

**INTERNATIONAL JOURNAL OF
INNOVATIVE RESEARCH AND KNOWLEDGE**

ISSN-2213-1356

www.ijirk.com

**PARTICIPATORY PROJECT DESIGN AND
SUSTAINABILITY OF INFRASTRUCTURE DEVELOPMENT
PROJECTS****ORWA SAMWEL OKINYI****ABSTRACT**

Infrastructure projects including roads, aviation, rail, water, housing and urban development projects, are key in improving the living standards of community members and ensuring economic growth. However, despite their increase in number over the years, infrastructure development projects have been portraying poor sustainability as they are characterized by stagnation, cost and time overrun. Most completed projects stop operations shortly after the exit of the financiers. Even though, project design is considered an important phase of a project, most project managers and stakeholders do not consider project design as an important phase of a project life cycle. As such, the purpose of this paper is to analyze the effect of Participatory project design on sustainability of infrastructure development projects. This seminar paper analyzed five articles on the project design and sustainability of projects. Convergent analysis was conducted to identify similarities and divergent analysis was done to identify differences in conceptualization, methodology and findings. The results indicated that project designs have an effect on performance of projects. However, project managers in both the developed and developing countries are not including project design during construction process hence resulting to cost overrun, schedule delays and productivity loss. Further, common changes in project designs include errors and omission in design, change of plan by clients, incomplete contract document, change of requirements/specifications, differing site conditions, unforeseen ground conditions and changes in government regulation. The study also found that impacts of design change include completion schedule delay, increase in project cost, and wastage of materials during rework, productivity degradation and working extra hours

(overtime) to meet deadlines of the project. Most of the studies on project design have used different dependents variables such as performance, building safety and cost among others. The study therefore recommends further studies should be carried out on project design and sustainability of projects used as the dependent variable.

KEY WORDS: *Project Design, Sustainability, Construction, Water Projects*

INTRODUCTION

Project sustainability is a state where the target beneficiaries are able to take responsibility for ensuring people in the current and future generation are able to benefits from the projects by sustaining its outcome, processes, resources and human capacity. However, projects need to include not only the social considerations of a project, but also other considerations like cost implications, safety, health and workforce education (Uwera & Kariuki, 2017). Therefore, the sustainability of a project should encompass social considerations, economic considerations and environmental considerations. Different authors have highlighted the importance of project design in ensuring the sustainability of projects (Bassa, Reta, Alyew & Tora, 2019).

Aslam, Baffoe-Twum and Saleem (2019) indicate that the complexity of construction projects has led to an increase in uncertainties involved in the planning and execution phases of a construction project. Traditionally, construction projects have separated design and planning from construction processes leading to changes related to design and scope during construction. The separation of project design from the construction leads to problems where the designs require changes during project implementation and this negatively affecting performance in terms of cost overrun, schedule delays, and loss of productivity.

Bassa, Reta, Alyew and Tora (2019) observed that the construction industry is normally uncertain and complex as different companies are involved throughout the life cycle of a project, that is, from inception stage to commissioning stage. Therefore, an integration of systems that involves the planning of both construction and design is important in ensuring the economic and social sustainability of building construction projects. For instance, poor project designs in building projects will necessitate changes and repairs after sometime thus affecting the economic (cost) and social sustainability (utilization) of the building project. As such, project design changes should be minimized as much as possible during the implementation of a project.

In Malaysia, Muhamad and Mohammad (2018) indicates that it is critical to ensure the sustainability of construction projects as they are considered major catalysts in ensuring economic growth. As the number of construction projects increase in number, they are also becoming more and more complicated. The project designs of many construction projects are complex, leaving construction companies with a narrow margin of error. To ensure sustainable of construction projects it is important to identify causes of changes in project designs and their impact on construction projects.

Uwera and Kariuki (2017) observed that while designing a project requires an upfront investment, less people are willing to invest in designing their project, the higher the risk of compromising its quality when the time for implementation comes. Poor project designs led to poor sustainability of projects in Rwanda and as such firms in Rwanda were still struggling to get competitive, innovative and cost effective ways of obtaining ICT services. The less the stakeholders are willing to invest in designing their project, the higher the risk of compromising its quality when the time for implementation comes.

