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# ANALYZING THE PROJECT DELAY CAUSES IN THE SOUTH AFRICAN CONSTRUCTION INDUSTRY

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**Abstract :** Construction projects have experienced major delays in the past decades. Project delay is a big burden in setting up projects. Professionals have established that delay in a project can only be controlled if its symptom is detected and acknowledged on time. A project has been described as a one-time undertaking that is established for a purpose. A questionnaire was designed and used to obtain the stakeholders' perceptions regarding the causes of project setbacks. The aim of this study is to detect and analyze the causes of project delays and their mitigation strategies. Fifty-four (54) causes of project delays were established through the literature review. Mitigation strategies against project delays were identified. The established mitigation strategies will help construction professionals to improve the successful delivery of projects. The study has proved that every project delay has a remedy. The three major stakeholders collectively contribute to the factors causing project delays. The study revealed that delays in one country may be different from another country. This study discovered that all the stakeholders are experienced and knowledgeable in terms of recognition of the factors creating project delays.

**Keywords:** Construction Projects, South Africa, Delay, Mitigation, Ethics

## I. CHAPTER 1 INTRODUCTION

Delays in construction projects have become a nightmare in the establishment of a project. Projects have been regarded as one-off development. Viles, Rudeli, and Santilli (2019) reveal that a project is a once-off unique undertaking that is constructed on a certain site under unrepeatable conditions. The study further discloses that the construction project is a composite venture that is executed through human efforts and the availability of equipment and materials. The study regards construction projects as a one-time venture on a specific area that remains unchangeable. The researchers advise that the principal source of low productivity within the labor force can be determined by further investigation of the character of human beings.

According to Aziz (2013), a project is fruitful only when finish within budget, time, quality, and owner's satisfaction. The study uses the relative importance index to rank the various groups. The authors report that there is a need for quality inspection and testing by the consultant. The study advises that efficient communication should be established to minimize the issue of delay in project execution. The study indicates that hindrance in any construction project affects the profitability of that project. This impediment is usually connected to the fulfillment of cost, quality, and time. The author reveals that delay in a project can only be controlled if its symptom is detected and acknowledged.

Agyekum-Mensah and Knight (2017) reveal that criticisms of the project setbacks have negatively affected many construction projects in every country. According to the report, several studies on project delays detected in the literature relied on ratings done by the participants. However, these are hardly authenticated by construction practitioners which are the real people involved in the project. The study maintains that to comprehend the real issues in the construction projects, it is advisable to verify from the personnel engaged in that project. The researchers classify delays into two major types such as excusable and nonexcusable delays. However, Agyekum-Mensah and Knight (2017) discover that excusable delays are created by the client, while unjustifiable delays are attributed to the contractor.

Hamzah et al (2011) caution that the inability to finish projects within schedule has negative impacts on those projects. The study maintains that once a project is behind schedule, there is a possibility of incurring extra costs to the project. Authors reveal that there is usually a percentage contingency added to the actual cost of the project but this is based on engineering judgment. Hamzah et al 2011 define contingency allowance as additional money added to the project cost to cover unforeseen circumstances. Authors maintain that delay creates a disturbance to work and can lead to loss of productivity. The study reminds of the necessity to maintain tracks of work progress to circumvent or minimize setbacks on projects.



Mahamid (2013) reveals that Palestine was subjected to serious economic problems that influence project performances. The study further conducted work on risk affecting construction time and detected 45 factors. However, the study reveals that late payment, ineffective interactions between project stakeholders generate serious issues on the project. The study warns all stakeholders to desist from involving political issues in any project endeavor. This could lead to the complete abandonment of that project. It is also discovered that financial and coordination issues are major elements influencing the conduct of projects in Malaysia. Study adds that bad soil and site terrain set projects behind schedule. The study further advises that particular attention must be shown to these factors to improve project performance.

Kikwasi (2017) is of the view that delay is an occurrence that happens either intentionally or unintentionally. The study reveals that once delay surfaces, project costs, and time schedules are liable to be affected. The report further interprets delay as something that reduces the progress of the work activities but does not actually halt the progress of the entire project. The study further asserts that delay can be classified as unforgivable delays, forgivable non-remunerative delays, forgivable remunerative delays, and coincidental delays. unforgivable delays are generated by the contractor, while forgivable non-remunerative delays are generated by unnoticeable circumstances. Remunerative forgivable delays are generated by the client. This is due to the client's failure to pay the contractor. The study maintains that delay can be regarded as a coincidental delay only when created by the client and contractor. The author reveals that if a disruption occurs in a project, the entire construction program will definitely be affected. The study has the view that some disruptions in the project are intentionally planned at the bidding phase of the project. The author advises that rework issues in projects should be expected due to natural human gross errors. According to Kikwasi (2017), unnecessary processes in approving a job and consistent scope creeps are factors that can affect the project's time schedule.

Shahsavand, Marefat, and Parchamijalal (2018) regard delay as a critical problem affecting successful project execution. The study defines delay as time overruns exceeding the contractual project completion date. Shahsavand, Marefat, and Parchamijalal (2018) are of the opinion that the early completion of the project indicates efficiency. The study discovers that the client's definition of delay is the loss of revenue due to the unavailability of comfortable production facilities for the project, while the contractor interprets the delay as higher overhead expenses due to an unplanned long period of work, inflation in the market and the high demand from labor. Study indicates the necessity to treat the principal source of delay in order to minimize its occurrence in future projects. Shahsavand, Marefat, and Parchamijalal

(2018) reveal that selecting the proper delay analysis method is the fundamental aspect of construction.

Wang et al. (2018) assert that one of the basic performance indicators in every construction project is the early completion of the project. The research addresses the importance of project schedules in construction projects. The study further maintains that if a delay could occur by the client, then it should be regarded as a compensable delay, while if occurred by the contractor, it is not compensable. The research discovers 75 factors that are delay project execution using the interview method.

However, Koshe<sup>1</sup> and Jha<sup>2</sup> (2016) stress that delays can be reduced only when their sources are detected and handled. The study maintains that lack of finance from the contractor, poor planning and scheduling, inflation of materials, lateness in payment of work done, and engaging unskilled professionals on the project management poses a greater threat to the project. The study recommends that there is a need to engage competent personnel who will master his/her responsibilities with attractive salaries. Koshe<sup>1</sup> and Jha<sup>2</sup> (2016) insist that a construction project can only be regarded as most successful if completed most safely is added as part of successful project completion criteria.

Rahimipour<sup>1</sup> and Shahhosseini<sup>2</sup> (2013) in different studies indicate that delays can be classified as justified and unjustified delays. The study is specifically speaking to the construction of schools in Tehran. According to the researchers, the main factors based on the opinions of the employers are late payment of the work done, financial constraints from the contractor, market inflation, engaging the lowest bidder to win the contract, lateness in delivery of the land for the project, engaging inexperienced engineers/contractors and poor management of financial resources.

Alzara\* et al. (2016) study how to use PIPS to reduce the factors creating project delays in South Arabian. The study identifies many causes of project delays and addresses them as poor performance of contractors, incompetent contractors, unavailability of manpower, problems of materials and equipment delivery to the site, implementing a low bidding system, using incompetent engineers, and late approval of the design documents by the client. The study further classified delay factors under three groups: client, consultant, and contractor. The authors are of the opinion that the delay in the material delivery has a crucial impact on the project time schedule. The study discloses that proper mitigation techniques should be carried out according to the risks in the project, market availability, and country in which the project is being executed. The report reveals that the factors affecting construction project success are classified as monitoring, communication, technical issues, project mission and schedule, feedback on project performance, and support from top management. Alzara\* et al. (2016) report that the use of competent project managers, availability of resources, stakeholders' full commitment to



the project, availability of sufficient funds, and utilization of experienced project team will aid in minimizing the construction project delays. The study further suggests that the use of incidental stipend and fast-tracking of activities on-site can minimize construction project delays.

According to the study done by Banobi and Jung (2019), 131 factors that cause project delays are identified. The study reveals that any delayed project generates an adverse impact on the client and contractor. Contractors are bound to incur additional expenses in terms of extra overhead costs. The research cautions that any delay caused by the contractor may hinder the contractor's future opportunity in securing business opportunities. However, the study maintains that in every situation, all three parties to the project aim for the successful completion of the project. Banobi and Jung (2019) insist that it is the sole responsibility of the client to minimize project delays. The project period is also considered a major contributor to construction project delays. Poor estimation of the bill of quantities, shortages of manpower, and delay in decision-making are regarded as the most critical contributors to the project delays. The lack of finance on the part of the contractor definitely affects the successful accomplishment of the project. Banobi and Jung (2019) believe that many construction project delays are connected to consulting engineers. The authors assert that good project risk management is an effective technique to minimize project schedule, quality management, and project cost. It is also discovered that if a project is able to meet its aims and objectives, then many gaps are not found between the client and contractor. However, the study maintains that the client and contractor have much duty to identify delays and design strategic measures to minimize them. The research concludes that most causes of project delays and their mitigation measures are connected to the project decision-makers.

Jongo<sup>1</sup> et al. 2019 classify delays as concurrent and consecutive delays, excusable and inexcusable delays, condemnatory and non-condemnatory delays, remunerative and non-remunerative delays. The study describes excusable delay as an unexpected occurrence that is beyond the control of everyone. The study further breaks down excusable delay as remunerative and non-remunerative delays.

In remunerative delay, the contractor is entitled to compensation in terms of additional funds or extension of time. But if the delay is to be regarded as a non-remunerative delay, then the contractor will receive only the extension of time and no additional finance. The report discloses that non-excusable delay arises from the project activities implemented by the contractor. In this case, no additional time and remunerative are given to the contractor for job delayed. The study maintains that it is the obligation of the client and consulting engineer to maintain clear and

readable contract documents. The study discovers that forgivable and unforgivable delays can appear at the same time in a project. However, Jongo<sup>1</sup> et al. 2019 discovered that the concurrent delay can be a condemnatory or non-condemnatory delay. The condemnatory delay affects the progress of the project while the non-condemnatory delay does not have any impact on the project completion date. It can only affect the superseding tasks that are not on the project's critical path. The study describes concurrent delays as delays appearing at the same time in a project. These delays are created by the client and contractor. The report discloses that compensable delays can manifest as a result of inadequate project designs and wrong project specifications. It is also discovered that critical delay can set project activities behind if it is not afloat in the project schedule.

Ogunde<sup>1\*</sup>, et al (2017) investigate the factors reducing project delay in Lagos Megacity', Nigeria, and discover that effective project planning and scheduling are mitigation factors against construction project delays. The study maintains that engaging the competent engineer and project manager on a project minimizes the management and human problems on the project. The authors insist that performing effective pre-construction planning on project resources and tasks may assist in monitoring the progress of the project against the targeted time and budget. The report cautions that poor project planning and scheduling can create project delays budget overrun. The early controlling of scope changes will also minimize project delays. To ensure effective control of scope changes, there is a need to engage competent consulting engineers and contractors who can prepare standard drawings and specifications. The study encourages effective communication and coordination among the team members to minimize project delays. Project issues should be given immediate attention to minimize their effects on the progress of the project. Early payment of project claims should be encouraged. However, the study summarizes the mitigation measures against construction project delays as ensure early payment of work done to the contractor, implement appropriate construction methods, encourage reliable risk management plan, engage in frequent project progress meeting, carry out preconstruction planning of project activities, early issuance of instruction to perform work to a contractor, engaging experienced project manager and consulting engineer, stakeholders' full commitment to the project, the competent site manager should be engaged on the project, and proper contract administration must be in place. The report cautions that project delay adversely affects the successful project delivery within time and budget. Ogunde<sup>1\*</sup>, et al. (2017) recommend that to ensure successful delivery of a project, client must ensure adequate fund is in place prior to the commencement of the project activities.



Panova and Hilletoft (2018) reveal that since construction projects are unavoidable, it is problematic to forecast the results of their execution in the future. Its success depends on how accurate the amount of equipment and materials and related flows are predicted. The report discloses that insufficient information about the project adversely affects the successful delivery of the project. Panova and Hilletoft (2018) caution that it is not easy to implement supply risk management in a complex project. The study reveals that the contractor needs to expand the quantity of safety items to minimize delay risks in material and equipment supply. The study insists that there is a necessity to incorporate the risks in the supply chain in the project initial stage. However, project risks can be portioned between contractor and client but no definitive agreement has been reached.

Raymond (2014) conducts research on the best practice for avoiding delay claims in the construction project. The study identifies that the client should have enough time and funds to ensure quality construction documents. The report maintains that the contractor should proofread the construction documents and designs for errors. There should be a reliable time for the project. The contractor should ensure that the commencement to the completion time of the project is reasonable. The contractor is to comprehend the client's priorities and how completion deadlines are interpreted. The author insists that the contractor should constantly submit a reasonable project schedule that reflects the as-planned construction sequence. The client is required to review, analyze, and comprehend the contractor's project schedule including the critical work items that if delayed, may affect the progress of the project. The risk allocation between the client and contractor must be properly defined before starting the project. According to Raymond (2014), reasonable liquidated damage must be ascertained for the delayed performance based on the respective project and expected costs if the project happens to be completed late. The contractor needs to constantly monitor the progress of the project and keep proper detailed daily reports of the activities. Updated project schedules must be submitted regularly to accommodate any changes in the project.

Srdić, (2015) reports that a construction project is composite undertakings that require large project costs and a long project duration. The study maintains that unexpected events are not avoidable in construction projects. The author cautions that although project plans may be prepared with due diligence, such unexpected events can still lead to project delays. The report reveals that all stakeholders may suffer if a project happens to be delayed. Srdić, (2015) investigates and confirms that the impact of delay on a project may generate additional costs and conflicts among the stakeholders, which may lead to litigation issues. However, this impact may be direct or indirect. The study recommends that it is necessary to identify and quantify delays when they occur in a project. It also recommends to quantify their impacts on the project performance for future

project delivery improvement. If the responsibilities for project delays are not allocated at the beginning of a project, there may be a risk of dispute among the stakeholders that may lead to litigation should a delay arises.

Various researchers have explored the factors hindering the successful delivery of projects in different countries, but many of these investigations are specific to particular areas (Akaranga and Makau (2016). Therefore the applicability of such investigations in South African construction industry context remains undiscovered. In addition to that, most previous studies have not considered the potential challenges and ethical principles in research work. Akaranga and Makau (2016) insist that researchers must maintain a good attitude in investigating and circulating discoveries in all academic writings. However, this study shows full consideration of ethical principles in research work.

To deal with the aforementioned issues, the study tends to eliminate this awareness deficiency by treating the following fundamental questions:

- What are the major causes of project delays in the South African construction industry?
- What are the mitigation measures against project delays in the South African construction industry?

A quantitative research method is applied to handle the abovementioned questions. Quantitative data is gathered from a literature review and survey questionnaires. Chen et al. (2019) are of the view that findings from this study will enlighten construction professionals on the fundamental causes of project delays. This will assist in developing constructive strategies to circumvent delays in future projects.

### **1.1 Structure of the dissertation**

This study is structured into 5 chapters. Chapter 1 details the entire study framework, enumerate research aims and objectives, research questions and problems, significance, ethical principles, and research plan. Chapter 2 details the literature review. Chapter 3 narrates the research methodology. In chapter 4, results and findings from the study are presented. Finally, chapter 5 contains a conclusion and recommendations for future studies.

