# PROCEEDINGS 21 – 23

# NIGERIAN INSTITUTE OF QUANTITY SURVEYORS: 5TH RESEARCH CONFERENCE– NIQS RECON5

## 9TH – 10TH NOVEMBER 2020

## THEME:

## Confluence of Research, Theory and Practice in the Built Environment

**EDITORS:**

**Dr L. O. Oyewobi**
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# Proceedings of the 5th Research Conference of the Nigerian Institute of Quantity Surveyors



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# FOREWORD

The development of a country's economy depends on the activities of its construction industry, as construction plays a significant role in providing the infrastructure required to sustain any country's growth. This by implication means that no country can witness any growth without an efficient and effective construction industry. However, the construction industries of most developing countries continue to be a serious concern to all the stakeholders not only because of poor performance but due to lack of enabling environment to engender cutting edge research that will reposition the industry and infrastructure development at large.Against this background, the Nigerian Institute of Quantity Surveyors (NIQS) conceived the idea of research conference to bring people together; both the academics and practitioners to engage in fruitful discussions that will provide the foundation for research that will enhance the growth of Nigeria's Construction Industry and lead to the emergence of new research focus in Quantity Surveying and Built Environment in general. The conference holding in Minna, Niger State Nigeria has as its theme Confluence of Research, Theory and Practice in Quantity Surveying Profession for a Sustainable Built Environment.

Over the years, Nigerian Construction Industry (NCI) practitioners have given teaching experience to their numerous organizations and institutions. There is, however, a paradigm shift in the way Quantity Surveying and therefore all professions in the Built Environment are practiced. Conventional functions and obligations are being developed beyond the previous standard. There are evolving roles which need to be addressed, and one way to do so is to conduct research into the potential application of those concepts and theories that govern these roles.

The conference welcomes paper submissions from all over Nigeria, the host nation. This represents the interest of the stakeholders in the NIQS research conference. The research papers consist of 56 papers on all sub-themes. Research papers have undergone a two-stage paper review process. The first stage included the screening of the abstracts and, if necessary, the review of each abstract by the members of the International Scientific Committee of the Conference. The second stage included the review of the original full article of each accepted abstract by at least two members of the Scientific Committee. The two-stage review process has helped to raise the quality and standard of the papers accepted for the conference.

The LOC hopes that the delegates will gain substantial benefits from the research papers presented at the conference, both in terms of research and professional practice. This will help to achieve the key aim of the Nigerian Institute of Quantity Surveyors Research Conference, which is to serve as a bridge between academics and construction industry practitioners. On this note, I would like to warmly congratulate the Institute's Professional Development and Library Committee, the Chairman and the Members of the Conference Organizing Committee and all those who have contributed to the success of the conference.

QS Mohammed Abba Tor FNIQS, FSCIArb, FNIMN, MBA
President
The Nigerian Institute of Quantity Surveyors
November, 2020

# PREFACE

It is with great delight and profound pleasure that I gladly welcome all of you, esteemed attendees, to this first virtual edition of the Fifth Research Conference of the Nigerian Institute of Quantity Surveyors (RECON5), organized by the Association of Quantity Surveyors / Educators. NIQS RECON is a bi - annual conference, and RECON5 is the fifth of the series.

The 5th Research Conference (RECON5) of the Nigerian Institute of Quantity Surveyors (NIQS) is a follow-up to previous four editions, which was hosted last by Enugu State University of Science & Technology, Enugu. The goal of the Research Conference is to provide a forum for researchers and practitioners in the Built Environment to address key issues and broaden knowledge domains in such a way as to include new thematic areas in order to promote greater participation and to eliminate barriers in areas of research interest that are fast becoming global best practice.

It was expected that the theme — the Confluence of Research, Theory and Practice in the Built Environment — would increase the required knowledge and understanding of the topical issues of collaboration between scholars and/or professionals. The level of participation in the subject matter of the conference has been sustained since the previous event, when hundreds of related abstracts were submitted for presentation at the conference. They were subjected to a double-blind peer review process prior to the publication of the final papers for the conference.