One of the measures of project sustainability is social considerations and the collapse of buildings leads to continued building crisis. Mutiku and Mutiso (2020) indicates that sustainability of building projects in Kenya

was poor as there were numerous cases of caving-in of excavation works, collapse of buildings, collapse of walling works as well as electrical fires and electrocution. However, design collaboration in building for safety significantly reduces accidents at work, maintains safety, reduces the building cost (economic sustainability) and ensures on-time completion and occupation of buildings (social sustainability). The authors also indicated that it is cheaper to eliminate and control accidents at design stage than at latter stages of a project.

JUSTIFICATION OF THE PROBLEM

Construction industries in Kenya are driven primarily by two key infrastructure sectors; transportation and building/housing. The Ministry of transport and infrastructure is responsible for policy initiatives and action with respect to road, aviation, rail housing and urban development. According to Business Monitor International, The Kenyan construction market is to record 8.5% growth in 2017 and remain growth outperformer in sub Saharan African until 2024. In a report by United Nations Children's Fund, about 60% of Kenyans do not have access to clean and safe water although the nation has adequate rainfall and reliable sources of water. In response, numerous projects have been launched in the last one decade by the national government alongside foreign investors, County governments as well as local and international NGOs in an effort to improve access to safe house, roads and clean and safe water. Despite the high number of these projects aimed at improving access quality of life, some of these projects stall shortly after they have been commissioned and others become costly to sustain due to high maintain and repair costs. In addition, most water projects in Kenya experience cost and time overrun, stagnation and when completed, their operations stop shortly after the exit of the financiers. Project design is consider an important phase of a project as it helps in the identification of key components in a project. However, most project managers and stakeholders do not considered project design as an important phase of a project life cycle. It is therefore important to understand how participatory project design influences the sustainability of infrastructure development projects in terms of social, environmental, and economic dimensions.

JOURNAL ARTICLE ANALYSIS

Aslam, M., Baffoe-Twum, E. & Saleem, F. (2019). Design Changes in Construction Projects – Causes and Impact on the Cost. Civil Engineering Journal, 5(7), 1647-1655.

Research problem: Aslam, Baffoe-Twum and Saleem (2019) observed that the isolation of design phase from various construction phases of a project has made the design changes inevitable in construction projects. Design changes have a detrimental effect on the implementation of a project in terms of cost, time and quality of a project. Specifically, in well-managed projects, changes in design have a direct impact on total cost of construction. Design errors also lead to reworks in construction projects account for between 5 and 20 percent of increase in project cost.

Purpose of the Research: The purpose of the study was to examine the impact of design changes on project cost and identifying actions responsible for these changes. The objectives of the study were to quantify the impact of design changes on the project cost; and to determine the causes of design changes resulted in project cost overruns.

Research design: Systematic review of past literature published in well-established journals, and contents analyzed. This helped the study to benefit from numerous research already done the field

Target population: All well-established journals, and contents.

Data Collection: This paper reviewed literature published in peer-reviewed journals and conference proceedings in the construction management field.

Sample and sampling procedures: Due to the numerous research studies already carried out in this field, the study purposively selected peer-reviewed English academic journals, peer-reviewed English conference proceedings and no books or non-published thesis or dissertations are considered. Three major academic databases Science Direct, Taylor and Francis and Elsevier were used as the primary source of relevant publications. Other sources such as google search engine were also adopted.

Data Analysis: Thematic analysis was used in the analysis of the literature. This study benefited on insight provided by existing records

Findings: The causes of design changes were categorized into clients' related causes, designer-related causes, contractor, related causes and external causes. The results also indicated that design change is one of the predominant factors to cost overrun, and in some cases, may upshot into cost overrun between 5 and 40% of the project cost. Some projects experienced closure as a result of owner induced design changes, although these changes were not significant in number. Design changes as a result of consultants and contractors in some cases might have reduced impact but are frequent.

Bassa, M., Reta, A., Alyew, A. & Tora, M. (2019). Causes and Effects of Design Change in Building Construction Projects in Three Selected Southern Ethiopia Zones. International Journal of Engineering Research & Technology, 8(12) 757-761.

Research problem: Bassa, Reta, Alyew and Tora (2019) observed that the initiation of changes in project designs by stakeholders including construction management, owner, consultants, contractors, authorities among others can have a positive or negative effect on Building Construction Projects. The paper highlights that project design changes by owners include deletions, modifications of original scope of work and additions, which can either, reduce or increase the cost of the project as well as the time schedule. It was therefore important to investigate the causes and effects of design change in building construction projects.