### **1.2 Research problems**

The construction industry contributes immensely to the improvement of the South African economy but this has been affected by project delays that manifest due to one reason or the other. This enormous economic contribution can only be maintained through continuous addressing of this issue on an everyday basis (Jongo<sup>1</sup> et al. 2019). Many problems experienced by projects are greatly affecting the successful completion of those projects. This issue has created a big setback for those projects in terms of project duration and budget overruns (Serdar<sup>1</sup>, Maksat<sup>2</sup>, and Syuhaida<sup>3</sup> (2017). Many studies have pointed out major



sources of project setbacks within various countries, but projects are still being delayed now and then. However, the delay in any project leads to an increase in overhead expenses, and generally affects the cash flow, and creates the risk of insolvency (Chen et al. 2019). Previous studies indicate that what causes project delays in one country may be different from another country (Jongo<sup>1</sup> et al. 2019). Therefore this study specifically addresses the project delays in the South African context.

### **1.3 Research questions**

- What are the major causes of project delays in the South African construction industry?
- What are the mitigation measures against project delays in the South African construction industry?

### **1.4 Research aim and objectives**

This study focuses on:

- Establish and assess the project delay sources in construction industry in South Africa
- Detect the mitigation measures in construction industry in South Africa
- Ascertain different views among stakeholders concerning project setbacks.

### **1.5 Research significance**

The study gives a clear indication of the major contributors to project delays for the benefits of the clients and contractors. The identification of the causes of the project delays will serve as an eye-opener to the parties involved in the project. This will serve as a guideline for the client and the contractor toward completing the projects within time, quality, and budget. It will also eliminate the issue of unnecessary disputes among the parties to the project. This investigation establishes numerous project delay factors. However, this extensive literature review will save future researchers enough time when conducting studies on similar topics. The outcome of this study will assist both the professionals and academicians to understand the fundamental sources of project setbacks and their relief strategies in the South Africa construction industry (Zidane and Andersen 2017). This study will help the risk planners of construction projects when dealing with the issue of project analysis, monitoring, and controlling, as these are the critical factors for the successful delivery of projects (Sweis et al. 2019). The study will also benefit the future college and university graduates whose intentions are to proceed to the working field after graduation. The client policymakers who can revise or create policies based on the findings of this study will also benefit. Finally, this research will be of benefit to all project managers, engineers, contractors, and other technical personnel whose practical experiences will be enhanced by these discoveries.

### **1.6 Research plan**

A structured reviewed approach is done using the objective of this research. The peer review of online literature makes it easier to obtain relevant and accurate data. This is more efficient when compared with other search engines. The quantitative findings from the existing researches are combined and narrated. The methodology used in getting the related papers and their combination is described, and this makes the research consistent (Panova and Hilletoft 2018). The following research strategies are implemented in examining the factors creating project delays in South African (Amoatey et al 2015).

#### **1.6.1 Target respondents**

The targeted participants in this study are the skilled engineering professionals involved in the execution phase of the building and engineering services. The engineering consultant, client, and contractors are the fundamental parties during the execution process. The only government established entities in the construction industry are considered as clients, consultants, and contractors. Therefore, these three parties are considered in this study, and the research is limited to the building projects, water and sewer projects, and road and stormwater projects in South Africa. At least two respondents from these three entities with relevant experience are considered (Wang et al., 2018).

#### **1.6.2 Research strategy**

This study uses a quantitative research method to gather primary data. Literature review and questionnaires are used to explore the factors creating project delays. Any data collected through personal delivery must be in a sealed envelope. All envelopes are kept together in a safe box until the end of the data collection period before they can be opened. No names or contact details are allowed on the envelopes. However, this study does not permit cost implications for the participants. Free envelopes are provided for the hard copy questionnaires. The literature review enables the gathering of existing data on the topic, while the information gathered through surveys is used to verify the contents of the existing literature on the issue of project delays. The quantitative data are collected based on possible ideas from the construction projects. To maintain quality, this study mostly considers only the researches in peer-reviewed books, journals, and articles (Panova and Hilletoft 2018).

#### **1.6.3 Data collection**

Due to the unforeseen circumstance of the Covid-19 Pandemic, research data are collected using only a quantitative research method. In data collection, several sources of evidence are used to collect the primary data. This study considers only 65 peer-reviewed papers. The research uses a literature review and questionnaires to



compare current and past factors that may result in project setbacks all round the project lifecycle. The primary data is collected using a literature review of published journals, books, and articles. Google search engine is also used for fast and direct collection of data (Jongo<sup>1</sup> et al. 2019). Primary data is also collected through questionnaires. The questionnaires are designed and distributed personally and through emails to the construction companies. Data are gathered from the engineering consultant, client, and contractor using questionnaires. The data collection focuses mainly on the professionals working on the building projects, road and stormwater projects, and water and sewer projects. Respondents answer the questions at their own time. This approach looks more relaxed than in face to face interviews. The participants will have enough time to think and take decisions. Questionnaires are designed to consist of open-ended and closed questions. Participants are opportune to express personal views regarding the study. Closed and open-ended questions are used to gather clear opinions of the respondents.

#### **1.6.4 Data handling**

Data handling guarantees safe storing and discarding of collected information after the study is completed. This process is necessary to maintain the uprightness of research data since it speaks to the confidentiality, preservation, and security of research data. The collected data will be handled electronically by archiving them in the emails and external drives. The paper data will be stored safely through non-electronic means such as keeping them in different paper files. Data collected through emails will be archived immediately in the folders and external drives. In the electronically handled data, integrity must be considered to safely protect the recorded information. Research data will be safely discarded to prevent unauthorized interference. Responses received through emails will be downloaded and stored in a safe folder and the emails will be deleted from the system.

#### **1.6.5 Research design and sampling techniques**

This research is fact-finding in nature. Both empirical and questionnaire approaches are used for collecting data that are needed in this study. A selective sampling system is implemented in ascertaining the actual sample for the research. The focus is mainly on the experienced engineers, project managers, and other experienced technical personnel in construction companies and consulting firms in South Africa (Amoatey et al. 2015). There are over 265 civil engineering construction and consulting companies operating in the building projects, road and stormwater projects, and water and sewer projects in South Africa. This study considers only 30 established companies from these groups. In terms of research sampling, only established construction companies are considered in this study. Each of these 30 established companies has at least 2-4 experienced

engineers and project managers. Paper questionnaires are sent to these construction industries by hand delivery (where possible) and through emails. The respondents' emails are selected from the list of construction industries in South Africa. The respondents will return the completed questionnaires through emails or hardcopy (in an enclosed sealed envelope) directly to the researcher to minimize risks to privacy and confidentiality. The respondents returning the questionnaires through emails are not required to include their contact details where possible. This study does not allow any participant to indicate his/her name, age, sex, race in the questionnaires. To proceed with this research, a minimum of two respondents are required from each company. These respondents from each of the companies will be selected at random for data analysis. All information obtained from research participants are properly secured and only made available to the researchers involved in this application. All companies and participants in this study will be unnamed in any presented research.

#### **1.6.6 Research limitations**

This investigation is restricted to identifying and analyzing the project delays and their mitigation measures. Questionnaires are distributed in the South African Environment. The research concentrates mainly on three stakeholders due to their significant roles in the lifecycle of the projects. The study is focused on the participants' past and current experience on the projects. Stakeholders' past and current experience helps in collecting quality data about construction project delays. The size of the target organizations is all construction companies in government engineering projects in South Africa.

#### **1.6.7 Research participants' rights**

This study confirms that the participants' rights in the following ways will be fully considered and secured: right to have enough time to consider whether to participate or not; right to be informed of the purpose of the research and its impacts on you (both benefits and risks); right to know and understand the device to be used for the research; right to be informed of any cost implication and compensation to you as a participant; right to ensure your confidentiality will be secured; and right to be aware of the contacts for questions on the questionnaires.

#### **1.6.8 Researcher's responsibilities**

In this research, the researcher is obliged to ensure that all responsibilities will be adhered to throughout the study period and such responsibilities include the following: get informed consent from all study participants; inform participants about changes to the benefits or risks in the study; taking responsibility for my own skills & career development; promptly report all unanticipated research related problems to the University; maintaining regular



contact with the supervisory team; attend to all questions from participants; Per policy, keep research records for at least 10 years after the investigation is over; maintain the confidentiality of research participants; good timekeeping; comply with the University's requirements and all dissertation final submission requirements.

### **1.7 Ethics consideration**

Akaranga and Makau (2016) define ethics consideration as collection of codes and attitude that talk to questions of what is favourable or unpleasant when conducting research that involves collecting, analyzing, reporting, and publishing information that deals with human beings. The study does not force anyone to answer the questionnaires. All the personal information of the respondents are kept private and confidential. The quality and integrity of the research are ensured. Participants are guaranteed the ethical principles of Anonymity, confidentiality, and privacy, autonomy, beneficence, maleficence, and justice. This study shows no harm, partiality to the participants. The targeted participants are adults and professionals in the construction field and an informed consent form is required from the participants. Therefore, a signed Informed Consent and Statement of Agreement will be obtained from the participants. The research is independent and unbiased (Akaranga and Makau (2016). However, this study does not permit any cost implications for the participants. Free envelopes are provided for the hard copy questionnaires.

#### **1.7.1 Non-maleficence.**

The principle of non-maleficence maintains that there is no obligation to harm others. Therefore, this study is committed not to harm others. Although where harm cannot be avoided, the study will ensure to minimize the effects on the participants. Such injury includes emotional trauma and discomfort, social pitfall, impact to participants' financial standing, visible injury to participants, disregarding participants' privacy, and anonymity. Typically, this research does not intend to hurt participants but it is the risk of harm that should be minimized, and to minimize this risk, the researcher needs to think about it. The principle of non-maleficence is applied in this study to avoid creating a study that will knowingly harm the participants. The research avoids creating anything that causes harm such as causing harm possible to affect participants' employment or income. However, this study considers harm and its effects on ethical decision-making.

#### **1.7.2 Beneficence**

Beneficence is regarded as a means of kindness, charity, and mercy with a strong commitment to doing good to participants including moral obligation. This research intends to do good to participants. Therefore informed consent must be obtained before the research commences. The participants must be aware of their participation in this research and what the study requires of them. The research

will ensure that the participants are informed of the reason and outcome of the research, the methods being used, including associated inconveniences, demands, risks, and discomforts that the participants may be subjected to. Participating in this study will be voluntary. Volunteers will participate without being deceived and coerced. To implement this principle in this study, every effort must be made to ensure it is in place in order to design studies that will benefit the participants. It must be intended for the good of the majority of participants. The research study must be executed in a way to benefit the respondents and reduces any foreseen adverse effects such as psychological risks social, legal and economic risks, invasion of privacy, and social and economic harms. This concept of beneficence is applied within the research-respondent/researcher relationship to ensure the goal of this study incorporates the welfare of the participants. Because this study intends to discover new information that would be beneficial to the construction industry, this study has been prepared in a way to avoid hurting anyone involved in the study. The researcher is obligated to use the best system to minimize the foreseen risks and to maximize the benefits for participants.

#### **1.7.3 Autonomy**

In the principle of autonomy, research participants have a right to self-determination, that is, to make decisions about their lives without interference from others. This research will give freedom to participants to determine to take part or not. This study respects the decisions made by participants concerning their own lives. Research partakers can withdraw at any phase of this investigation. In the ethics consent form, participants are informed of their rights and freedom to pull out at any time. Autonomy is applied in this study to ensure that participants are treated as autonomous. This enables the participants to make their own informed decisions about whether to partake in the study. In order to treat participants as autonomous, they are furnished with complete information about the study to enable them to decide on their own whether to participate. Where participants are very sick or with mental disabilities, they are protected by involving them in research under special conditions since it is hard for them to make a real informed decision on their own.

#### **1.7.4 Justice**

Justice indicates the fair and equal treatment of individuals. This study will ensure each participant is given what he/she is due or deserved. This can be measured in terms of need, fairness, equity, or any other means that is material to the justice decision. All participants will be treated equally and no unfair burdens will be imposed on any participant. The study will not condone any sort of partiality among the participants. Combining beneficence and justice, the study is obligated to work for the benefit of those who are unfairly



treated. Justice is applied in this study to maintain the concept of fairness. To ensure this, questionnaires are developed in such a way there is fairness when selecting the participants and choice of questionnaire distribution strategies. This encloses the issues of benefits and risks of research to participants. The framework for thinking about these decisions is created in a way to ensure fairness and equity. Participants are not just included in this research because they are the target population that is easy to access. To maintain the principle of justice in this research, the questions being asked in the questionnaire are developed in a way to be relevant to the participants in the study.

#### **1.7.5 Confidentiality, anonymity, and privacy**

Akaranga and Makau (2016) describe confidentiality and anonymity as part of ethical practices that are developed to secure the privacy of human beings while collecting, analyzing, and reporting data. The study reveals that confidentiality is an act of separating the personal information of the participants from the collected data. However, it is noted that anonymity is a method in quantitative research studies that refers to collecting data without obtaining participants' personal information. This is mostly the reason why the researcher must ensure to protect any information collect from the participants. Although the report indicates that if any information needs to be disclosed, then consent needs to be obtained from the participants. The study further discloses that anonymity is mostly used in quantitative research studies while confidentiality is applied in qualitative research studies. Because this study involves a signed consent consensus and confidential information, the research ensures that the confidentiality of participants' data is in place by retaining this information using password preserved folders. Since confidentiality is identifiable data, locked doors and drawers are also used to keep hardcopy information secured. Because participants in this research may not be recognized by names alone, only complete discoveries and not personal-level information are reported publicly to maintain confidentiality. During the informed consent process, this study permits participants to know the precautions needed in order to protect the confidentiality of information. This principle allows the participants in this study to know the parties who may have access to their information such as the research team. The principle of anonymity is applied in this study since the collection of data involves signed consent documents which is the only identifying information linking the participants to the study. Although this information is mostly waived since this study uses an online survey that indicates not more than least danger to the participants. Since privacy is about people, the principle of privacy is incorporated in this study to control the circumstances of physically selecting participants in the study. Some participants may not want to be seen as being selected to partake in the study. Strategies are in place to protect

privacy interests regarding contact with potential respondents.

#### **1.7.6 Deception**

During the research exercise, the researcher must tell the truth to the participants. Deception occurs when the researcher tells lies to the research respondents for the purpose of misleading research subjects. Akaranga and Makau (2016) maintain that if such a situation occurs in the research, the researcher must provide an explanation as to why deception is required in this research and a justification for the deception. Since deception occurs when the participants are not told the truth about the purpose of the study or are given false information. However, deception may be considered as a useful research technique and the study that uses deception has contributed significantly to science. The use of this technique has created a big load of duty on researchers to furnish a scientific reason for the deception. In this case, this study furnishes supplementary protection to treat the likely negative impacts on respondents such as destroying the respondent's self-respect through suffering shame, stress, embarrassment, feeling manipulated, or lacking control over their own experience, the potential of deception to facilitate an unwanted and inappropriate invasion of privacy, feeling forced to have knowledge about one's self that otherwise, one might not want to know, the potential enforcement of participants into acting against their own will, potential for participants to change their mind about using of their information after the deception is disclosed.