It is expected that presentations at theconference will be able to inform policy formulations across Nigeria and the Built Environment in particular. The broad sub themes covered by the conference include:

**Construction**
Building Information Modelling (BIM)
Cost and value Management
Construction Procurement and Contract administration
Change management
Financing of Infrastructureprojects
Construction education and training
Disaster management
Concept of sustainability in construction
ICT in construction
Knowledge management and construction organisations
The construction industry and national economy
Project management
Public private partnership
Health and safety

**Real Estate and Land**
Housing policy and property
Planning challenges in Urban development and management
Asset, property and Facilities management

**Ethics and Legal Issues in Construction**
Alternative Dispute resolution
Building Regulation Control
Construction Contract Laws
Law of property
Legal educations in Construction and property
Professional Issues and Ethics in the Built Environment
Taxation

Warm appreciation is expressed to researchers who have successfully undergone a two-tier peer review procedure in order to have their papers accepted and published in this proceeding. The review process would have not been possible without the kind support of the members of the Scientific and Technical Committee. The LOC is grateful for this voluntary service, which is central to the quality of accepted papers.

I would like to take this opportunity to appreciate the President of The Nigerian Institute of Quantity Surveyors, Abba Tor, FNIQS, the past and the current National Executive Council (NEC) for their commitment and support. I also wish to thank the local organising committee led by Dr Yakubu Mohammed for their commitment to the success of the conference.

QS Dr Ganiyu Amuda-Yusuf FNIQS
Secretary, Professional Development & Library
9th - 10th November 2020 *Federal University of Technology, Minna*

The Nigerian Institute of Quantity Surveyors
November, 2020

# ACKNOWLEDGEMENTS

The Organizing Committee of the NIQS Research Conference (RECON 5) would like to express its gratitude to the President, the Nigerian Institute of Quantity Surveyors, QS Abba Tor, FNIQS and to the entire past and present Executive Council of the Institute for the Support of the Association of Quantity Surveying Lecturers / Educators (AQSLE) and to individuals for their support of the conference. The organisers are appreciative of the efforts of Dr Ganiyu Amuda-Yusuf, Secretary of Professional Development and Library towards the success of RECON 5.

We thank Prof. Ahmed Doko Ibrahim, Chairman of the Quantity Surveyors Lecturers/Educators' Forum, for the vision of the Research Conference as a platform for developing strong research work in the industry. We are also grateful to the Chairman of the Organization Committee, Dr. Yakubu Danasabe Mohammed, for his contributions and unflinching support. The Niger State Chapter of the NIQS is commended for their efforts to carry out this enormous mission.

The efforts and unique support of the Scientific and Technical Committee, which has worked hard and long to prepare refereed and edited articles and written conference proceedings, are truly appreciated. The contributions of Dr Luqman Oyekunle Oyewobi, Prof A. D. Ibrahim, Dr Kasimu Alhaji Mohammed, Dr Abdulganiyu Adebayo Oke, Dr Abdulwasiu Adeniran Ola-awo and Mr Ibrahim Inyass Adamu (Conference Editorial Assistant) are warmly welcomed. We are truly thankful to the authors, participants, conference organizing committee and all academic colleagues especially Dr A. A. Shittu, for their immense contribution to the success of this conference.

Finally, we are thankful to Prof R. A. Jimoh of Building Department, Federal University of Technology Minna, for his support in the review process. Any mistake contained in this work is accidental and very greatly regretted.

**Dr Y. D. Mohammed**
**Chairman, Local Organising Committee**

## DECLARATION

All the papers in this conference proceedings undergone double-blind review process at both abstract and full paper stage by members of the Scientific Committee. This process involves detailed screening of the abstracts and papers by at least two referees, reporting of comments to authors, modification of papers by authors whose papers were accepted by the reviewers, and re-evaluation of revised papers to ensure quality of content.

## THE PEER REVIEW PROCESS

In order to maintain and ensure a high-quality conference process, the organizers of this conference adapted a comprehensive two-stage peer review process to the papers submitted by at least two recognized experts in the field of the paper.