Purpose of the Research: The study conceptualized project design in terms of detailed plans and specifications, identification of activities, identification of resources and construction planning. The purpose was to identify Causes and Effects of Design Change in Building Construction Projects in Three Selected Southern Ethiopia Zones.

Research design: Survey research design was adopted. However, to improve on the quality of data, in-depth interviews would have been incorporated. The study neither put forth research hypothesis nor do research questions that would enable it gain more insight into the analysis

Target population: Personnel were selected from project managers, consultants, contractors, client's representatives and construction managers. This study doesn't show how many on each category were selected to participate in the study

Sample and sampling procedures: Purposive sampling was used in the study to select personnel involved in construction projects of southern Ethiopia cities.

Data collection: A questionnaire survey containing of fifty-one (51) questions about the cause and effect of design changes during the building construction. It was organized in the form of a priority scaling (1=very low, 2=low, 3=medium, 4=high, and 5=very high).

Data Analysis: The Relative Important Index (RII) method was adopted for similar studies to determine the relative importance of various factors. This method was applied to this study to identify the Relative importance of various causes and effects of design change based on responses from contractors, owners and consultants.

Findings: The results indicated causes of design change include lack of design review during design process, errors and omission in design, change of plan by clients, incomplete contract document and differing site condition. The study also found that major impacts of design change include completion schedule delay, increase in project cost, wastage of materials during rework, productivity degradation and working extra hours (overtime) to meet deadlines of the project.

Muhamad, N. H. & Mohammad, M. F. (2018). *Impact of Design Changes in Construction Project. Malaysian Journal of Sustainable Environment, 2(3), 1-18.*

Research problem: Muhamad and Mohammad (2018) observed that changing of designs in construction projects is unavoidable and is always expected. However, changes in projects designs have implications on time performance and cost performance of different types of construction projects. They also indicated that reasons for schedule and cost increase with design changes and hence identifying reasons for design changes should be the first step in addressing the problem and coming up with correction actions.

Purpose of the Research: The purpose of the study was to identify the causes and impacts of design changes on project performance and to provide insights for future studies in Malaysian context.

Research design: The study used literature review and preliminary study methodologies,

Target population: Director of Construction Contracts Consultants and Deputy Project Director of Construction Consortium

Sample and sampling procedures: Purposive sampling was used in the selection of the respondents. The reason of selecting the experts' panel as the respondents during the survey is due to their experience in evaluating the impact of design changes on construction project performances.

Data collection: This paper reviewed literature published in peer-reviewed journals and conference proceedings in the construction management field and had emailed several questions to the expert in construction industry in the collection of primary data.

Data Analysis: Data analysis was done by use of thematic content analysis and the results were presented in a narrative form.

Findings: The findings indicated that design changes originate mainly from the owner side are identified as important causing factors to time overruns and cost overruns. The results indicated that the design changes are the significant factor for time delays and cost overruns. Causes of project design changes include change of requirements/specifications, addition or omission or scopes, slow decision-making, unclear initial design, lack of coordination, discrepancies in design, inexperienced consultants, unforeseen ground conditions and changes in government regulations. Changes in project designs had an impact on the cost of the project (cost overrun), schedule delay and number of projects.

Uwera, P. & Kariuki, P. M. (2017). *Effect of Project Design Practices on Sustainability of Information Communication Technologies Infrastructure Projects in Rwanda: A Case of Regional Communication Infrastructure Project. International Journal of Science and Research, 6(9), 1880 – 1884.*

Research problem: Uwera and Kariuki (2017) observed that the ever increasing business needs have necessitated the government of Rwanda to improve its infrastructure within a short duration of time. Long term Strategic plans like the country have acknowledged that ICT is important in the economic growth of the country. This led the development and implementation of ICT plans like NICI I-III 2000-2015 to guide ICT4D programs and other

initiatives. However, even though the government has heavily invested in ICT projects, the nation is still characterized by limited infrastructure, low telecommunication density, few internet subscribers, limited technical expertise as well as costly and low quality ICT services. This has compelled stakeholders to re-evaluate their project design practices so as to align them with sustainable outcomes of a project.

Purpose of the Research: The purpose of the study to establish the effect of project design practices on the sustainability of ICT projects in Rwanda. The study specifically looked at the effect of project identification, project formulation, project implementation planning and project monitoring & evaluation planning on the sustainability of ICT infrastructure projects in Rwanda.