#### **1.8 Participant's informed consent process and a statement of agreement**

Research partakers shall be allowed the chances to inquire about the study in order to assist them in deciding whether partaking or not. Prior to selecting the participants for this research, participants shall be accorded all information concerning the study and the likely implications of their involvement in the study. This information is given either verbally for those using hard copy questionnaires or in a written format for those participating through email contacts. Questionnaires summarizing key information about the study are used. Signed written consent is required. Oral consent is acceptable in the presence of a witness. An informed consent agreement form is attached to the questionnaire during distribution to the partakers. The content of the consent form is clear and precise.

##### **1.8.1 Required elements of informed consent**

The name and contact details of the researcher are made available to participants for further inquiries. The expected duration and reason for the study are indicated. The exact procedure to follow is explained to participants. The participants are also made to understand the research activities involved in the study. The participants are



informed of foreseeable discomforts or risks that are connected with the research study. A clear indication of the foreseeable benefits of partaking in the research study is explained to the participants. If the research participation is voluntary, it is clearly indicated. The research participants are informed of any future use of information if any and consent must be obtained. The right to refuse to partake in the research or to pull out consent at any time during the

period of study without any effect on their future is explained to the participants. The participants are informed that participating is voluntary and that there is no punishment or loss of benefits in rejecting to partake in the study. The participants may discontinue from partaking in the research at any time without harm. This study has developed the following informed consent process template to be presented to participants.

<b>University of Johannesburg</b>
<b>Informed Consent Form to partake in a research</b>
<b>Consent form for research participants:</b> This informed consent form is for construction professionals working in the South African construction industry and who are being invited to partake in research titled: <b>‘Analyzing the project delay causes in the South African construction industry’</b> .
Name of researcher: Anthony Obododike Ekwuno Name of Institution: University of Johannesburg Name of Project: ‘Analyzing the project delay causes in the South African construction industry’
<b>This Informed Consent Form has two parts:</b> <ul style="list-style-type: none"> <li>• Datasheet to disseminate details about the research</li> <li>• Consent certificate for signature and date should you decide to get involved</li> </ul>
An informed consent form will be given to you for signature and date before proceeding.
<b>Part I: Datasheet</b>
<b>Introduction:</b> My name is Anthony Obododike Ekwuno, a master of philosophy student in engineering management at the University of Johannesburg. I am exploring the project delay causes and mitigation measures which are very common in the South African construction industry. I will invite and furnish you with the full information to partake in this study. You are not mandated to give an immediate decision about whether to get involved or not. Prior to deciding, you are free to speak to any reliable person regarding this study. This consent form is likely to encompass words that you may not know. Please ask me for clarification and I will explain it to you. Please ask me or another researcher any questions you may have later.
<b>Purpose of the research:</b> Delay in projects has been a vital issue affecting the South African economic growth. This research is seeking a way to prevent this from occurring. I am of the opinion that you are in a better position to help me by telling me what you know about project delay causes in general. This study seeks to learn the understanding of people who reside and work in South Africa regarding the sources of project delays. I want to study the various means that the construction industry can stop this before it generates a bigger picture. I will also like to understand more about project delay causes because this knowledge might help me to understand the better way to circumvent project delays.
<b>Kind of research involvement:</b> This study will use an online survey or hard copy questionnaires that will give you more comfort to answer the questions properly.



**Selection of partakers:**

I am inviting you to get involved in this research because I notice that your experience as a responsible construction professional worker in the construction industry can add much to my apprehension of the causes of project delays

➤ **Questions to clarify understanding:**

- Are you aware why I am inviting you to participate in this study?
- Are you aware of what the study is about?
- Do you have any questions?

**Voluntary Participation**

Your involvement in this study is absolutely voluntary. Responsibility is upon you to decide whether to get involved or not. Your rights as a person will still be maintained and nothing will change if you decide to refuse participation. Your participation will have no adverse impacts on your job. You are free to revise your decision later.

➤ **Questions to clarify understanding:**

- In deciding to refuse to get involved in this study, are you aware of the options available for you?
- Are you aware that you can refuse to participate in this study?
- Do you have any questions?

**Strategies:**

**A.** I am requesting you to assist me to gain an understanding of project delay causes in South Africa. However, you are being invited to partake in this research. If you welcome this invitation, you will need to sign a consent form before proceeding.

**B.** For the questionnaire survey, you will fill out a survey which will be provided to you by email or hardcopy by Anthony Obododike Ekwuno and collected by Anthony Obododike Ekwuno. You are required to complete the questionnaire yourself or someone can assist you to fill the questionnaire. You are free to leave out any question in the survey that you may not like to answer. The survey will be distributed through emails and hardcopy where necessary. Your recorded data is absolutely confidential. No name will be inserted on the forms. You can only be identified by a number and nobody apart from Anthony Obododike Ekwuno (Researcher) has the opportunity to access your information.

**Duration:**

The research will be conducted within five-weeks starting from 21<sup>st</sup> September to 25<sup>th</sup> October 2020. During this time, I will be reminding you once a week of your participation.

➤ **Questions to clarify understanding:**

- If you consent to be involved, are you aware of how long the survey will take?
- Where will it take place?
- Do you know that you will be reminded of your participation?
- If you consent to this, are you aware you can annul partaking?
- Are you aware that you can leave out any question if not willing to answer it?
- Do you have any more question?

**Risks:**

The foreseen risks associated with this research include psychological risks like unnecessary alterations in an idea and feelings (for instance, an incident of unhappiness, doubt, feelings of pressure, accountability, and loss of self-respect), social, legal, and economic risks like the controlling of delicate information that can injure the participants through infringement of confidentiality. This can cause discomfort within a participant's social group or deprivation of employment. However, I do not expect this to occur. You are not by law required to respond to any question or participate if the questions seem to be too private or you feel uncomfortable participating. This risk is minimized through assessing the proposed study in line with the guidelines indicated in ethical principles. The invasion of privacy of participants through observation of behaviour that the participants may consider private. This risk is minimized ensuring that the research design is modified in a way



to be conducted without storming the participant's privacy. All these risks are minimized by furnishing thorough information in the ethical agreement concerning the proposed study, ensuring that only researcher in this study conducts the research, ensuring that the estimated study sample size is adequate to give helpful outcomes, and collecting data with a degree of care to prevent needless threat such as intrusion.

**Benefits:**

You will not get direct benefit from this study, but your getting involved is likely to assist me ascertain more on project delay factors and how to minimize them in South Africa.

**Reimbursements:**

Participation in this study is voluntary. Therefore, there is no incentive available for participants in this study.

**Questions to clarify understanding:**

- Are you aware of the benefits that you will have if volunteer to partake part in the study?
- Do you have any other questions?

**Confidentiality:**

Research conducted in the South African construction industry may attract attention and if you decide to involve in the study, other people in the industry may ask you some questions. Hence, your information will not be exposed to anyone who is not a member of the research team. Any data concerning will have a number on it rather than your name. Only the researcher will be aware of your contact details. Your information will be locked up in private locker with key. None will share your data apart from the research sponsors who will have access to the information.

**Sharing the results:**

There is nothing that you provided in this study that will be shared with anyone outside the research team. You will be informed of the knowledge gained from this study before it is publicized. As a respondent, a summary of the results will be given to you. Thereafter, the results will be published to enable other people interested in the study learn from the knowledge.

**Right to refuse or withdraw:**

Remember once again that you are not required by law to participate, if you are not interested in the study. However, refusing to partake create no negative impact on your job. You may decide to stop partaking in the survey at any time you want and your job will not affected. You have the chance at the ending of survey period to finally confirm your responses.

**Contact Information:**

Should there be any questions, please ask me at any time. You may decide to contact Mr Anthony Obododike Ekwuno on [anthonyekwuno@yahoo.com](mailto:anthonyekwuno@yahoo.com), +27780031896. Please note that the University of Johannesburg has reviewed and approved this proposal. This is a committee whose responsibility is to ensure absolute protection of the research partakers from any harm. Should you need to find out more about the University of Johannesburg, please dial 011 559 2109.

➤ **Questions to clarify understanding:**

- Are you aware of your right to annul participating in this study when you want to?
- Are you aware that you are free to ask more questions later?
- Are you aware of the research contact details for more information?
- Do you have any other questions?

**Part II: Consent certificate**

I have been requested to get involved in study about project delay causes in South African construction industry. I do confirm reading through the foregoing instruction. Enough opportunity was given to me to ask questions and all my questions were treated to my contentment. I am aware that my involvement is non-mandatory and that I have the right to pull out at any time, without a reason, and at no cost. I am also aware that a copy of the consent will be given to me for signature and date. I voluntarily agreed to be get involved in this survey.



Name of Participant _____
Signature of Participant _____
Date _____
<b>Statement by the researcher:</b> I precisely studied the datasheet and ensure that the respondents comprehend the contents and requirements of this research. However, I do affirm that the respondents were permitted to inquire about the study. All queries were answered accurately as much as I could. I do confirm that participants were not pressurized to give consent. The consent has been freely given voluntarily. I do affirm that the respondents have given an informed consent form. Name of researcher _____ Signature of researcher _____ Date _____

**1.8.2 Documentation of informed consent**

The main purpose of this research is to ascertain and analyze the major roots of project setbacks and their relief strategies in South African construction industry. The different opinions among among the stakeholders concerning projects setbacks will be examined. This research is also a way to advise, verify a theory, and add to improving knowledge in the field of study. This study will discuss the importance of this research such as a means to comprehend various roots of project setbacks and their relief strategies. It will also serve as an instrument for improving knowledge and facilitating learning. The research will serve as a means of verifying untruths and promote truths. It will be an opportunity to embrace reading, writing, analyzing, and communicating relevant knowledge. The researcher is obliged to document the participants' signed and dated informed consent form.

**1.8.3 Reporting results**

The result section of this research paper reports the information collected as a result of the methodology applied. This section will indicate the findings, without bias, and arranged in a logical sequence. The report will be in a simple unambiguous and concise manner. Every technical jargon will be avoided. The report is sent to different levels of participants and the forms are designed to suit the respective levels. However, the report will be reasonably accurate and should be correct within the margin of error permitted to avoid losing trust in the report. The results will be reported using written statements and tabulated Statistics. This report will be prepared and presented on time.

**1.8.4 Informed consent statement of agreement**

Before agreeing to participate, please ensure that you are aware of the contents of the study before signing. The researcher will give you a copy of this document for your records if required. Further questions about the study after signing this document should be directed to researcher on email: [anthonyekwuno@yahoo.com](mailto:anthonyekwuno@yahoo.com) or WhatsApp at +2761054612. Note that signing this document means agreeing to take part in the study and ensure you understand

what the study is talking about. A copy of this document will be given to you for record purposes if required. The original copy will be kept with the study records. Should you like to gain an understanding of the discoveries from this study, please email me at [anthonyekwuno@yahoo.com](mailto:anthonyekwuno@yahoo.com) or WhatsApp at +27610546121 and I will be glad to attend to your request.

Thank you very much for participating in this study.

Signed: \_\_\_\_\_ Date \_\_\_\_\_

Name \_\_\_\_\_ of \_\_\_\_\_ researcher: \_\_\_\_\_

Enrolled in: Master of Philosophy in Engineering Management  
University of Johannesburg

**1.8.5 Consent certificate**

I have studied and comprehended the details provided. I was given enough chance to ask questions and all questions were answered to my contentment. I am aware that my involvement is non-mandatory and that I have the right to pull out at any time, without a reason, and at no cost. I am also aware that a copy of the consent form will be given to me for signature and date. I voluntarily agreed to get involved in this study. I therefore admit to being conversant with what the study is about and all my queries have been addressed. I accept to participate in this study.

Signed: \_\_\_\_\_ Date \_\_\_\_\_

Name \_\_\_\_\_ of \_\_\_\_\_ participant: \_\_\_\_\_



**1.8.6 Consent to be informed for partaking in future research study**

I do permit the researcher to keep my contact information and to inform me of future research studies.

Yes: \_\_\_\_\_ No: \_\_\_\_\_

Signed: \_\_\_\_\_ Date \_\_\_\_\_

Name \_\_\_\_\_ of participant: \_\_\_\_\_

**1.8.7 Researcher’s attestation**

I declare that the contents of this study were clearly explained to the participant. I explained the consent form to the participant and all questions were answered. The

**1.9 Research provisional time schedule**

**Table-1 below summarizes the estimated duration of the study**

Anticipated time period	Anticipated activities
25 <sup>th</sup> August 2020	Chapter 1. Introduction
11 <sup>th</sup> September 2020	Chapter 2. Literature review
5 <sup>th</sup> October 2020	Chapter 3. Research methodology
20 <sup>th</sup> October 2020	Chapter 4. Results and findings
26 <sup>th</sup> October 2020	Chapter 5. Conclusion and recommendations
11 <sup>th</sup> November 2020	Submit complete minor dissertation

**II. CHAPTER 2. LITERATURE REVIEW**

Delays in project delivery have been generating major problems in the construction industry. These delays have caused major budget and time overruns within the construction industry. It is discovered that a construction project is a compound undertaking that needs the collaboration of people and resources. The study further reveals that factors such as lack of materials, use of inexperienced workers, change of scope, unforeseen circumstances, sudden change of scope could make the scheduled project difficult to achieve. The study asserts that construction errors, altering work scope, and substandard management of work activities create delays in the execution stage of the project. Low productivity, conflicts, and lack of experience are mostly attributed to the labor force. According to Zidane and Andersen (2017), the successful delivery of a project is evidence of efficiency. As a result, many researchers have shown much attention to finding the fundamental sources of project delays. Several studies focused on project delay factors and their mitigation measures. However, this study will concentrate on identifying and analyzing the fundamental sources of

participant got a proper understanding of the information and accurately responded to the following queries:

- Do you understand the aims and purpose of this investigation?
- Do you know the likely risks of taking part in this investigation?
- Do you know what is required of you in this investigation?
- Do you know the likely benefits of taking part in this investigation?
- Must you partake in this investigation?
- Are you likely to incur any expenses in this investigation? If yes, how much?
- Do you intend to leave this investigation when you wish to?

Signed: \_\_\_\_\_ Date: \_\_\_\_\_

Name \_\_\_\_\_ of \_\_\_\_\_ researcher: \_\_\_\_\_

—

project setbacks and their relief strategies in the South African construction industry.

**2.1 Causes of project delays in the construction industry**

Abdullah<sup>1</sup> et al. (2018) report that the major factors delaying palm oil refinery projects in Malaysia are poor time management and wrong costing. The study discloses that enormous investment improves the performance of the construction sector in Malaysia. Using a literature review system, the researchers identify and enumerate in a tabular form a list of 176 factors from 89 out of 140 questionnaires that were sent to participants. The study reveals three major contributors to project delays as engaging unskilled subcontractors, poor planning/scheduling, and delays in subcontracted works. The research indicates that good strategies and strong decision principles are needed for construction projects to progress within the predicted project cost and time schedule. The study finds that inaccurate and delays in the design are the most critical factors causing project cost overruns.