At the first stage of the reviews, each abstract received was reviewed in order to ensure: its appropriateness to the theme of the conference, originality of the paper, the intellectual rigour and the intended contributions to the knowledge after which it was sent to at least two reviewers. At this point, a total of 111 abstracts were received and sent to the reviewers. Subsequently, the authors of approved abstracts received comments from the reviewers and were recommended to proceed to complete paper submission, including all suggested changes in the revised abstracts.

A total of 61 full papers were obtained and submitted for peer reviews. The comments and suggestions arising therefrom were then forwarded to the authors of the accepted papers requiring that they address all of the issues raised by the reviewers. Follow-up revisions made by reviewers to the original authors' papers were also provided to the authors to aid in the revision of their papers. Authors whose papers were rejected were also provided with comments from the reviewers so that they could understand the flaws identified by the reviewers. It was assured that, during the peer review process, members of the paper review committee, editors and conference organizers were not involved in the review of any paper they wrote or co-authored.

A total of 56 papers in which the authors showed clear evidence that all the suggestions of the reviewers had been addressed were accepted in the conference proceedings.

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# IMPACT OF HEALTH AND SAFETY PREVENTION COST ON CONSTRUCTION COST IN KWARA STATE

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## ABSTRACT

Construction activities involve risky and unhealthy operations which give rise to mortality and morbidity rate and adversely affect the overall construction cost. However, Stakeholders (especially contractors) within the construction industry believe that investment in health and safety (H&S) programme increases overall construction cost and therefore tend to neglect relevant accident prevention activities on construction site. There is limited empirical evidence to back this claim. Therefore, this study assessed the impact of H&S prevention cost on construction cost in Kwara State using cost data of previously completed projects. Data collection were through structured questionnaires. Research population constituted 40 professionals who participated in the preparation of invitation to tender and award of contract; and cost data from the archive of Kwara State Ministry of Works and Housing on sixty (60) construction projects awarded and completed between 2006 and 2016.Analyses of data were done using Relative Importance Index (RII) and Pearson Correlation. The study identified 35 elements of H&S programme, which form the basis for H&S prevention cost forecast, under 4 major components out of which safety manager on site (RII = 0.78), onsite safety inspection (RII=0.71), safety helmet (RII=0.74) and tool-box talk (RII=0.44) were the most important under each component. Health and safety prevention cost were observed to fall between the range of 1-10% of the contract sum. It was discovered that there exists a strong positive and significant relationship between H&S prevention cost and construction cost. Thus, H&S prevention cost and construction cost increases together. It was, therefore, recommended that adequate cost control measures should be adopted to checkmate H&S expenditure during construction process instead of total avoidance H&S programme.

**Keywords:** construction, cost, elements, health and safety programme, prevention

## INTRODUCTION

Construction industry immensely contributes to the economic growth of a nation and occupies a central position in the developmental plans of developed and developing countries (CIDC, 2016). Construction activities and project execution usually take place outdoor under conditions not suitable for safety and health. Consequently, workers in the construction sites are subject to the dynamic nature of work, the location of work and the mix of worker. Overtime, this has resulted in high accident and fatalities incidence, thus affecting construction project performance negatively. In Nigeria, the construction industry has the largest employed labour and remains the riskiest of all industries in terms of health and safety hazards despite its import to national economic development (Mohd *et al.*, 2008; Mahmud *et al.*, 2015).

Every year many people fall victim to injury, harm and even death caused by health hazard and accidents on construction site and the leading causes were identified, by OSHA, and include falls, electrocution, struck by object and caught in/between (Pete, 2013). Kadril *et al.* (2014) argued that negligence was the major cause of accidents on construction sites. Faith (2014) also reports that 29%, 21% and 13% of workers who predisposed to occupational accident in construction site are unqualified workers, moulders and plumber, respectively. Kadril *et al.* (2014), in addition, confirm that labourers are the major class of workers that are mostly affected by these accidents, and further showed that they consist of 53.33%, 50% and 60% amongst the multinationals, large scale and small-scale firm respectively. Olutuase (2014), however, opines that though a construction job or work environment is considered as highly hazardous the likelihood of accident can be control and this will largely depend on "work situation" which is humanly controllable.