Research design: The study adopted a cross-sectional survey design. This design is useful since the study wanted to collect specific data in time from the population

Target population: The target population was 43 employees in higher institutions of learning that were benefiting from Regional Communication Infrastructure Project and employees of the project who were involved in the project design.

Sample and sampling procedures: A census approach was used as the population of the study was small.

Data collection: Both primary and secondary data were used. Primary data was collected by use questionnaires and secondary data was collected by use of annual reports and other reports like regional communications infrastructure projects.

Data Analysis: Data was analyzed using descriptive statistics and inferential statistics. Inferential statistics included Pearson correlation coefficient and regression analysis. However, the results from descriptive analysis were not presented. The results were presented in tables.

Findings: The findings of the study indicated that project design practices including project identification, project formulation, project implementation planning and project monitoring & evaluation planning had a significant effect on the sustainability of ICT infrastructure projects in Rwanda.

Mutiku, J. K. and Mutiso, J. (2020). Influence of Project Design Collaboration on Building Safety in Nairobi City County, Kenya. The Strategic Journal of Business & Change Management, 7(3) 195 – 205.

Research problem: Mutiku and Mutiso (2020) indicates that in the last two decades, Nairobi City County has been experiencing building crisis attributed to low supply and high demand of housing units. The crisis is also associated with limited expertise and few building professionals in the building sector leading to an influx in uncontrolled developments, most of which have not been approved by authorities. This has in turn led to structural failures, on-occupancy collapse, collapse of buildings during construction and considerable damage of properties. Most of the times, the collapse of the buildings is blamed on the building designs due to inclusions and omissions in the designs. The study therefore, highlighted a need for project design collaboration between architects and other project stakeholders.

Purpose of the Research: The purpose of the study was to examine the influence of project design collaboration on building safety in Nairobi City County, Kenya. The study specifically sought to assess the influence of designer-client collaboration and designer-designer collaboration on building safety in Nairobi City County, Kenya.

Research design: The study adopted a descriptive research design that as enabled it obtain information that describes existing phenomena and captured the perception, attitude, behavior and value.

Target population: The target population of the study was 206 architects registered with Board of Registration of Architects and Quantity Surveyors (BORAQS-Kenya).

Sample and sampling procedures: A census approach was used in this study and hence there was no sampling.

Data collection: Primary data was used and was collected by use of semi-structured questionnaires, which comprised of both open ended and closed ended questions. The variables of the study were measured using five point Likert Scale.

Data Analysis: With the help of Statistical Package for Social Sciences (Version 20), descriptive and inferential statistics were used in the analysis of the quantitative data from the questionnaires and content analysis was used in the analysis of qualitative data from open ended questions. Inferential statistics included correlation analysis and regression analysis.

Findings: The results indicated that both designer-client collaboration and designer-designer collaboration had a positive and significant effect on building safety in Nairobi City County. In addition, an emphasis in designer-client collaboration practices such as the designer cooperating with the client throughout the project design process, risk assessment, risk elimination and risk control. The results also indicated that improvement in designer-designer collaboration practices such liaising with quantity surveyors to ensure that safe materials are recommended, architect-quantity surveyor cooperation, architect-interior designer engagement and architect-engineers engagement.

CONVERGENT ANALYSIS

Conceptualization of the problem

Three of the five articles identified the causes and impact of project design changes on construction projects (Aslam et al., 2019; Bassa et al., 2019; and Muhamad & Mohammad, 2018). In addition the three studies looked at project design changes related to the owners/client, contractor related causes and designer/architect related causes. Three of the five studies used performance of construction projects as their dependent variable (Aslam et al., 2019; Bassa et al., 2019; and Muhamad & Mohammad, 2018).

Methodology

Two of the five studies utilized systematic review of past literature (Aslam et al., 2019; Muhamad & Mohammad, 2018). However, one of the disadvantages of use of literature without any primary data is that it is not specific to an organization or project. In addition, Bassa et al. (2019), Uwera and Kariuki (2017) and Mutiku and Mutiso (2020) collected data by use of questionnaires that used a five likert scale to measure various indicators in the variables.

In regard to sampling and sampling procedures, both Uwera and Kariuki (2017) and Mutiku and Mutiso (2020) utilized a census approach as the sample size was small. In addition, purposive sampling technique was used by Muhamad and Mohammad (2018), Bassa, Reta, Alyew and Tora (2019) and Aslam, Baffoe-Twum and Saleem (2019).