Agyekum-Mensah and Knight (2017) conduct research on project delay factors and identify 32 factors causing project delays and grouped them into 16 sections as insufficient



planning, design problems, poor information flow and communication, poor coordination, lack of knowledge, health and safety restrictions, wrong application of construction methods, poor space and logistics management, and scope creep. The study maintains that good communication and resource management can minimize project delays. The study maintains that to comprehend the real issues in the construction, it is advisable to ask people engaged in the project. The researchers classify delays into two major types such as excusable and nonexcusable delays. The study further discloses that excusable delays can be compensable or non-compensable. The report maintains that compensable delays can be reimbursed to the contractor in the form of time extension or cost depending on the contractual agreement.

Akaranga and Makau (2016) in their survey reports emphasize that human beings experience certain challenges when making ethical decisions in life. The authors discover that it is not easy to differentiate between morality and ethics. The researchers caution that it is mandatory that every research work must adhere to the 15% or less plagiarized material rule before it can be approved and included in the research repository. The authors add that the study of ethics has generated social norms which centers on the character expected of a person at a particular time. The study explains that moral values are instilled in a person's life which can be controlled by the manner a person communicates in society. The study also reveals that research ethics is very important in the life of a person in order to safeguard the dignity of his/her topic. The authors identify two philosophical approaches to research ethics: teleology and deontology. The teleological view states that the end of research work defends the techniques. This indicates that research benefits can only be measured against the value of complying ethically, while the deontological theories indicate that unethical research can never be used to measure the end results of research work. These experiments led to the death of many while many were permanently crippled. The study cautions that plagiarism is unethical in research work and that plagiarism commonly manifests in the introduction and literature review parts of research work. The study maintains that this can be due to laziness or ignorance and that it is the duty of the researcher to reference the original materials correctly as this can affect the dignity of the researcher. The authors explain that plagiarism can be self-plagiarism or multiple duplications and that the main reason for maintaining research ethics is to improve the welfare of people and circumvent prejudice. The study finally advises that there is a need for all academic members of an institution and postgraduate students to enroll and acquire google scholar accounts in order to upload their published documents appropriately.

Alsuliman (2019) identifies 50 factors of project delays in construction. A special group of 211 participants was

considered. Top 20 causes were revealed. Those top 20 factors are summarised as follow: applying the lowest bidder system in awarding contract, low financial capability of contractors, selecting contractors with bad implementation history, government's negligence of developing engineering sector, government lateness in paying the contractors, inadequate technical capacities of the contractors, government inability to withdraw the delayed projects from the contractors, construction parties' negligence of construction timetable, use of weak competitors, using unqualified subcontractors, poor salaries to workers, variation orders during the course of construction, inaccurate construction details, poor coordination of the work by parties on the project, engaging weak and inexperienced engineers on the project, using poor consultant offices, lack of training and development of the work personnel, weakness of government technical supervisors, government poor planning method and use of wrong information between government and contractors on the projects.

Alzara\* et al. (2016) investigate mitigation measures against delay in the university project. The study observes ten major causes of project delays as the late document approval, late payment, substandard achievement, incompetent contractor, engaging low qualified contractors, no manpower, no engineer on-site, contractors delays in the payment of salaries to their workers, shortage of manpower, and poor bidding method. The report reveals that when the contractor is affected by cashflow problems, the overall project completion schedule will be affected. The researchers discovered that the major delay factors are attributed to the consultant due inability to identify mistakes and discrepancies in the design documents. Alzara et al. (2016) reveal that although it is hard to coordinate all parties on the construction projects, good communication and coordination remain the vital parts in improving the chances of project success. Alzara\* et al. (2016) maintain that factors causing delays are resolved on project phases.

Alnuaimi, Mohammed, and Mohsin (2013) in their survey reports on the project delay factors reveal that delays are unavoidable. The study discovers that delays can be a devastating factor for every construction plan if it is not sorted out on time. The researchers further advise on the necessity to design a set of remedial actions to circumvent the issue of project delays. The study maintains that the critical delay factors in Jordan are unforeseen site conditions, scope changes, bad weather, late materials delivery, unexpected variation orders, market inflation, and bad economic situations. The study also discovers that these critical causes of project delays are grouped as design delay, financial setback, government regulation setback, construction delay, and management delay.

Amoatey et al. (2015) identify 37 causes of project delays and group them into ten major categories as financial related



(which involves lack of fund to pay for the work done), environmental-related (which involves bad weather, the conditions of the site, ground conditions), technical related (continuous changing of the scope of work, using wrong methods of construction, involving too many variation orders), operational related (using incompetent engineers and contractors, unnecessary bureaucracy in construction, lack of quality), economic-related (lack of sufficient funds from the sponsors, inflation), relationship-related (negligence of some parties to the project, lack of direction, negligence of industrial relations), resource-related (poor productivity of labor, immediate price increase, using substandard equipment and materials, lack of materials on-site), legal-related (complicated and insufficient details in the contract documents, long disputes resolution methods in the contract documents, government/political-related (change of government, lack of government commitment to the projects, government complicated policy), security/safety-related, (lack of safety measures on-site, vandalism of materials and equipment, uncontrolled accident and injuries, negligence of safety and security officers on-site). The study finally reveals that delays on a project can lead to budget overrun, termination of a contract, complete absconding of the projects, legal issues, and contractor being lured into critical financial crisis.

Amoatey and Ankras (2017) conduct research on delay factors in Ghanaian road projects and observe that 70% of road projects in Ghana experienced delays, while 52% of the projects are subject to cost overruns. The study maintains that five major sources of delays are attributed to the late payment of work done by the contractor, hiring inexperienced contractors, modification of the scope of work during the course of construction, late handover of the site to the contractor, and inflexibility in allocating finance to project. The study states that the client creates excusable delays and the contractor creates unforgivable delays. Researchers warn that the contractors should not involve in a project if they are not financially capable to handle the project. The study concludes that the most challenging problem in road projects is the issue of risk management of time and budget overruns.

Ansah and Shahryar (2018) define a delay as a failure to complete a project within a specified period of time. The survey report indicates that delays emanate at different stages of construction, but the major setbacks occur at the implementation stage. The study reveals the identification of actual causes of delays can effectively reduce the time and budget overruns. Ansah and Shahryar (2018) further reveal that the incapacity nature of any party to a project can generate serious delays to that project. The research discovers that delays related to the client include: suspension of work, lateness in approving materials, lack of funding, and late decision making, while the delays due to the engineers are incompetent and shortage of staff to review design documents. Also, delays related to the

contractor are engaging incompetent workers, lack of finance, and conflicts among the team members. Shortage of materials poor supply chain techniques create a material-related setback. Labor-related delays are due to a shortage of skilled labor, while the delays due to unrealistic project period are the causes of contract disputes. The authors reveal that delay factors and respective risks are linked to the 4P (Project-Related, Practices, Participants, and Procurements).

Aziz\* (2013) investigates delay factors after the Egyptian revolution and identified 99 reasons for project delays in Egypt. The study classifies the delays into 7 groups: delay due to consultant, contractor, external factors, labor, materials, client, and project-related causes. The study uses the relative importance index to rank the various groups. The authors report that there is a need for quality inspection and testing by the consultant. The study advises that efficient communication should be established to minimize the issue of project setbacks. Researchers indicate that time delay in every construction project is of fundamental significance to the benefits of projects. The study further unfolds that delay factors are usually connected to the fulfillment of budget, time, and quality. Aziz\* (2013) regards the project as being successful only when finished within quality, budget, time, and to client's satisfaction. The author reveals that to control delay effectively, its causes must be detected and handled. Aziz\* (2013) finally cautions that any problem arising from defective communication among the parties on the project may create a serious misunderstanding among the parties, thereby causing a delay in the execution of the project.

Banobi and Jung\* (2019) focus on studying the delay factors and their relief measures in the power projects. According to the study, many construction projects experience critical delays that generate a lot of losses. The study identifies major delay factors as the owner's financial incapacity, vandalism on site of work, lateness in payment by the client and contractor for the work done or materials supplied to site, engaging incompetent workers, lateness in issuing work permits by the government authorities, use of lowest bidder system, using ineffective communication system and poor coordination of site. The study maintains that there are little gaps between the clients and the contractors if the project plans are met. The report discovers that project delay factors and their relief measures rely on the progress performance of the project. The study concludes that numerous project delay factors are much related to the implementation of the lowest bid system, insufficient funds, and kind of decision-makers within the management.

Chen et al. (2019) conduct an investigation on delay factors in the Chinese grain bin projects. After careful reviewing of existing literature, it is found that little effort has been shown in identifying the causes of grain bin project delays in China. The study uses a total of 20 papers to carry out the



investigation. It is revealed initially that 39 factors contribute to the project delays. However, survey questionnaires are administered to public officials, industrial personnel, and academic researchers. Their responses show that 20 factors contribute to the construction project delays. The study further stipulates that the five major factors that pose a greater threat to the project success are lack of equipment, disputes between subcontractors, incompetent design team, poor interaction among the parties on the project, and the client's continuous change of orders.

Dr. Samarah<sup>1</sup> et al. (2016) define delays as an extension of time beyond the contract period. The study discovers that the effects of delays on a project may likely alter the efficiency of that project. The authors maintain that delays can be minimized through the acknowledgment of their exact causes. The study further classifies delay factors as external and internal factors. The report indicates that the effects of setbacks on a project are time and budget overruns, disputes, and project desertation. According to researchers, the relationship between the impacts and causes of delay on a project can be classified as direct and indirect relationships. The authors reveal that execution time is regarded as one of the performance measures used on the construction projects and that these measures include cost, time, and quality. The study concludes that the success of every project is determined by these performance measures and that this issue mostly concerns the client and the contractor.

Durdyev and Hosseini (2018) focus on the comprehensive list of project delay factors and discover a total of 149 factors that cause project delays. The research further discloses that the most common eleven factors include ineffective communication, unforeseen weather conditions, lack of equipment, insufficient materials on-site, poor project planning, shortage of workers, lack of knowledge among the parties on the project, improper coordination, and conflicts among the parties on the project, poor management of the site and the insufficient fund for the project. The study also maintains that unforeseeable delays are compensable delays that can not be controlled by contractors. The study further discovers that internal delays are caused by the project stakeholders, while the external delays are caused by the third parties on the project such as labor unions, the providers of utility services, and the government authorities. The research adds that contractual relationships, project delivery systems, and culture must not be overlooked in the construction industry.

Elawi<sup>a</sup> et al. (2016) research and identify reasons for project delays in road and bridge projects in Saudi Arabia as the engaging incompetent contractor, lack of finance, defective design, and use of lowest bidder system, change orders by the owner, lack, and cost of materials in the market as well as difficulties in obtaining work permits. The study compares the outcomes with the projects in other gulf countries. The outcome of this comparison shows that the

major cause of project delays is the land acquisition factor. The researchers further indicate that the other factors causing delays are attributed to the incompetent contractors, underground utilities, and redesigning. It is also revealed that more causes are due to the owners as compared to that of consultants, contractors, and other stakeholders. The study discloses that the major factors creating project setbacks surface during the construction stage due to the continuous involvement of unforeseen risks. The researchers classify the construction project's lifecycle into initial, design, and construction phases. Elawi<sup>a</sup> et al. (2016) classify delays as justifiable and unjustifiable delays, whereas justifiable delays are the ones caused by the client. This type of delay is compensable to the contractors as damages if it is included in the contract documents. The unjustifiable delays are created by contractors and are not compensable to contractors.

Famiyeh et al. (2017) indicate that the critical sources of budget and time overruns in projects are wrong definitions of project scope, financial problems from the client and the contractors, unrealistic project period imposed by the client, using incompetent engineers for inspection and supervision, underestimation of quantities of work, using the wrong method of construction, poor site management by the parties on the project, government lateness in issuing work permits, improper communication plan, a sudden increase in prices of materials. The study maintains that delays can be minimized if competent personnel is used in the project. The research further adds that the underestimation of the complexity of the project should be avoided. The research discovers that in practice, budget and time overruns do occur in projects but the degree of these occurrences differs from one project to another. According to the study, a negative value signifies budget saving while a positive value indicates budget overrun. The report cautions that the contractors should desist from underestimating the complexity of any project irrespective of the size.

Fugar and Agyakwah-Baah (2010) investigate delay sources in Ghanaian building projects. Researchers use contractors, clients, and consultants as key stakeholders. According to the report, 32 likely causes are discovered. The analysis shows that all participants agree that the major causes of project delays are within the financial, economic, unpredictable conditions and material supply aspects of the project which involve a late payment of work done, market inflation, and inability to assess credits from financial institutions. The study also notes the issue of poor project monitoring as one of the critical roots. The report further classifies delays into a forgivable but non-remunerative delay, remunerative delays, and unjustifiable delays. The research maintains that remunerative delays are created by the client, while forgivable but non-remunerative delays are created by factors that are beyond the control of all parties on the project. The study indicates that inexcusable delays are caused by the contractors. The research reveals that



external related causes are due to the act of God, government action, and the suppliers of work materials and that these causes are beyond the control of all parties on the project.

The survey report by Islam<sup>1</sup> et al (2015) on the project delay factors in causes of Bangladesh discovers 10 major project delay factors out of the 79 listed factors. The study listed these 10 major delay factors as engaging incompetent managers, wrong project planning and scheduling, lowest bidder system, client's financial crisis, improper project management, scarcity of skilled personnel, contractor's financial incapability, market inflation, work overloading on the contractors and poor site conditions. However, the authors regard delay as an extension of work beyond the agreed project period. To the contractor, delay signifies loss of money while it means loss of revenue to the client. The authors conclude the study by cautioning that delays on a project can lead to corrosive conditions like litigation, arbitration, and complete abandonment of the project.

Jongo<sup>1</sup> et al. (2019) focus more on the project delay relief measures in Dar-Es-Salaam, Tanzania. The study is limited to building projects in Tanzania. Research reveals 25 mitigation measures out of which proper project planning and scheduling are regarded as one of the most effective measures. This is followed by effective communication among the parties and the ability to monitor and control changes in design. However, the study discovers that more attention should be shown to the appointment of a competent manager, provision of the accurate bill of quantities, early payment of work done, proper planning for equipment, and materials delivery in order to minimize construction project delays. The study indicates achieving project success is fundamental as companies operate on confined limits. The report discloses that delay and cost overruns affect the client's financial capacity thereby leading the project to be abandoned incomplete. It is discovered that the construction project is of high value and time-bound. The study identifies five parameters of a project as scope, time, cost, quality, and resources. Out of these five parameters, time and scope mostly define a project. In this situation, scope, cost, and time become the main parameters for a given quality. These parameters are required to balance each other in order to achieve project objectives effectively (Jongo<sup>1</sup> et al. 2019). The study also identifies 25 relief measures to minimize budget overrun and delays in public building works.