Thus, the provision of aids and strict adherence to safer construction practices improves productivity because productivity of labour and project performance are directly hampered by inadequate labour safety on site (Shree and Murali, 2016). According to Rafiq *et al.* (2008), the adoption of a safety management system in the construction industry provides enormous opportunities for saving the cost of accidents including investigation costs, supervisor's time diverted, clerical efforts, production downtime, medical expenses, damage to equipment or material/product, sick pay, repairs, expenditures on emergency supplies, legal costs, court fines, cost of insurance, public liability claims, business interruption, loss of expertise and experience, training of replacement staff, loss of goodwill or loss of cooperate image. The importance and need for implementing measures to improve the performance of construction industry is therefore a major concern to the Nigeria construction industry. One of the means identified is a conscious process of progressively monitoring the performance of projects based on relevant indicators. The UK working groups on Key Performance Indicators (KPIs) listed ten parameters for benchmarking projects, in order to achieve a good performance. These include seven project performance indicators namely: construction cost, construction time, cost predictability, time predictability, defects, client satisfaction with the product and client satisfaction with the service; and three company performance indicators namely: safety, profitability and productivity. Therefore, the traditional performance measurement of time, cost and quality have ceased to be the only benchmarks for construction projects. In recent years there is an acute focus on health and safety requirements, especially in regards to accidents prevention in construction site, because of the challenging impact of accident on construction performance (Takim and Akintoye, 2002; Shibani *et al.*, 2013).

The definition of health and safety prevention cost, otherwise referred to as accident prevention cost, is established in literature. Laufer (1987) explains the meaning of health and safety prevention cost in terms of its components. It was stated that health and safety prevention cost encompass expenses for safety planning, purchase of equipment and protective installations, training of personnel, salaries for safety staff, safety measurement and accident investigation. Elias *et al.* (2011) added that health and safety prevention cost captures the expenditures by contractors to prevent accidents on site and to ensure maximum benefit. These objects of safety expenditures relate to elements of health and safety programme and form the basis for determining health and safety prevention cost during the design stage. In addition, it is obvious from the previous discussions on the definition of health and safety that effective management practice is required to ensure good health and safety performance in construction site. Therefore, in the context of this work health and safety prevention cost are those specific H&S Management provisions put in place to prevent accidents as already discussed above.

Limpakornkul (2006) finds that safety management system in developing countries need improvement. It was observed that some stakeholders within the construction industry lack understanding of safety management and thus perceived safety cost as a burden. It was further suggested that promotion of construction health and safety knowledge in terms of cost can change the notion. Okoye and Okolie (2014) and Muhammad (2015) further assess the opinion of construction stakeholders on the relationship between health and safety programme and overall construction cost and discovered that majority of construction workers belief that implementation of H&S programme significantly increases the construction cost. It is therefore necessary to verify this claim by using actual cost data of previously awarded and successfully completed construction projects. The aim of this study was therefore to assess the impact of H&S prevention cost on construction cost in Kwara State using cost data of previously completed projects. The objectives pursued to achieve this were: to identify the major and applicable elements of health

and safety programme used to forecast health and safety prevention cost of these projects; and to determine the relationship between H&S prevention cost and construction cost.

## LITERATURE REVIEW

### Occupational Health and Safety Management in Nigeria

Health and safety management is a major concern to all stakeholders in the construction industry due to continuous occurrence and impact of accidents on construction site (Muiruri and Mulinge, 2014). According to Robson *et al.* (2005) health and safety management system is concern with the integration of organizational elements engaged in the continuous cycle of planning, implementation, evaluation, and continual improvement geared toward the abatement of occupational hazards on construction site. Some of these elements include organizations' health and safety relevant policies, technical resources, accountability structures and practices, hazard controls, quality assurance practices, evaluation practices, and organizational learning practices. However, the effectiveness of safety management undertaking is essential for goal realization within an organization. It is established in existing literatures that the level of effectiveness differs from country to country and from construction company to construction company. Olutuase (2014) finds that existing management system in Nigeria are poorly organised and characterised by ineffectiveness and poor documentation. Hallowell (2012) attributes these problems to transient nature of project, individuality of construction project and project complexity. Diugwu *et al.* (2012) however argue that statutory regulation to ensure proper adoption and implementation of health and safety management systems are either inadequate or ineffective. It was further revealed that organizations are unwilling to give enough attention to health and safety management. Waziri *et al.* (2015) also fault the strength of regulations and the level of compliance which account for the effectiveness of health and safety measures and performance in Nigeria. Thus, the performance of health and safety in Nigeria largely depends on the effectiveness of health and safety management system.