In the data analysis, Aslam, Baffoe-Twum and Saleem (2019) and Muhamad and Mohammad (2018), Uwera and Kariuki (2017) and Mutiku and Mutiso (2020) used thematic analysis in analyzing qualitative data from literature and open ended questions. Further, Uwera and Kariuki (2017) and Mutiku and Mutiso (2020) used descriptive and inferential statistics in the analysis of quantitative data from the questionnaires. The inferential statistics included correlation analysis and regression analysis.

Findings

All the five studies found that project designs have an effect on the performance of projects in terms of schedule delays and cost performance (Aslam et al., 2019; Bassa et al., 2019; and Muhamad & Mohammad, 2018; Uwera & Kariuki, 2017; Mutiku & Mutiso, 2020). In addition, Aslam et al. (2019), Bassa et al. (2019) and Muhamad and Mohammad (2018) found that the causes of design changes were, owner/client related (deletions, modifications of original scope of work and additions), consultants related and contractors related, authorities. The three studies also found that the impacts of design change include completion schedule delay, increase in project cost, wastage of materials during rework, productivity degradation and working extra hours (overtime) to meet deadlines of the project.

DIVERGENT ANALYSIS

Conceptualization of the problem

While three of the studies (Aslam et al., 2019; Bassa et al., 2019; and Muhamad & Mohammad, 2018) focused on design changes and their impact on construction projects, Uwera and Kariuki (2017) looked at project design practices conceptualized in terms of project identification, project formulation, project implementation planning and project monitoring & evaluation planning, and Mutiku and Mutiso (2020) conceptualized project design collaboration in terms of designer-client collaboration and designer-designer collaboration. In addition, the five studies used different dependent variables. While Aslam et al. (2019), Bassa et al. (2019) and Muhamad and Mohammad (2018) used performance of Projects as their dependent variable, Uwera and Kariuki (2017) used sustainability of information communication technologies infrastructure projects and Mutiku and Mutiso (2020) used building safety.

Methodology

In relation to the research design, Aslam et al. (2019) and Muhamad and Mohammad (2018) used systematic review of literature, Bassa, Reta, Alyew and Tora (2019) used survey research design, Uwera and Kariuki (2017) used cross-sectional survey design and Mutiku and Mutiso (2020) used a descriptive research design. In addition, while Aslam et al. (2019) and Muhamad and Mohammad (2018) used secondary data from journal articles and books, the other three articles used primary data collected by use of questionnaires (Bassa et al., 2019), Uwera & Kariuki, 2017; Mutiku & Mutiso, 2020). Also, While some studies used purposive sampling technique (Uwera & Kariuki (2017); Mutiku & Mutiso, 2020) others used a census approach as the sample size was small. In the data analysis, some of the studies were qualitative and hence used thematic analysis, and others were quantitative and hence used descriptive and inferential statistics in the analysis of quantitative data from the questionnaires. The inferential statistics included correlation analysis and regression analysis.

Findings

The five studies had different findings as they were conducted in different contexts and used different concepts and methodologies. For instance, Aslam, Baffoe-Twum and Saleem (2019) found that design change is one of the predominant factors to cost overrun, and in some cases, may upshot into cost overrun between 5 and 40% of the project cost. Some projects experienced closure as a result of owner induced design changes, although these changes were not significant in number. Design changes as a result of consultants and contractors in some cases might have reduced impact but are frequent. Bassa, Reta, Alyew and Tora (2019) found that causes of design change include lack of design review during design process, errors and omission in design, change of plan by clients, incomplete contract document and differing site condition. The study also found that major impacts of design change include completion schedule delay, increase in project cost, wastage of materials during rework, productivity degradation and working extra hours (overtime) to meet deadlines of the project.

Muhamad and Mohammad (2018) established that design changes are the significant factor for time delays and cost overruns. Causes of project design changes include change of requirements/specifications, addition or omission or scopes, slow decision-making, unclear initial design, lack of coordination, discrepancies in design, inexperienced consultants, unforeseen ground conditions and changes in government regulations. Changes in project designs had an impact on the cost of the project (cost overrun), schedule delay and number of projects.

