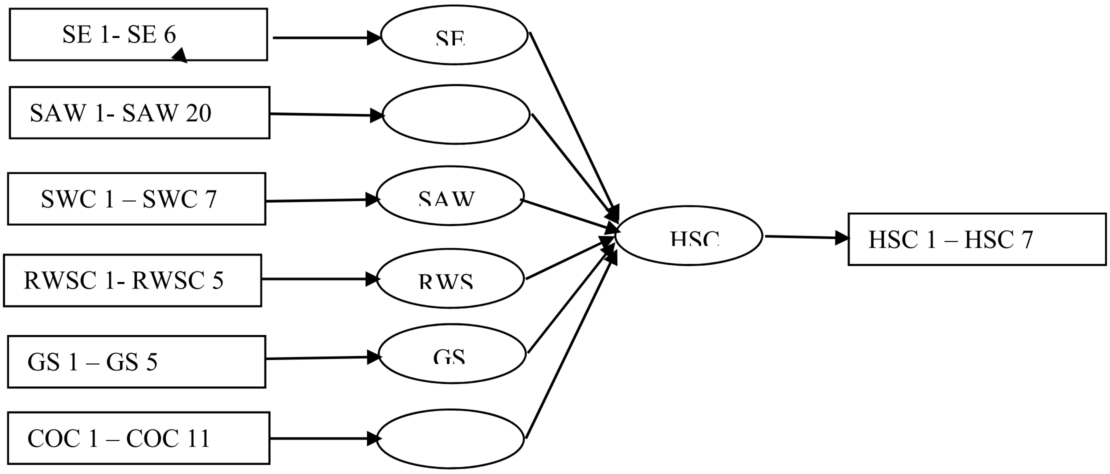

Figure 1. Conceptualised Mode for H&S Compliance

Measurement Component of the Model

The measurement component of the hypothesised model comprises of the following H&S compliance factors: SE = 6 measurement variables; SAW = 20 measurement variables; SWC = 7 measurement variables; RWSC = 5 measurement variables; GS = 5 measurement variables; COC= 11 measurement variables and HSC = 7 measurement manifest variables. The success for the consideration of H&S compliance for the benefit of the construction industry has been theorised in the present model. The Health and Safety Compliance (HSC) model has 7 measurement manifested variables as shown in Table 1 and Figure 1.

Justification for Model Development and how it is intended to be tested

There is no policy, body or process that governs Occupational Safety and Health in Ghana. There is a sign of inadequacy and the existence of inconsistent, sometimes conflict in research results about the factors that shape construction H&S compliance. The discrapancies in research is from the differences in samples. As the sample for most studies might not be representative of the population under study and the way the key variables may be defined. It may also be because of how construction research has been carried out in the global context of the studies or how the data was analyzed. The theorised H&S compliance model will guide the Ghanaian construction industry in the enforcement of H&S regulations. The H&S models will help to monitor and guide future use of the model to be developed for the construction industry in Ghana. Models from the Delphi survey and literature will be evaluated to enable the development of the H&S compliance model. Data gathered via the questionnaire survey will be analysed using Structural Equation Modelling (SEM) software Version 6.2. This will be used to assess the factor structure of the constructs. The conceptual variables will be tested as a prior using SEM of the questionnaire survey results. The SEM process will be undertaken as Confirmatory Factor Analysis (CFA) of the prior model for an integrated H&S compliance. Data from the Delphi and questionnaire survey on H&S compliance will be conceptualised and validated. The final output of the survey will be the model to be presented.

Recommendation

It is recommended that a Delphi survey should be carried out among experts (construction professionals and academics) to determine the outcome of H&S compliance.A median or inter-quartile (IQD ≤ 1) should be obtained for a consensus to be reached among the measurement variables.

Conclusion

The purpose of this paper was to highlight the **c**onceptualised integrated H&S compliance model for the Ghanaian construction industry.The theorised conceptual model is not based on prior study that HSC model is a multidimensional structure composed of seven latent variables as shown in Table 1.The **c**onceptualised integrated H&S compliance model will serve as a guide to project managers in the execution of H&S in the construction industry. The compliance of H&S by employees will contribute to reduction in accidents and increase in productivity.

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