There is an agreement among researchers on how health and safety management in Nigeria can be improved. Waziri *et al.* (2015) suggest the enforcement of effective health and safety standards and guidelines to reduce accidents on construction sites and ensure safe working conditions. Diugwu *et al.* (2012) call for the revision of the laws guiding health and safety management and regulation. This study therefore assessed the health and safety management system for public project in Kwara State with specific reference to financial commitment and the level of implementation of health and safety programme on construction site.

### Occupational Health and Safety Cost

Accidents rate in the construction industry is much higher than the average in other sectors of the economy. This has been recognized as the outcome of poor health and safety management system. In addition to the increase in accident rate, mismanagement of safety issues on construction sites also generate high economic cost, often absorbed directly by the employer and consequently results to reduction in the profits of the construction projects (Pellicer *et al.*, 2014). The health and safety cost of a construction project differs from place to place. No two organization can have the same costs, even if they choose, measure, and count the same items as components of safety costs (Prichard, 2002). Pellicer *et al.* (2014) classify health and safety cost into four categories: insurance cost, prevention cost, accident costs, and recovery costs; and these costs can be assessed during the design phase. Prichard (2002) however asserts that safety cost for inclusion in construction bid requires a different degree of detail than justifying expansion of the corporate safety function.

There are convergent views on health and safety prevention cost in existing body of knowledge. Lopez-Alonso *et al.* (2013) define prevention cost as those incurred in order to fulfil legal requirements related to accident prevention, to implement measures to prevent accidents during construction work and to improve health and safety conditions in all areas of the work performed. According to Pellicer *et al.* (2014), safety prevention cost component includes individual protection elements, collective protection elements, safety and control systems for machinery and equipment, company medical service and first aid supplies and prevention service (of the company itself or another service provider). Similarly, Tang *et al.* (1997) highlight three components of safety investment which include safety administration personnel comprising site staff and head office staff; safety equipment such as purchasing of safety boots, googles, helmets, first-aid facilities, and any other equipment that provides safety; and safety training and promotion.

Hallowell (2011) discovers that the cost of construction accident has an immense impact on the financial success of construction organization and also increase the overall costs of construction up to 15%. Rafiq *et al.* (2008) further listed the cost of accidents which include repairs, medical expenses, damage to equipment and materials, sick pay, public liability claim, business interruption, loss of expertise, training of replacement staff, cost of insurance, production down-time and loss of cooperate. These enormous impacts are expected to spur the implementation of various management techniques to reduce the frequency of the accident. But Okoye and Okolie (2014) reveals that construction stakeholders, especially contractors, scarcely plan and implement health and safety programmes and policies. It is assumed that the implementation of health and safety programme for construction project increases the overall cost of the project without any consideration for the resultant benefits (Muhammad *et al.*, 2015). This uninformed assumption has continued to impact health and safety performance negatively in Nigeria. Hence, there is need to know the empirical relationship between health and safety prevention cost and construction cost, this will form the basis for construction stakeholders to compare prevention cost against accident cost and also improve health and safety management performance.

## Health and Safety Prevention Programme

Health and safety problems are obtainable on virtually all construction sites and construction companies implement a wide variety of methods to prevent accidents on construction site (Hallowell, 2011). According to Mensah (2010), those employed to undertake construction work on site should be adequately trained, competent, and fit to carry out the task without jeopardizing their own or others health and safety; well-coordinated and given explicit instructions; have access to the appropriate tools, equipment, plant and protective clothing; have arrangements for employees' health surveillance where required, including reports on accidents or work-related illness to the appropriate authorities within a reasonable time frame.