Kazaz<sup>1</sup>,et al. (2012) list the major project delay factors as alterations in designs, lateness in making payments for the work done, financial crisis from the client, low and poor productivity by the workers, contractor's inability to pay the workers. The study indicates that a change in design and materials is the most critical factor. The authors advise that all these delay factors can be reduced by engaging a competent project manager except on the environmental issues that can not be controlled. Kazaz<sup>1</sup>,et al. (2012) reveal

that deviation from a planned project time schedule is a usual matter in advanced and emerging countries. The systematic work flow is interrupted due to various factors arising during the construction period. The study discloses that time extensions are chronic problems in projects. Projects are successful only if complete within time schedule, costs, and specified quality. In practice, the budgeted project time schedule may be exceeded due to the owner, legal, contractors, and natural occurrences. It is discovered that financial factors include cash flow issues, market inflation, delay in payment of work done, contractor's financial difficulty. Project-based factors consist of the use of old construction methods, lack of proper site investigations, project complexity, poor maintenance of works, equipment, and materials. Resource-based factors consist of poor material management, improper selection of materials, problems of material storage, transportation problems of resources, and poor resource productivity. Owner-based factors consist of bureaucracy and management inefficiency. Environmental factors consist of work accidents, geological issues, location and layout of the site, and adverse weather conditions. Labor-based factors include low productivity, lack of competent workers, and construction defects. Management factors include manager-labor relationship, conflicts among parties on the project, design changes, poor quality control, improper bill of quantities, and poor site coordination.

Koshe<sup>1</sup> and Jha<sup>2</sup> (2016) report on project delay factors in Ethiopian construction industries. The study discusses 5 critical delay factors in the Ethiopian construction industries. The researchers maintain that lack of finance from the contractor, poor planning and scheduling, inflation of materials, lateness in payment of work done, and engaging more unskilled professionals on the project management pose a greater threat to the successful completion of a project.

Lessing<sup>a</sup>,et al. (2017) discover in their surveys that the major project delay factor is unanticipated soil conditions as soil tests unforeseen the entire site conditions. Authors conduct surveys mainly on construction and site managers with 10 years of working experience. It is observed from the respondents that design-related issues contribute a major part to construction delays. It is realized that this issue is due to the lateness in completing design documents, uncertain and incomplete details on the drawings. The study reveals that the construction industry is a project-based production, and this has caused the construction supply chain to be broken into pieces. The research maintains that the problems causing project delays are universal and that by identifying these factors, delays on the construction projects can be managed. The research explains that the only way to measure the success of a project is through the cost, quality, and time at the end of the project. The report insists that every project possesses its own quality standard but there cannot be a compromise on time and budget



constraints. The study indicates that maintaining a high degree of construction relationship improves the quality of project performance.

Marzouk and El-Rasas (2014) identify leading project delay factors using research questionnaires. The study indicates that major causes of project delays are improper planning, financial incapacity, scope creep, poor supervision, inexperienced workers, poor soil conditions, lack of materials, late payment, and design errors. The study maintains that unexpected variation order causes project set back. The study also highlights the major ways to minimize project setbacks in construction. According to Marzouk and El-Rasas (2014), no difference in opinions is found from the stakeholders regarding project delay factors. The study maintains that delays created by the client pose a very high risk to the project while the delays caused by the contractor score a high degree. The research adds that the delays caused by the consultant, labor, and equipment pose a low risk in the assessment table.

Masood<sup>1</sup> et al. (2015) identifies 53 causes of project delays and classified into nine categories as labor-related setbacks, setbacks due to the project itself, setbacks due to design, setbacks due to materials, setbacks due to equipment, setbacks due to contractor, setbacks due to consulting engineer, setbacks due to client, set backs due to labor force and set backs due to unforeseen circumstances. The study further maintains that 3 factors creating project setbacks are linked to the project itself, 6 causes are related to design, 7 causes relate to materials, 6 causes relate to equipment, 7 causes relate to the contractor, 4 causes relate to consulting engineer, 5 causes relate to the client, and 6 causes relate to the labor force.

The literature review by Mello et al. (2015) indicates that poor coordination causes delays on the construction projects. Considering the engineer-to-order supply chains, companies have it as responsibilities to undertake different activities such as design, commissioning, logistics engineering, and procurement in the project implementation (Mello et al. 2015). The research warns that the occurrence of delays can seriously impact the capacity of a company. Rework and long delays are unique in large engineering projects. This increases project period and costs. Mello, Strandhagen and Alfnes (2015) report that to maintain the stability and order of a system, proper coordination is important in the decision making process. Authors further discover that inadequate external support, poor communication, insufficient cooperation, ambiguities in authority relationships, and improper initiating structure are some of the common coordination problems. There has been a greater increment in the number of outsourced events without considering the associated risks attached to them. The timely delivery of a project is regarded as the most vital measure for project efficiency. The research indicates that in the engineer-to-order(ETO) establishments, project delay

factors differ from one project to another due to numerous uncertainties.

Mydin<sup>1</sup> et al (2014) report that ten major causes of project delays are bad weather conditions, inexperience consultants, consistent construction errors, late approval of project scope, continual contract adjustment, a financial constraint on the part of the contractor, poor site management by parties on the project, poor documentation by the consultant, contractor's poor coordination of work and unbearable site conditions. According to the study, a delay is an unexpected occurrence that alters the project completion date. The authors caution that an unexpected delay in a project extends the completion date of that project thereby inflating the cost of that project.

Ntshangase and Tuan (2019) discuss delay factors affecting the progress of the South African electrical distribution projects. The authors use concept star software for modeling in this study. The three factors discovered include poor planning, poor communication, and poor project schedule. The study states that project delays have adverse effects on the stakeholders. Researchers caution that this can lead to untrustworthiness, cash flow issues, litigation, arbitration, and poor relationships in the future. The authors warn that customer satisfaction can also be affected if care is not taken. The study further reveals that the negative effects of delays on a project include poor quality work, lack of safety, and budget overrun. Ntshangase and Tuan (2019) maintain that slow in making decisions creates delays in the construction field. It is also reported that poor service delivery can lead to community unrest which will create project delays. The research concludes that the major delay factors are lack of funding and late payment of work done, excessive variation orders, poor soil conditions, lack of proper planning and scheduling, and contractor's financial constraints.

Ogunde<sup>1\*</sup> et.al. (2017) on the study of the delay relief measures on projects in Lagos Megacity emphasize that a common problem affecting the whole world in the construction field is a delay. The study reports that the major delay factors are poor site coordination, scarcity of materials, consistent construction errors, and defective works. The authors use mean ranking index to discover the impacts of delays on the contractors as cost overrun, late payment, an extension of project time, rescheduling of project, disputes among the parties on the projects, arbitration, Litigation issue, poor quality of work at the end of the project, damage of reputation of the company, loss of efficiency and productivity, complete abandonment of the project.

A survey conducted by Panova and Hilletoth (2018) indicates that the late supply of materials creates project setbacks. The study suggests that in order to analyze and evaluate the threats in a project, there is a need to initially calculate the threat-free situation indicators like expenses, taxes, and income for the overall duration of the project.



The study advises that the increase in supply levels of safety stocks can minimize the risks of lateness in the supply of materials. The authors maintain that even though the risk can be shared between the client and the contractor, but no solid agreement can be drawn. The study adds that all the parties are interdependent and that both parties can gain economically if the project is successful. Authors discover that there is a need for the client to evaluate the risks in the project to minimize time and budget overruns. It is revealed that risk can be managed once it is estimated in the feasibility studies.

Pourrostam and Ismail (2012) focus on classing the delay factors in projects. This study is more specific to construction projects in Iran. The study discovers 77 factors causing project delays in Iran. The research also classifies these delays into seven groups as a delay due to the client, contractor, design, material, labor, consultant, and outside factors. The report maintains that change orders by the client during the course of construction, wrong estimation of project duration/cost, financial constraints from the contractor, engagement of inexperienced staff, poor management of the site by the contractor, lateness in completing designs, unclear and insufficient details in drawings, lateness in procuring materials and equipment, market inflation, engaging inexperienced consultant, late/negligence of inspecting and testing of work, poor communication, conflicts among the parties on the project, unforeseen bad weather, changes in government policies, poor site conditions, low productivity of workers, and shortage of workers pose a major threat to the successful project delivery.

Prasad et al (2019) investigate the factors causing project time overrun and reveal that in developing countries such as India, late payment, lack of funding, scarcity of workers, lack of construction site, lateness in design review and approval by owner, slow decision making by the client are major threats to project success. The study further maintains that factors such as lateness in obtaining work materials and equipment, high inflation, using incompetent designers/contractors, wrong bill of quantities, social problems, changes in site conditions, and political unpredictability play a significant part in project delays. Prasad et al. (2019), in an extended literature review on causes of project delays in some developed countries, reveal that project delay factors in Florida, USA are rectification in designs, difficulties in getting building permits approval, poor documentation, and change order. In Western Australia, labor shortages, financial constraints, unrealistic project period, and unforeseen ground conditions have been identified as the major issues facing successful project delivery. In the United Kingdom, unpredictable weather conditions, and high inflation have negative impacts on successful completion of a project. In Singapore, the study finds that scarcity of workers/materials, poor site coordination, and management affect the performance of the

project schedule of public housing projects. The report reveals that poor project planning, lack of finance, slow in making decisions by the project authorities, omissions, and errors in project execution, and indecisiveness of project requirements are the major delay factors in Denmark. The study concludes that the project delay factors in developing countries are not the same as that of developed countries.

Ojoko<sup>1</sup> et al. (2016) investigate the project delay factors and their effects. The study reveals 34 project delay factors and 10 effects of these factors on projects. The report classifies stakeholders' as a client, consultant, and contractor. These delay causes are classified into eight major causes. Time and cost overruns are the leading effects on project delivery (Ojoko<sup>1</sup> et al. 2016). From the results of the analysis, it is discovered that the ten (10) leading project delay factors in the Nigerian building industry are late interim payment, poor planning & scheduling, change orders, delay in material availability, cost overruns, poor monitoring & feedback, poor financing, time overruns, dispute, and Loss of profit, contract document variances, poor communication & coordination, material prices escalation, and inadequate essential materials. According to Ojoko<sup>1</sup> et al (2016), the two major factors creating project setbacks are sudden change order and late interim payment. The authors insist that in order to minimize the causes of project delays, clients should quickly act on the verified interim certificates and avoid any change order during the construction process. The study maintains that if any delay occurs on a project, the client will suffer the loss. If project finance is a loan from the bank, the client will suffer the additional problems of mounting interest on non-performing capital. The report cautions that the economy of the nation at large will lose the benefits of taxable incomes from such a project.

Rachid, Toufik, and Mohammed (2019) conduct research on the factors creating project setbacks in Algeria and detected 59 factors creating project setbacks. The study ranks the delay causes according to their relative importance and classified them into groups. The study also reports that the fundamental sources of project setbacks are slow in change orders, the commencement of work before completing the designs, high extra quantities of work. The clients and contractors finally agree that the client related causes of delays are the most critical and significant sources of delays. Rahimpour<sup>1</sup> and Shahhosseini<sup>2</sup> (2013) focus more on the comparison of the factors creating project setbacks from the client and contractor's perspectives. The study is specifically speaking to the construction of schools in Tehran. According to the researchers, the main factors based on the opinions of the employers are late payment of the work done, financial constraints from the contractor, market inflation, engaging the lowest bidder to win the contract, lateness in delivery of the land for the project, engaging inexperienced engineers/contractors and poor management of financial resources. The report concludes that the major causes of project setbacks are lack of funding, market



inflation, late payment of work done, and engaging incompetent professionals.

Raymond Esq (2014) discovers that to avoid claims from delays, there is a need to avoid changes to the work scope. The study maintains that work scope, project duration, and budget are under the control of the client. The researcher further indicates that coordination, construction methods, and procedures are under the control of the contractor. The author advises that to circumvent project delays, the client should invest time and money in order to prepare quality contract documents, establish realistic project duration, define the risk allocation method for delays between the client and contractor, and engage experienced engineers to monitor the progress of the work. The study maintains that it is the responsibility of the contractor to review all the construction documents for errors, ensure the project duration is realistic, ensure the project priorities, evaluate and understand the critical items of work in the project schedule, monitor and manage the project on an ongoing basis, continuous updating the project schedule and reporting to the client.

The literature review conducted by Serdar<sup>1</sup>, et al. (2017) on the factors creating project setbacks in Cambodia addresses both factors and relief measures required to reduce the setbacks in projects. The study discloses that the two main challenges projects are experiencing in Cambodia are the wrong estimation of the bill of quantities and poor project scheduling. The report indicates that lack and late delivery of materials to the site, financial difficulty from the client, unsafe site conditions that create accident on-site, consistent absenteeism on the side of workers, frequent breakdown of construction equipment, market inflation, conflicts among the team members, lack of skilled workers, consistent rainfall, design and construction errors play a critical part on setting projects behind.

Shahsavand, et al. (2018) investigate the factors creating project setbacks and discover 78 factors. The field survey is done on 58 contractors, 55 consultants, and 62 clients. The study discovers that the client's definition of delay is the loss of revenue due to the unavailability of comfortable production facilities for the project, while the contractor interprets the delay as higher overhead expenses due to an unplanned long period of work, inflation in the market and the high demand from labor. The study maintains that the early completion of a project is a sign of efficiency and effectiveness. The research advises that due to numerous unpredictable factors affecting the construction process, there is a need to have a detailed assessment of the project and calculation of the losses with consideration of time wasted for extension of project time if the project happens to be delayed. The study discloses that ascertaining the contractual responsibility of delay can cause construction disputes.

Shebob, et al. (2011) disclose that 35 factors are related to individuals, while 10 factors are related to consulting

engineers. The study reports that the causes of delays in the project are due to the lateness in approving the drawings and confirming the tested materials, economic issues like devaluation of the currency, market inflation, lack of equipment, and utility works of public organization. The research also confirms that the major factors causing delays are lack of work materials, unforeseen bad weather, late delivery of materials, financial constraints from the client and contractor, late payment of work done, incomplete design documentation and client interference during the operational period. The researchers after assessing the causes of project setbacks in the U.K and Libya confirm that the two countries have different factors creating project setbacks. This is due to the methods of construction being implemented in both nations.

Sivaprakasam<sup>1</sup>, et al. (2017) confirm that delays generate major complications in the construction project and that this can distort the overall budget and project time schedules. The study discovers 73 causes of project delays. The research further reveals that poor construction management, market inflation, lack of materials, underestimation of the bill of quantities, poor supervision of site are parts of the major causes of project delays. There is another indication that if the causes of delays are identified and analyzed, there is every possibility of minimizing their impacts on the construction projects. The researchers also reveal that delays can be classified as concurrent and consecutive, condemnatory and non-condemnatory, remunerative and non-remunerative, justifiable and non-justifiable and that their impacts on the project include arbitration, reduction of profit on the side of the contractors, lack of trust among the parties, an extension of time quarrels between the clients and contractors, non-productivity loss, late payment of work done.

Srdić (2015) conducts online surveys on the project setbacks and their relief measures. It is found that even though project plans are well prepared, unforeseen circumstances still manifest during the course of construction and that such occurrences contribute serious impacts on the project's success. The author maintains that the appearance of these unexpected occurrences can end up in conflicts, cost increments, and litigation among the parties on the project. The research further classifies the impacts of these occurrences on the project as direct and indirect. It is also emphasized that any delay generated by the client is compensable to contractor and that an extension of time or monetary compensation should be allowed in the conditions of the contract. The study classifies delays as excusable and inexcusable delays. The study further describes justifiable setbacks as delays that are beyond the capacity of the parties to the project, giving examples as critical weather conditions and acts of God. However, it is revealed that any non-justifiable setbacks are created by the contractor and that such delays do not permit any extension of time or monetary compensation to the contractor. The report reveals



that a delay can be compensable to the contractor if created by the client (Srdić 2015). The study advises that contractors should be allowed for an extension of time and extra monetary cost in the conditions of the contract. The inexcusable delays are caused by the contractor while excusable delays are beyond the capacity of both stakeholders. The contractor is entitled to the payment of liquidated damages to the client according to the conditions of the contract.