Uwera and Kariuki (2017) revealed that project design practices including project identification, project formulation, project implementation planning and project monitoring & evaluation planning had a significant effect on the sustainability of ICT infrastructure projects in Rwanda. In addition, Mutiku and Mutiso (2020) found that both designer-client collaboration and designer-designer collaboration had a positive and significant effect on building safety in Nairobi City County. In addition, an emphasis in designer-client collaboration practices such as risk assessment, risk elimination and risk control. The results also indicated that improvement in designer-designer collaboration practices such as architect-quantity surveyor cooperation, architect-interior designer engagement and architect-engineers engagement.

SUMMARY OF THE GAPS

This section outlines conceptual, methodological and contextual gaps from the five studies. In the five studies the research questions or hypothesis were not clearly stated. For instance, Aslam et al. (2019), Bassa et al. (2019) and Muhamad and Mohammad (2018) focused on project design changes while Uwera and Kariuki (2017) looked at project design practices and Mutiku and Mutiso (2020) looked at project design collaboration. However, all of the studies failed to show research questions and hypothesis.

In addition, the five studies used different research designs, methods of data collection and data analysis methods. Research designs used in the studies include systematic review of literature, descriptive research design and cross-sectional studies designs. However, none of these designs-can be used to show the cause-effect relationships between variables. Also, the data collection methods included survey questionnaires and systematic review of literature from journal articles and books. However, qualitative data was not collected leading to partial understanding of the problem. The use of mixed methods research would have to combine both qualitative and quantitative research approaches is better than as it ensures that the approaches complement each other.

Further, the five studies were conducted in different contexts in terms of sectors and countries but validity test for the instruments of sample size determination was not provided For instance, Aslam, Baffoe-Twum and Saleem (2019) focused on Construction Projects, Bassa, Reta, Alyew and Tora (2019) looked at building construction projects in three selected Southern Ethiopia Zones, Muhamad and Mohammad (2018) focused on construction project, Uwera and Kariuki (2017) looked at sustainability of information communication technologies infrastructure projects, and Mutiku and Mutiso (2020) looked at building safety in Nairobi City County.

CONCLUSIONS

The study concludes that project designs have an effect on performance of projects. However, project managers in both the developed and developing countries are not including project design during construction process hence resulting to cost overrun, schedule delays and productivity loss. Further, the study concludes that projects are complex and changes in design are unavoidable. Common changes in project designs include errors and omission in design, change of plan by clients, incomplete contract document, change of requirements/specifications, differing site conditions, unforeseen ground conditions and changes in government regulation. The study also concludes that impacts of design change include completion schedule delay, increase in project cost, wastage of

materials during rework, productivity degradation and working extra hours (overtime) to meet deadlines of the project.

RECOMMENDATIONS

The study recommends that institutions across the world should incorporate project design as a part of project life cycle in order to reduce the number of changes that are required before the completion of the project. In addition, construction companies should include participatory project design during construction process to ensure that the projects' goals are achieved. Project design ensures that the projects under construction are completed within the stipulated time frame, cost and set budget.

In addition, there should be increase collaboration between owners of projects, designers, consultants and constructors should avoid design changes as much as possible. This is because design changes lead to cost overrun, time overrun, quality problem, increases overhead expenses, wastage of materials due to rework, productivity degradation due to equipment and material, claim and disputes between client and contractor.

Most of the studies on project design have used different dependents variables such as performance, building safety and cost among others. The study therefore recommends further studies should be carried out on project design and sustainability of projects used as the dependent variable.

REFERENCES

- Aslam, M., Baffoe-Twum, E. & Saleem, F. (2019). Design Changes in Construction Projects – Causes and Impact on the Cost. *Civil Engineering Journal*, 5(7), 1647-1655.
- Bassa, M., Reta, A., Alyew, A. & Tora, M. (2019). Causes and Effects of Design Change in Building Construction Projects in Three Selected Southern Ethiopia Zones. *International Journal of Engineering Research & Technology*, 8(12) 757-761.
- Muhamad, N. H. & Mohammad, M. F. (2018). Impact of Design Changes in Construction Project. *Malaysian Journal of Sustainable Environment*, 2(3), 1-18.
- Mutiku, J. K. and Mutiso, J. (2020). Influence of Project Design Collaboration on Building Safety in Nairobi City County, Kenya. *The Strategic Journal of Business & Change Management*, 7(3) 195 – 205.
- Uwera, P. & Kariuki, P. M. (2017). Effect of Project Design Practices on Sustainability of Information Communication Technologies Infrastructure Projects in Rwanda: A Case of Regional Communication Infrastructure Project. *International Journal of Science and Research*, 6(9), 1880 – 1884.