The elements of health and safety prevention programme are well established in literature. Rajendran and Gambatese (2009) identify 50 elements of health and safety prevention programme under 13 categories. Hallowell (2011) also lists 13 elements from existing literature that are most effective they include upper management support, subcontractor selection and management, employee involvement, substance abuse programs, job hazard analyses, frequent worksite inspections, safety and health committees, project-specific training, safety manager on site, safety and health orientation and training, written and comprehensive safety and health plan, recordkeeping and accident analysis and emergency response planning. The United States Department of Labour through its occupational safety and health administration (OSHA) also lists four major components of health and safety programme which include management

commitment, worksite analysis, hazard prevention and control, and safety and health training. This study therefore made use of more generally and frequently used elements under the four identified components by OSHA, as presented in Table 1, to rank those mostly implemented in Kwara State.

Table 1: Key Elements of Health and Safety Prevention Programme

| Major Components | Key Elements |
|---|---|
| Management Commitment | Health and safety policy<br>Organizational communication<br>Safety budget<br>Support in the use of safety principle and practice<br>Safety meeting<br>Assignment of responsibility<br>Safety and health committee<br>Emergency response planning<br>Safety manager on site |
| Worksite Analysis | Routine job hazard analysis<br>Accident investigation<br>Onsite safety inspection<br>Safety need survey<br>Safety audit<br>Risk assessment<br>Record keeping |
| Hazard Prevention and Control | First aid<br>Fire protection equipment<br>Respirator<br>Safety belt<br>Ear plug<br>Eye protection<br>Safety shoe<br>Safety glasses<br>Gloves |
| Health and Safety Training | Substance abuse programme<br>New workers orientation<br>Employee assistance programme<br>Project-specific training<br>Tool-box talk<br>Hazard communication<br>Fire safety<br>Material handling<br>Workplace violence |

Source: Authors' Compilation of Literature (2020)

## METHODOLOGY AND DATA COLLECTION

This research employed the use of both primary and secondary sources to collect data. Well-structured questionnaires were designed and distributed to professionals to gather data from the primary source while secondary source include an extensive review of literature using journal articles and other published books and cost data from the archive of Kwara State Ministry of Works and Housing. Sixty (60) construction projects awarded and completed between year 2006 and 2016 were studied in this research.

Population for the research constitutes the number of public construction projects in Kwara State supervised by the ministry of works and housing, and professionals who took part in the design, tender and implementation phases of the projects. Purposive sampling method was used to select

the sample for the study. The questionnaire was developed based on the literature that examined the elements of health and safety prevention programme. These literatures include Rajendran and Gambatese (2009), Hallowell (2011) and Pellicer (2014). The identified elements in the previous studies were adapted to reflect Nigerian construction industry context as shown in Table 1. This was justified by Umeokafor (2017) who states that health and safety issues in developing countries should be addressed contextually.

Tables and figures were employed to present the data extracted from the questionnaires administered. Analysis of data was carried out using relative importance index (RII) and Pearson Correlation to determine the level of implementation of the identified elements of health and safety programme adopted in Kwara State and the relationship between health and safety cost and construction cost. The analyses were carried out with the aid of Statistical Package for Social Sciences (SPSS) software. Conclusions and recommendations made at the end of this research were based on the research findings.

## DATA ANALYSIS, PRESENTATION AND DISCUSSION OF RESULTS

### Description of sample

The cost data of 60 construction projects which were awarded and completed between year 2006 and 2016 were extracted. Also, 40 questionnaires were administered, and 26 were returned completed, of which 23 were valid for analysis. The response rate was 57.5% which is an acceptable response rate.

### Respondents' profile

According to Table 2, a sizeable number of respondents were construction managers representing 65% of the total respondents, quantity surveyors (17%), Architects (9%) and other construction professionals (9%). This implies that majority of the respondents were construction managers.

Table 2: Background of respondents

| Profession | Frequency | Percentage |
|---|---|---|
| Construction manager | 15 | 65 |
| Quantity surveyor | 4 | 17 |
| Architect | 2 | 9 |
| Others | 2 | 9 |
| Total | 23 | 100 |

Table 3 shows that majority of the respondent constituting 70% have a working experience ranging from 5 – 10 years while 13% of the respondents have above 20 years of experience. The period in both categories of respondents are relatively long enough to provide a reliable response.