Sunjka<sup>1</sup> and Jacob<sup>2</sup> (2013) conduct a literature review on the project setbacks and their effects in Niger Delta, Nigeria. This study is specific to construction projects in Niger Delta. The study discloses that delays do occur only when the agreed project duration is exceeded. The research further classifies delays into excusable non-compensable delays that are created by nature, non-justifiable delays created by the contractor, justifiable compensable setbacks created by the client, and concurrent delays created by both the client and contractor. Based on the literature review, the study identifies thirty-eight (38) factors that are causing project delays. There is another discovery that the most critical delay factors are the poor planning by the contractors, youth unrest, engaging wrong engineers, errors and mistakes in the designs, unrealistic project duration created by the client. The main contractor's inability to coordinate and control the subcontractors is also part of the causes. The study maintains that budget overrun can only happen when the original budgeted cost of the project is exceeded due to some reasons, while the time overrun occurs only when the agreed project duration is also exceeded. However, the study adds that delay in project execution can lead to litigation, poor quality work, arbitration, and complete abandonment of the project. According to the report, the future relationships among the parties on the project may also be affected. The study finally cautions that clients or sponsors do not gain any profit from project delays should they happen.

Sweis, et al (2019) conduct a study on project delay factors in Iran. The study underpins seven major factors such as human error, changes in the design, environmental difficulties, substandard imported materials, poor planning and scheduling, ineffective communication among the parties on the project and late approval system as the main threats to successful project delivery. The study maintains that poor interaction with the supply chain poses a greater threat to project early delivery. It is indicated that it is not possible to fully avoid delays in a project but could be minimized. The fundamental sources need to be considered mostly and handled to keep the project on track. The study maintains that the client creates major factors, who in this case are called the owners. The study notes that the complexity of a project can give rise to complexity in the project schedule. According to the report, the extent of delays on a project can alter the project future which may likely give rise to overall project failure as the worst

condition. The report cautions that the project can be placed in a greater challenge if any attempt to remove the signs or symptoms of the unwanted situation is implemented. The study further warns that deleting these symptoms in the entirety is a very big mistake as the problems can no longer be monitored.

Thapanont<sup>1,2\*</sup>, et al. (2018) on the literature review of project setbacks in Thailand observe that 26 factors are the fundamental sources of project setbacks. These factors include financial constraints from the contractors, lack of site workers, low productivity by the workers, continuous construction errors, lack of construction materials on-site, lateness on materials delivery, poor work coordination, poor site management, using unskilled workers, inconsistent availability of contractors' staff on-site, using low skilled subcontractors, lack of construction equipment on-site, lack of finance from the client, adjustment of the contract during the course of construction, negligence of coordination by the client, adverse site conditions. Thapanont<sup>1,2\*</sup>, et al. (2018) also indicate that after interviewing construction management personnel from the department of highways and bureau of highways construction, it is revealed that the major factors are lateness in resolving environmental issues, poor site management, lack of materials and equipment, late relocation of existing services and using inexperienced project engineers. The study concludes by adding that this research will improve the knowledge of the project engineers on the issue of early completion of the highway projects in Thailand.

Uddin<sup>1</sup>, et al. (2017) report that construction is a very necessary undertaking for the development of the quality of life and cultural aspects of human beings. The study admits that the project is victorious only when completed within quality, budget, and time, as agreed in the contract documents. The authors maintain that the major issue in the construction industry is a delay. The research further reiterates that these delays on a project can be reduced if there is strong teamwork among the parties on the project. The study further narrates that the causes of these delays include lateness in the supply of materials and equipment, lateness in production of construction drawings, poor interaction among the team members, sudden changes in the scope of work, lack of motivation of workers, using incompetent contractors, late payment of the work done, unclear project definition, critical financial problems and irregular supervision of the site. Uddin<sup>1</sup>, et al. (2017) disclose that delays are the most critical problems in every construction project. The study maintains that delays can be minimized with the aid of proper teamwork and a good plan with the joint cooperation of the consultant, contractor, and client.

Varghese<sup>1</sup> and Varghese<sup>2</sup> (2015) analyzes project setbacks and confirms that the main problem in civil engineering projects all over the world is a delay. The research indicates that the 3 major factors are time, quality, and economy.



Varghese<sup>1</sup> and Varghese<sup>2</sup> (2015) maintain that the source of project set backs are attributed to client, consultant, labor and equipment, external causes, and contractors. According to the research findings, the 10 major causes of project delay include lateness in making payment by the client, non-payment of work done to the workers by the contractor, slow in making a decision by the parties on the project, poor management, inconsistent site supervision, slow working system of the subcontractor, lack of materials/equipment, construction errors/omissions, lateness in procuring the work permits and late commissioning of work by the external sponsors.

Viles, et al. (2019) disclose that the major factors creating project setbacks include unforeseen circumstances during construction, workers' conflicts, issue of construction mistakes, changing of project scope, using contractors and engineers with lack of experience, low productivity by the workers, financial crisis, issues of administration, workers' conflicts on site and poor management by the parties on the project. The study maintains that delay happens only when a project exceeds its agreed completion date. The study regards a construction project as a one-time development on a specific area that never changes. The study further reveals that factors such as lack of materials, use of inexperienced workers, change of scope, unforeseen circumstances, sudden change of scope could make the scheduled project difficult to achieve. The researchers insist that irrespective of every definition, the significance of any delay comes from its cause. However, if care is not taken, the delay may likely lead to the creation of disputes among the parties on the project, and inflates the project cost. The study asserts that construction errors and scope creep are the main sources of delay in the execution stage. Low productivity, conflicts, and lack of experience are mostly attributed to the labor force. It is finally deduced that the problems arising during labor conflicts, execution, and administration are the major sources. The authors indicate that the outcome of this research is beneficial to future researches that are aimed at meeting the project deadline and reducing project cost. The report adds that the construction project design stage will also be improved.

Vyas (2013) reports that delay is a major issue in construction industries in India, China, and some of the countries in the South East. The author conducts research on factory construction, multi-story buildings, and the power plants that are public and private-owned. The study identifies that the sources of project setbacks are lack of motivation and late payment of work done. Based on responses from participants, quality of materials, lack of setting daily target and review, lack of strategic planning and decision making power, unfavorable work conditions, absence of teamwork & coordination, late payment of completed work are the critical roots of project setbacks. During investigation, the study also finds that exceeding project budget, decrease in efficiency, increase in market

cost, decrease in safety of the workers, late production, decrease in trust among the parties and creation of more stresses to the workers are most of the impacts of delays on a project.

Wang et al. (2018) conduct a literature review on the project setbacks in the Chinese housing projects. The study advises that early completion of a project is a critical indicator of every construction project. The research addresses the importance of project schedules in construction projects. The study further maintains that if a delay could occur by the client, then it should be regarded as a compensable delay, while if occurred by the contractor, it is not compensable. The research discovers 75 factors that create project setbacks. The study enumerates the factors causing delays that are created by the clients, engineers, contractors, and subcontractors. The study further advises that poor relationships among the parties on the project, insufficient delegation of power to the engineer by the client, client demanding of unreasonable upfront capital, breach of contract by the project stakeholders, poor health & safety system, and inability to claim indemnity must not be overlooked in the construction field.

Gebrehiwet<sup>a</sup> and Luo<sup>b</sup> (2017) are of the opinion that the project setback is not new and affects projects in many ways. The study identifies 52 causes of project delays at different stages of construction. The impacts of delays on projects are compared at the initial, construction, and post-construction stages. The study discovers that the average causes of project delays relate to all stages. It is also indicated that the influential cause of construction delays are ineffective project planning, scheduling, corruption, unavailability of utilities at site, and inflation. The researchers reveal that cost overrun, termination of the contract, time overrun, litigation and arbitration are the critical effects of construction delays. According to Gebrehiwet<sup>a</sup> and Luo<sup>b</sup> (2017), a construction project can be regarded as being successful only when finishes within time, budget, and quality. In the pre-construction stage of a project, the authors discover 10 main causes of project delays and rank them accordingly.

Zidane and Andersen (2017) identify the top 10 universal project delay factors and enumerate them as scope creep, design errors, improper planning & scheduling prior to commencement of construction, engaging inexperienced contractors, financial constraints from the client, wrong or incomplete designs, financial constraints from the contractor, lack of resources for the work, poor management and low production by the workers. Delays that occur in many construction projects and their magnitudes differ considerably from one project to another. The study maintains that there is a need to ascertain the actual sources of these project setbacks in order to reduce their effects on construction projects. The delay is a common problem and has become part of the project's lifetime. The early delivery of projects can be regarded as an indicator of efficiency. The



research discovers that delays could increase the project budget. Zidane and Andersen (2017) warn that risks could be controlled but must not be forsaken entirely.

The table below indicates the 54 major roots of project setbacks. These critical roots project setbacks were

**Identified causes of project delays**

identified from literature review and used to carry out the field studies to verify their relative impacts on the project lifecycle. This table is also used in the results and finding section of this research to compute the relative importance of each factor toward the project lifecycle.

<b>ID</b>	<b>Delay factor</b>
1	A wrong costing of the bill of quantities
2	Bad economic situations
3	Poor communication system
4	Financial problems
5	Unclear project objectives/scope
6	Late payment to contractors
7	Neglecting some parties to the project
8	Using unqualified subcontractors
9	Shortage of manpower
10	Unforeseen circumstances
11	Poor salaries for workers
12	Vandalism of materials and equipment
13	Work overloading on the contractors
14	Engaging inexperienced engineers
15	Change of government
16	Complete abandonment of the project
17	Reworking of the completed job
18	Suspension of work
19	Unexpected variation orders
20	Underestimation of quantities of work
21	Use of lowest bidder system
22	Market inflation
23	Uncontrolled accident and injuries
24	Engaging unskilled sub-contractors
25	Lateness in land acquisition
26	Community unrest
27	Conflicts among the team members
28	Lateness in delivery of materials and equipment
29	Poor planning/scheduling
30	Unrealistic project period imposed by the client
31	Poor monitoring and control
32	Legal disputes between parties
33	Use of weak competitors
34	Health and safety restrictions
35	Delays in subcontracted works
36	Lateness in approving design documents by the client
37	Lack of government full commitment to the projects
38	Lateness in issuing permits to start work
39	Delay in performing inspections and approval by the consultant
40	Design errors/changes
41	Consistent construction errors and defective works
42	Late relocation of existing services
43	Lack of safety measures on-site
44	Government complicated policy
45	Using sub-standard equipment and materials
46	Contractor's delays in paying salaries to their workers



47	Poor coordination of the work by parties on the project
48	Inaccurate construction details
49	Poor project management
50	Frequent equipment breakdown
51	Lack of direction on the project
52	Negligence of industrial relations
53	Lack of sufficient materials and equipment on-site
54	Slow in decision making

## **2.2 Mitigation measures against construction project delays**

Abdullah<sup>1</sup> et al. (2018) report that project delays could be minimized if quality practices are maintained throughout the project lifecycle until project objectives are achieved. The study discloses that enormous investment improves project performance. According to Alzara al. (2016), the use of experienced and knowledgeable contractors and consulting engineers can minimize project delays. Study maintains that project delays can be mitigated when the risk assessment documents and selection of experienced personnel are done through competent vendors. The authors add that early action in minimizing construction project delays can help in attaining the project objectives.

Amoatey and Ankrah (2017) conduct research on the causes of project setbacks in Ghana. The study reports that project delays can be mitigated if there is effective planning and costing in the early stage of the project. Contractors should not involve in the project if they are not financially capable to handle that project. The study indicates that if the most challenging problem in road projects such as the issue of risk management of time and budget overruns can be handled properly, then project delays can be minimized. Aziz\* (2013) reveals that the project can be controlled easily if factors affecting it are detected and handled. However, good interaction and coordination strategies improve project success.

Banobi and Jung (2019) focus on studying project delay factors and their relief strategies. Research suggests that three major factors that will help to minimize project delays are a strong commitment from the top management, creating realistic project objectives, and good project scheduling. The researchers also discovered that to control project performance, regular supervision, and motivation of workers are the key factors. According to the study, to control project performance, regular supervision, and motivation of workers are the key factors. The study further indicates that constant construction project supervision will contribute to reducing project delays. This will also serve as an efficient way to monitor and control project performance. The authors further summarize mitigation measures to construction project delays and indicate them as constant supervision of the project, timely delivery of design documents, early payments of completion certificates, improving the morale of workers through motivation, motivating workers to raise morale, full commitment, and

support from the top management, engaging experienced workers, proper project planning and management, early procurement and delivery of materials and equipment, proper preparation of bill of quantities, and early identification of risks and assessment.

Durdyev and Hosseini (2018) focus on the comprehensive list of project delay factors and discover that contractual relationships, project delivery systems, and culture must not be overlooked in order to reduce project setbacks. The authors advise that proper management of a project is key to minimizing all these delays in every construction project. Famiyeh, et al. (2017) indicate that delays can be minimized if competent personnel is used in the project. The researchers emphasize the need for the consultants to engage competent personnel to handle site inspection. The report cautions the contractor to desist from underestimating the complexity of any project irrespective of the size.

Jongo<sup>1</sup> et al (2019) reveal 25 mitigation measures out of which proper project planning and scheduling are regarded as one of the most effective measures. This is followed by effective communication among the parties and the ability to monitor and control changes in design. However, the study discovers that more attention should be shown to the appointment of a competent manager, provision of the accurate bill of quantities, early payment of work done, proper planning for equipment, and materials delivery in order to minimize construction project delays. However, to keep project within budget and time, careful judgment and good implementation are required (Jongo<sup>1</sup> et al. 2019). The study summarizes the mitigation measures against project delays as implementing proper bill of quantities, engaging competent project manager, constant monitoring and controlling of project progress, engaging experienced and knowledgeable contractors, proper controlling of the scope change, ensure there are sufficient project fund and time, involving contingency allowance in the bill of quantities, early approval of design documents and contract agreement, reliable project scope, engaging competent consulting engineers, ensure effective communication channel, early mapping of strategies for solving project risks as they occur, and producing constant project financial and cash flow plans, ensure effective planning and scheduling, creating incentive scheme for the staff, maintaining consistent and early payment of work done to the contractor, ensure sufficient materials and equipment on-site, maintain disclosed communication among the team members,



encourage health & safety plan, early engaging of the stakeholders in time unforeseeable events that may affect the progress of the project, encourage teamwork among the staff and provide training to the unskilled workers where applicable.

Koshe<sup>1</sup> and Jha<sup>2</sup> (2016) report that there is a need to engage competent personnel who will master his/her responsibilities with attractive salaries in order to minimize the occurrence of project delays. Designs must be proofread by the appointed party prior to commencement of the construction phase, avoid the idea of focusing on the lowest bidder system, make early payment of work done, collect sufficient data and survey, and carry out a detailed site investigation to avoid the issue of variations, prepare a proper bill of quantities and ensure sufficient fund before the commencement of the project. Lessing<sup>a</sup>, et al. (2017) discover that maintaining a high degree of construction relationship can improve the quality of project performance. Good planning and sound judgment are keys to keeping a project within budget and time. The researchers advise that for these delays to be reduced and circumvented, there is a need to initially establish the delay factors.