Table 3: Respondents' years of experience

| Experience | Frequency | Percentage |
|---|---|---|
| Less than 5 years | 3 | 13 |
| 5 – 10 years | 16 | 70 |
| 10 – 15 years | 1 | 4 |
| 15 – 20 years | 0 | 0 |
| Above 20 years | 3 | 13 |
| Total | 23 | 100 |

## Analysis of the elements of health and safety prevention programme

The results of the RII showing the identified elements of health and safety prevention programme, in order of importance, are presented in Table 4.

Table 4: Ranking of Key Elements of Health and Safety Prevention Programme

| **Management Commitment** | **RII** | **RANK** |
|---|---|---|
| Safety manager on site | 0.78 | 1st |
| Support in the use of safety principles and practice | 0.74 | 2nd |
| Organizational communication | 0.73 | 3rd |
| Safety budget | 0.70 | 4th |
| Health and safety policy | 0.68 | 5th |
| Assignment of responsibility | 0.67 | 6th |
| Emergency response planning | 0.66 | 7th |
| Safety and health committee | 0.60 | 8th |
| Safety meeting | 0.56 | 9th |
| **Worksite Analysis** | **RII** | **RANK** |
| Onsite safety inspection | 0.71 | 1st |
| Risk assessment | 0.69 | 2nd |
| Record keeping | 0.68 | 3rd |
| Safety need survey | 0.65 | 4th |
| Routine job hazard analysis | 0.63 | 5th |
| Safety audit | 0.63 | 5th |
| Accident investigation | 0.62 | 6th |
| **Hazard prevention and control** | **RII** | **RANK** |
| Safety helmet | 0.74 | 1st |
| Safety shoe | 0.74 | 1st |
| First aid | 0.73 | 2nd |
| Fire protection | 0.72 | 3rd |
| Safety glasses 0.71 | 0.71 | 4th |
| Gloves | 0.70 | 5th |
| Safety belt | 0.68 | 6th |
| Eye protection | 0.66 | 7th |
| Respirator | 0.63 | 8th |
| Ear plug | 0.63 | 8th |
| **Health and safety training** | **RII** | **RANK** |
| Tool-box talk | 0.44 | 1st |
| Fire safety | 0.43 | 2nd |
| New workers' orientation | 0.41 | 3rd |
| Employee assistance programme | 0.41 | 3rd |
| Project-specific training | 0.40 | 4th |
| Material handling | 0.40 | 4th |
| Hazard communication | 0.38 | 5th |
| Workplace violence | 0.38 | 5th |
| Substance abuse orientation | 0.37 | 6th |

Table 4 shows 35 important elements of health and safety (H&S) prevention programme under 4 components of H&S programme. These are *management commitment, worksite analysis, hazard prevention and control and H&S training*. Nine important elements of H&S prevention programme were identified under management commitment with RII ranging between 0.78 and

0.56. The elements here range from *safety manager on site* which is the highest ranked (0.78) to *safety meeting* which is the least ranked (0.56). Seven important elements of H&S prevention programme were identified under worksite analysis. These range between *onsite safety inspection* with RII of 0.71 and *accident investigation* with RII of 0.62. Hazard prevention and control comprises of ten important elements of H&S prevention programme ranging from *safety helmet* (RII = 0.74) to *ear plug* (RII = 0.63). The nine important elements of H&S prevention programme discovered under H&S training range between *tool-box talk* (RII = 0.44) and *substance abuse programme* (0.37).

This finding is consistent with the studies of Rajendran and Gambatese (2009), Hallowell (2010) and Pellicer *et al.* (2014). Rajendran and Gambatese (2009) use most of these elements to develop and validate a sustainable construction H&S rating system based on the degree of implementation of H&S programme. Hallowell (2010) assessed the cost-effectiveness of some of these elements. Pellicer *et al.* (2014) also alludes to some of these elements to propose an innovative method to calculate H&S costs in construction projects. Furthermore, the least ranking of emergency response planning, safety and health committee and safety meeting under management commitment category confirms the report of Muiruri and Mulinge (2014) that foremost management support of health and safety in construction site is ineffective.

## Descriptive Analysis of H&S Prevention Cost and Contract Sum

The health and safety prevention cost were also analysed. In this regard, health and safety prevention cost falls between 1 – 10% of the contract sum as shown in Fig. 1.