Marzouk and El-Rasas (2014) reveal some mitigation measures that may be applied to minimize construction project delays. The authors conclude that all parties on the projects should preview the site due diligence and create formal relationships to minimize the project delays. Masood<sup>1</sup>(2015) recommends the solutions to project delays as early payments of work done by the contractors, using the modern management tools, engaging experienced and knowledgeable professionals to prevent reworking, the introduction of risk management system for bad weather conditions, involving subcontractors only in their areas of specialization, ensuring detailed planning is done. Frequent monitoring and controlling of the site must be practiced. Thorough investigations must be done at the initial stage.

A literature review done by Mello, et al. (2015) suggest that coordination methods adopted to manage engineering projects should be consistent with coordination efforts. The authors maintain that project delays can be avoided if continuous interactive coordination mechanisms are applied. Mello, et al. (2015) reveals that improving the delivery of a project depends on both increasing the reliability of the bill of quantities and minimizing the project duration. Mydin<sup>1</sup> et al. (2014) report that to minimize construction delays, there should be an early approval of drawings. The communication system must be improved. Consistent monitoring and controlling of work must be adhered to. Effective planning must be done before the commencement of project execution. The client must ensure adequate funds for the project prior to starting the project. There must be a realistic project duration. The motivation factor should be introduced for early project delivery.

Ogunde<sup>1\*</sup> et.al (2017) on the study of the factors militating against project delays reveal that delays can be minimized

through the following means: early payment by the client, appointing an experienced project manager, appointing qualified subcontractors & suppliers, involving knowledgeable project team, using the right construction methods, consistent progress meetings, proper planning of the project, effective project scheduling & programming, early planning of project activities, applying risk management system, early clearing of the project site, using competent client representative on the project, and paying of financial damages. Ogunde<sup>1\*</sup> et.al (2017) indicate that early identification of project delays and implementation of the mitigation measures have a good impact on early project delivery.

Rachid, et al. (2019) recommend that project implementation can be improved through the combined efforts of all parties in the project, ensuring enough fund are available for the project, minimizing changes in the scope of work, engaging qualified professionals, checking the availability of materials and resources before awarding the contract, ensuring drawings are clear and properly designed, creating an effective communication channel, and ensuring realistic project duration.

Zidane and Andersen (2017) indicate that if the causes of delays are recognized, and actions to avoid them are taken, then the risks of these delays can be minimized. Vyas (2013) identifies that mitigation measures such as understanding the need of all parties on the project, proper goal setting, good strategic planning, involving motivational system, setting a daily target, and its implementation can assist in minimizing project delays.

Viles, et al. (2019) advise that if the critical sources of project setbacks are considered in the initial stage, the construction industry will benefit a lot. This will help in mitigating the potential consequences of delay in advance.

Uddin<sup>1</sup>, et al. (2017) are of the opinion that engaging new technical equipment can prevent unwarranted setbacks and budget overruns. The use of untrained workers is not advisable in the areas they are not suitable for.

Srdić (2015) encourages paying special attention to the initial stage of the project and ensures the availability of adequate documentation to minimize construction project delays.

Sivaprakasam<sup>1</sup>,et al. (2017) suggest the following remedies to reduce the construction project delays: on-time payment of work done, early procurement of materials/equipment, use of modern construction methods, and the client to expedite decision making. The study maintains that the use of proper resources management tools, regular site inspection/supervision, implementation of effective project planning, and scheduling methods should not be overlooked. Shahsavand, et al. (2018) indicate that delay is something that can not be avoided or controlled at all times in every construction industry.

Serdar<sup>1</sup>, Maksat<sup>2</sup>, and Syuhaida<sup>2</sup> (2017) discover that the only ways to minimize project delays are improving the



delivery time of materials and equipment, engaging competent site supervisors, ensuring sufficient funds before commencing the project, creating a realistic project schedule, and improving on-site safety and security. Ojoko<sup>1</sup> et al. (2016) advise that delays could be mitigated if sources are detected and properly handled.

The table below indicates the relief strategies against the top 20 project delay factors as identified from literature. The most crucial delay factors will be diagnosed and tabulated according to their relative importance. Their mitigation measures will be tabulated and displayed on the results and finding section of this research.

**Mitigation measures against top 20 project risk factors**

S/No	Delay factor	Mitigation measures
1	Financial problems	The client and contractor should ensure that adequate funding is available before embarking on a project
2	Late payment to contractors	The client should prioritize early payment of work to contractors
3	Lack of sufficient materials and equipment on-site	Early arrangement for the procurement of enough materials and equipment must be in place
4	Contractors delays in paying salaries to their workers	Early payment of salary to the workers must be encouraged. The client must maintain consistent payment work done to contractors to minimize the financial crisis
5	Shortage of manpower	Contractor must ensure enough manpower on site. Early arrangement should be done prior to commencement of job activities
6	Suspension of work	All parties on the project must stick to the contractual agreement especially in terms of time, money, and quality
7	Community unrest	The community must be notified of the project in the initial stage. Local communities need to be engaged in areas they are suitable for.
8	Using unqualified subcontractors	Engaging unqualified subcontractors should be discouraged. Select contractors based on knowledge and experience.
9	Unexpected variation orders	Contingency allowance must be incorporated into the bill of quantities at the early stage of the project
10	Consistent construction errors and defective works	Effective quality control must be in place. It is the sole responsibility of everyone to avoid defects. Hence, it is a collaborative effort to ensure there are no defects on the job.
11	Unclear project objectives/scope	The client should be specific when deciding the project scope and objectives in the early stage.
12	Poor monitoring and control	Close project monitoring and controlling are encouraged. As a project manager, you need to maintain traces of the commitments of all stakeholders in the project
13	Lateness in approving Design documents by the clients	The client should create a project approval team to oversee all projects. The maximum turn-around time to approve the consultant's drawings and designs must be indicated in the project schedule and document.
14	Delay in performing inspections and approval by the consultant	Consulting engineer should create a favourable time table for early project inspection. Inspection should be done as soon as the job activity is ready for that. Competent engineer must be engaged to carry out inspection activities
15	A wrong costing of the bill of quantities	Stakeholders should engage an experienced quantity surveyor to handle the costing of bill of quantities to avoid underestimation of bill of quantities, which will affect the project performance on the later stage.
16	Lateness in delivery of materials and equipment	Contractor should place an order for materials and equipment on time to ensure early delivery to site.
17	Poor communication system	Establish a baseline for effective communication. Parties on the project must prioritize a close communication system to



		eliminate critical burdens on time.
18	Poor project management	A competent and experienced project manager must be engaged to oversee the project implementation
19	Poor planning/scheduling	The consultant and contractor should ensure effective project planning and scheduling from initial stage to the completion stage.
20	Engaging inexperience engineers	A competent and experienced engineer must be engaged to oversee the project implementation.

**Conclusion**

Summarily, a literature review has indicated that project delay is a universal occurrence that does happen in every country that the magnitude of this occurrence differs in many places. These project delay factors can be attributed to the clients, consultants, and contractors as a whole. Literature also confirms that the financial constraint and late payment for work done pose a bigger risk to the overall project lifecycle and that this issue is unique in the emerging countries. The construction industry has experienced a series of project delay challenges. The study maintains that the causes of project setbacks and their relief strategies differ depending on project progress.

**III. CHAPTER 3. RESEARCH METHODOLOGY**

**3.1 Introduction**

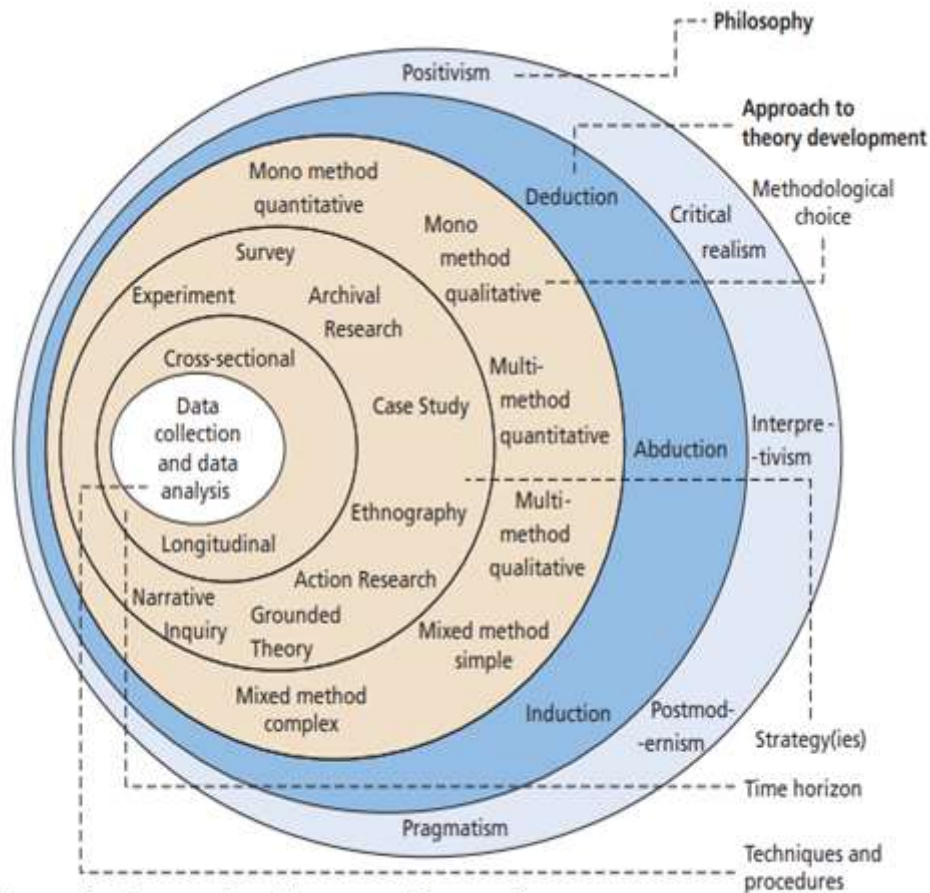
The research methodology is elucidated as a technique through which problems that exist in the industry are resolved. This section of the research reveals the various layers of research that are needed to resolve order to resolve research problem. According to kumar (2010), the researcher does get involved in the practical and logical applications of several methods that are used in research work. However, a different problem uses a different methodology. For instance, the inductive approach may be useful in some researches while the deductive approach may be useful in other researches. Some of these studies are focused on already confirmed facts while some studies are based on the discovery of new theories. Although, the research entirely goes in a different direction in both cases. Research methodology helps the researcher to sustain and design an action plan to be used to control all the layers of the research. This system is almost identical to a housing project where the architect decides on the shape and dimension of every component of the house.

The initial background and significance are discussed. Objectives and theories were formulated. The main research objective is to identify and analyze project delays and relief strategies. A further objective is to investigate the perceptions among the clients, contractors, and consultants

concerning project setbacks. The research onion consists of 6 layers. These layers are employed to gather data from the partakers.

Saunders, Lewis, and Thornhill (2016) developed the research onion in 2016 as shown in figure 1 on page 70. This research onion displays different layers that must be attended to when the research strategy is being developed. Looking from the outside of the diagram, every layer has a thorough description. Research onion provides a constructive development that helps in designing the research methodology. The adequacy of the research onion depends on its flexibility to be used for any kind of research methodology. Students and academicians might find it complex at the beginning of getting familiar with future studies. This is one of the major parts of the research study that must be addressed in the first place. It is revealed that due to insufficient literature review, it is then difficult to differentiate various techniques and theories. Hence, it is a great task to develop a clear research design mostly for newcomers.

Saunders, et al. (2016) discovered that exploration of the future is not a new occurrence but relatively a new perspective for scientific studies. Hence analyzing the evolution of futures studies from a scientific perspective is very imperative to determine the fundamentals of conceptual structure. The study maintains that there is still a big challenge in developing a reasonable futures research methodology irrespective of the fact that the methodology of futures studies has been broadly conversed about in the futurologists' society. However, it is necessary to examine the present systemic models in the correlated fields in order to close this opening and furnish academicians and students with an instrument for the development of methodology. It is revealed that suitable research methodology can be developed step by step from the research onion model. This can be utilized as a major academic research model. The study reveals that irrespective of the fact that the research onion is broadly utilized in social sciences, it can also be used in exact sciences.



**Figure 1- Research onion as a framework**  
 Source: Saunders, Lewis, and Thornhill (2016)

### 3.2 Research onion as a model of developing research methodology

Research methodology describes how and the way to carry out research. According to Saunders, Lewis, and Thornhill (2016), research onion furnishes a detailed explanation of major layers that need fulfillment in order to prepare an efficient research methodology. Research onion contains six main layers: research strategies, philosophy, time horizons, theory development, methodological choice, and techniques and procedures. These layers are interdependent and need to be implemented in the same manner to acquire research outcomes.

#### Layer 1: Research philosophy

Research philosophy describes the ways and how the research will be conducted. This is the initial stage of the research exercise. It assists every researcher in acquiring knowledge on a specific topic. It creates different ways of gathering research data. However, the main parameters of research philosophy are the selection of research methods, analyzing data, and application of the acquired knowledge. Research philosophy has various types. According to

Melnikovas (2018), there may be distinguished two mainstreams in research philosophy – positivism and interpretivism, and two rather recent mainstreams – pragmatism and critical realism, Postmodernism.

#### • Positivism

Positivism is based on natural science. It believes that reality is changeable. Positivism views reality as something that can be observed. It believes that only true cognition is reliable. It also maintains that reality can merely be investigated and enlarged. Objectivity is regarded as subjectivity. Positivism sticks to the expectation that human problems will definitely be resolved by science.

#### • Critical realism

Critical Realism believes in scientific knowledge rather than perceived knowledge. Realism believes that conclusions can only be trusted if supported by scientific ideas. According to Melnikovas (2018), critical realism is an approach that assumes the flexibility of the future. The study maintains



that the future is real and comprises numerous possibilities and achieved through transformative events. There is a possibility of influencing the future for at least to some extent by the participation actors, (Melnikovas, 2018) insists.

**• Interpretivism**

Interpretivism philosophy examines civil society. It bases on the assumption of the unpredictable nature of the future. It believes that the work of a researcher is ruled by his faiths and morals. Melnikovas (2018) insists that the future is viewed as a confused and uncertain bond of activities. The study maintains that it is not possible to predict the future and that it is only through an intuitive strategy that

knowledge of the future can be obtained. The main advantage is that interpretivism permits deeper level investigation using a qualitative research method. Data collected using this approach maintains a high level of validity. In general, the interpretive approach relies on the following faiths:

**i. Relativist ontology:** This approach views reality as inter-subjectively that relies on senses and conceptions on empirical and social levels.

**ii. Transactional or subjectivist epistemology:** This believes that there is a definite connection between the research subject and researcher and that people hardly isolate from their cognition.