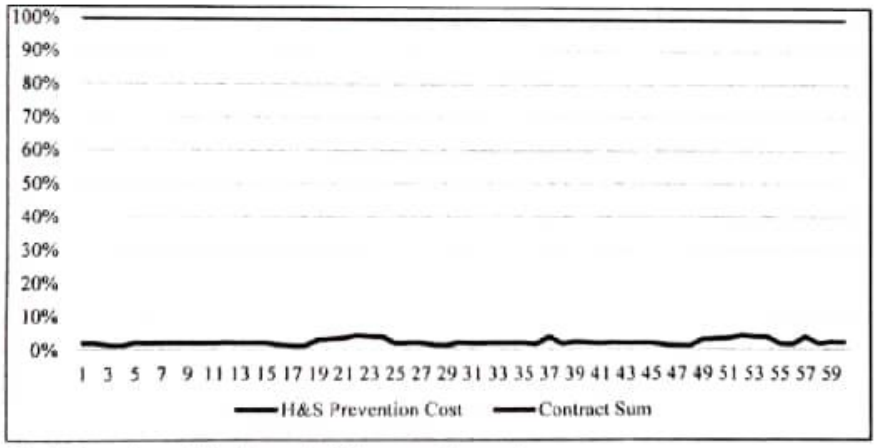


**Fig:1 Percentage of health and safety prevention cost**

This finding implies that the health and safety prevention cost is optimum. This is in line with the conclusion drawn by Tang et al. (1997) that optimal minimum safety investment on a building project is 0.6% of the contract sum.

## Correlation between H&S Prevention Cost and Construction Cost

It was observed in Table 4 that, the value of the Pearson correlation was positive and very high (0.969). Correlation was found to be significant at 0.05 level (2 tailed). The "R" value 0.69 indicates a high association between the H&S prevention cost and construction cost. It was also

empirically established that this relationship was statistically significant with P value 0.000 which is less than 0.05 level set.

Table 5: Correlation between H&S prevention cost and construction cost

| Analysis No | Variable X | Variable Y | Pearson Correlation (R) | P-Value | Strength of Relationship | Remark |
|---|---|---|---|---|---|---|
| 1 | H&S Prevention Cost | Construction Cost | 0.969 | 0.000 | Very Strong | SS |

Key: SS - Statistically Significant

The implication of this result is that the cost of implementing health and safety programme and overall construction cost increases together. This outcome agrees with the findings of Okoye and Okolie (2014) and Muhammad (2015). Both studies assessed the opinion of construction stakeholders on the relationship between health and safety programme and overall construction cost. It was discovered that majority of construction workers' belief that implementation of H&S programme significantly increases the construction cost.

## Conclusion

This study has verified the assumption of construction stakeholders on the impact of health and safety prevention cost on overall construction cost by using actual cost data of 60 public projects awarded and completed in Kwara State between year 2006 and 2016. The evidence from the analysis lucidly shows that construction cost increases as health and safety prevention cost increases. The result also indicates that the health and safety prevention cost for all the 60 projects considered fall between 1 – 10% of the contract sum but the ranking of elements of health and safety programme commonly implemented on construction site reflects a weak health and safety management performance. Major elements identified include safety manager on site, onsite safety inspection, safety helmet, safety shoe, and tool-box talk. It was further revealed that elements of health and safety programme constitute the cost items of health and safety prevention cost. The following recommendations were made from the results of the findings:

i. Management commitment to health and safety should be stepped up in order to ensure the implementation of functional health and safety programme on construction site.

ii. Health and safety budget should be based on relevant elements of health and safety programme applicable to the proposed project to avoid excessive cost projection during design phase.

iii. Proper cost control measure should be taken to checkmate health and safety expenditure during the construction process.

iv. Construction industry stakeholders should avoid undue profit and cost consideration during design stage detrimental to health and safety performance since accidents cost do have greater impact than prevention cost.

In summary, the implementation of health and safety programme on construction site increases the overall construction project cost. This rise in cost can get out of acceptable proportion where there is improper health and safety planning during the design phase and ineffective management or expenditure control during the construction phase.

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