**Table 1 The basic differences between positivism and interpretivism**

<b>Assumptions</b>	<b>Positivism</b>	<b>Interpretivism</b>
Real life	Visible, purpose	Publicly formulated, multifold
Targets	Classification, solid forecast	Cognizance, infirm projection
Technique	Deductive approach, information, cause and effect, content breakdown	Inductive approach, lived experience, explanatory
Area of attention	unspecific, standard and indicative	What is certain, distinctive, and non standard
Cognition generated	Legislation,time, human character, large scale study to obtain information from entire population	Significance, time value inclined, culture inclined, small scale study to obtain detailed information, personalized research findings to obtain different experiences from different population
Researcher/Topic Interconnection	Solid isolation	Collective and collaborative learning, all inclusive
Required Data	Number of people that reason and implemnet particular activity or possess particular issue	What people believe and implement, nature of issues facing and how to tackle them
Trustworthiness	Copyable: study outcomes can be duplicated, trustworthy if different researchers obtained the same results.	Interpretive awareness: Researchers recognize and attend to implications of their subjectivity
Effectiveness	Confidence: gathered information honestly assess actuality	Hold justifiable cognition. Soundness is necessary and can be obtained using quantitative information which is substantial and extensive

**Source: Pizam and Mansfeld (2009)**

**• Postmodernism**

According to Elaati (2016), Postmodernism focuses on questioning accepted ways of reasoning and give opinions to different marginalized views. The link between modernity and postmodernity is frequently seen as a contradiction. Hence this belief has been unhelpful. This means that every unit is self-supporting and unchanging. However, some postmodernists still not believing. They insist that looking to direct change toward undermining the modern form of life is separate or total. They maintain that

both modernity and postmodernity contain the seeds and residues of the other. Elaati (2016), adds that each of them needs the continued presence of the other in order to appear—through objection— well defined and reasonable.

**• Pragmatism**

The philosophy of pragmatism is based on the idea that it is possible to adjust to either positivist or interpretivist position depending on whichever that is suitable for the research question. It is a philosophy that maintains that any



concept can be regarded as correct only when a kind of action is initiated. Pragmatism believes that every situation in this world has different ways of solving it. The study insists that a single problem has various ways of solving it. However, pragmatism shows that different approaches to research are integrated and implemented to draw a decision. Pragmatism claims that the choice of research philosophy relies on the research problem. Researchers are free to make a choice of the techniques, methods, and procedures that are suitable for their needs, Melnikovas (2018) insists.

In this research study, the positivism research approach is implemented because Positivism confides on quantitative data and is more dependable than qualitative research. It looks more reliable and there is minimal room for mistakes.

**Layer 2: Approaches to theory of development**

Saunders, Lewis, and Thornhill (2016) identify 3 major strategies to theory growth as deductive, inductive, and abductive approaches. The study defines deductive research reasoning as reasoning that moves from the general rule to a certain law-like deduction or conclusion. This is normally applied for evaluating hypotheses.

This is a system of developing theory from where a general principle is prepared. This focuses on the research questions. Inductive reasoning is the bottom-up approach while deductive reasoning is a top-down approach as indicated in figure 2 below.

• **Deductive reasoning approach**

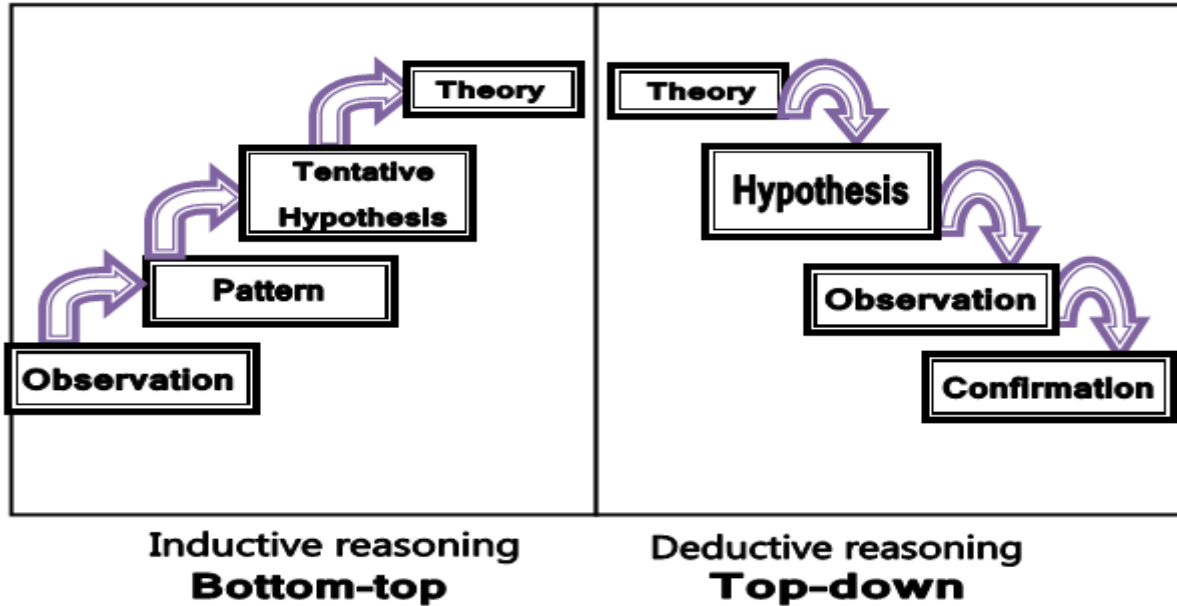
Based on physical argumentation, the deductive reasoning approach is concerned with controlling direct knowledge and functions. This approach is very suitable for predefined hypotheses and conclusions. This system is described as a research procedure with the prearranged hypothesis that requires proving true or false by utilizing various approaches.

• **Abductive reasoning approach**

According to the study, the abductive reasoning approach aims to identify links, structures, and hindrances. It uses perceptive conflicts. Abduction examines facts and figures out how it is likely to happen. This relies on the available proof. This observes signs and generate an idea for further investigation.

• **Inductive reasoning approach**

This is an alternative reasoning approach to developing a theory on the project delay factors and their relief strategies. This approach understands the nature of problems through perceiving the current situations. The idea from this approach is used to generate a hypothesis that is frequently regarded as a conceptual framework. This approach develops a reasoning power that permits establishing a cause-effect relationship. It is a bottom-top reasoning approach as shown in figure 1 below.



**Figure 1: Deductive and inductive reasoning**  
Source: Trochim (2006)



Table 2 below illustrates the roles of deductive, inductive, and abductive from thought to research.

**Table 2 Deduction, induction, and abduction: from reason to research**

	<b>Deduction</b>	<b>Induction</b>	<b>Abduction</b>
<b>Augumentation</b>	In a deductive reasoning if establishments are real, conclusion must also be accurate	In an inductive reasoning, existing establishments are used to initiate unproven conclusions	In an abductive , existing establishments are used to initiate provable conclusions
<b>Popularize</b>	Popularize from extensive to distinct	Popularizing distinct to extensive	Popularizing from the inerlinkage between distinct and extensive
<b>Implementation of information</b>	Data gathering is used to assess an argument connected to present assumptions	Data gathering is used to assess an argument, detect topics and figures and formulate theoretical structure	Data gathering is used to assess an argument, detect topics and figures, find these in a theoretical structure and evaluate this through resulting information
<b>Assumption</b>	Hypothesis manipulation or confirmation	Hypothesis initiation and development	Hypothesis initiation or alteration, including present hypothesis where necessary to develop hypothesisi or alter present hypothesis

In this research study, the deductive research approach is selected because there is possibility of describing informal connections between ideas and variables (Trochim 2006). It is easy to measure concepts quantitatively. Charts, tables, and graphs can be easily used to illustrate collect information (Saunders, Lewis, and Thornhill, 2016).

**Layer 3: Methodological choice**

Saunders, Lewis, and Thornhill (2016) define research methodological choice using qualitative and quantitative research techniques. The quantitative research technique uses numbers and mathematical operations, while the qualitative system uses a system of gathering illustrative information.

**• Mono method**

This method is used when gathering quantitative or qualitative information.

Data gathering can be done using either a quantitative or qualitative system. However, this method uses only a quantitative or qualitative research system. It is also called a quantitative or qualitative research system. The function of this method is to gather the information that is based on numbers. The information can be illustrated using tables and graphs. The mono method identifies the facts and figures that can be used to draw possible conclusions. The researcher is more concerned with asking relevant questions that can produce reliable data on which to draw conclusions.

**• Mixed-method**

This method uses both quantitative and qualitative methods. This helps in attaining research objectives and reduces the limitations of using the mono method. A combination of these methods is used in research work. Views of participants are gathered about the research topic. This system makes research more fascinating.

**• Multi-method**

A multi-method study uses numerous systems to carry out research work. This system is very simple to understand. Multi-method uses multiple quantitative or qualitative methods. This method allows researchers to generate numeric data and views of people.

In this research, the Mono method is used to identifying the major sources of construction project delays as well as their mitigation measures. This is because a mono method uses only one method for data collection. The method allows either a quantitative or qualitative approach. A survey questionnaire is used in this system. This system is clear and precise to use. There could be duplicate results but this can be eradicated in the quantitative approach. The research conducted with the quantitative technique is nameless. Due to the anonymous nature of quantitative research, it is then regarded as a useful method for data collection. In this case, the participants are free to give honest answers to the questionnaires when there is an assurance that their



responses will not harm them. In this system, respondents can fill the questionnaires in the absence of a researcher. Participants are not required to be monitored.

#### **Layer 4: Research strategies**

Saunders, Lewis, and Thornhill (2016) describe the research strategy as a general means of selecting and gathering data. The study suggests that the main research strategies should include: action research, case study, experiment, grounded theory, ethnography, surveys, narrative inquiry, and archival research. However, the study discovers that quantitative and qualitative research methods are popular methods of collecting data. In addition to quantitative and qualitative research techniques, there are explorative and normative groups of research methods. The study reveals that the explorative research method studies numerous futures and identify likely developments. The normative method modifies the wanted and unwanted future and designs a bond of activities. This layer illustrates how the research will be conducted. The research strategy assists in analyzing the objectives of the research. These methods are described below:

##### **• Experimental research**

The findings from the experimental research method are assessed against the findings from the experiment are assessed against the predicted results. It requires a very limited number of factors to derive conclusions. This method is very common in research work.

##### **• Surveys**

Surveys are common in quantitative researches. This generates quantitative data that can be examined empirically. This method involves extracting a representative sample from the total population. Surveys are very useful in examining causative variables among humans and their thoughts and behaviours.

##### **• Archival research**

In an archival research system, the source material is required in order to establish results. The existing materials are used to conduct a new investigation. This kind of research uses a literature review system.

##### **• Case study research**

The case study research does deep investigation in any topic or situation. Research can be broken down into manageable units. This is very helpful in testing existing knowledge in the field of study. The research is opportune to conduct a deep investigation into the research topic.

##### **• Ethnography**

Ethnography investigates people and inquires into their culture and processes. In this kind of research, the research

is based on the views of the individuals participating in the research activities.

##### **• Action research**

Action research uses practical techniques to resolve a particular research problem in area of practice. This method uses contemplative procedures where professionals and experience of professionals are examined. This type of research is unique in the teaching and nursing professions, where the practitioner examines the ways they can boost their understanding and professional approach.

##### **• Grounded theory**

Grounded theory is a quantitative type of research system. It utilizes an inductive research system. The results of the research emerged primarily from the research that has been existing. The new data is collected and compare it with the existing information. This method is very useful in social science studies.

##### **• Narrative inquiry**

Narrative inquiry is a relatively new qualitative research methodology. It is a system of thinking and studying experience. This method uses a recursive, reflexive, or unthinking process. It highlights ethical matters as well as modifies new theoretical understandings of people's experiences.

In this research study, the survey research strategy is used because the survey system is cost effective. The responses from this approach can be in thousands. Data gathering is easier in surveys. The responses from a few participants are sufficient to draw reasonable conclusions. Surveys give the researcher an opportunity to get to thousands of possible participants if necessary. The anonymity of surveys encourages the participants to be more honest is responding. To gather accurate information, participants are required to be truthful in their responses. The causes and mitigation of project delays are identified and analyzed using questionnaires. Furthermore, various closed-ended questions are framed in the voluntary research questionnaires, and responses of respondents from the construction industry are gathered and analyzed to derive conclusions.

#### **Layer 5: Time horizons**

Time horizons are the period over which the researcher handles the research. This layer indicates the time frame to complete the study. Kosow and Gaßner (2008) identify 3 kinds of time horizons as short-term that has a maximum period of 10 years; Medium-term that lasts up to a maximum of 25 years, and a long-term horizon that last more than 25 years. The study further observes that static observations connect to normative strategies. This is used as a relief time horizon. The time horizon can be regarded as a



diary or snapshot. Snapshot is referred to as a cross-sectional research study, while the diary is a longitudinal research study.

● **Cross-sectional research studies**

In this type of research study, data is collected from a representative subset or population at that particular time. Cross-sectional refers to a state where the research is conducted to respond to a particular question at a specific time. It usually makes use of a survey or case study as a research strategy.

● **Longitudinal research studies**

This system permits information to be collected on the same subject continuously at a specific time. Researches can last for years. This is specifically applied when conducting research on a certain change or development. However, the research is regarded as longitudinal, if the data being collected requires extending the research period in order to answer a question or address an issue. This type of research normally uses strategies such as action research, archival research, experiment, and grounded theory. However, this research study is focused on cross-sectional research. This technique is chosen due to its cost and time effectiveness. The researcher can collect data much faster. The data collected can be used for numerous kinds of research. The responses are gathered once and the respondents' perceptions are analyzed only one time. This is described as cross-sectional research.

**Layer 6: Techniques and procedures**

This is the last stage of research. Thereafter, data collection commences. The type of techniques to be used for data gathering is ascertained by previous choices. This is useful in responding to research questions. A questionnaire or interview is used as a research instrument. All other layers are considered when drafting a questionnaire.

● **Research design**

Trochim (2007) reveals that research design is what keeps study together. The study maintains that design is very useful when structuring the study. All important sections of the study like samples and techniques are accommodated to deal with the central research questions.

● **Major types of design**

This study discovers that the main difference in designs is based on the exploratory system applied. The study identifies two kinds of design as experimental and quasi-experimental designs. The experimental design uses an aimless selection system to pick information while the quasi-experimental design does not. Having a clear view of the interconnections of various designs is helpful when deciding on design choices. Saunders, et al. (2016) also

reveal that quasi-experimental thinking is very useful in applied social research and program evaluation.

● **Experimental research**

Experimental research exploits unconventional variables and applies them to conventional variables to weigh their impacts on the conventional variables. Their impact on the conventional variables is recorded for some time. This helps the researchers to draw a reliable conclusion on the interconnection between the 2 variables. It may be hard to accomplish since it relies on the contrasting between two or more groups with simple logic. Experimental research patterns are done by gathering quantitative data and carrying out analytical examinations on them during research. Therefore, it is regarded as a quantitative method.

● **Quasi-experimental research**

A quasi-experimental study exploits unconventional variables without a random selection of respondents to study. Pretest-posttest designs are the major types of quasi-experimental research. This research type eradicates drawbacks in the study by controlling of the unconventional variables.

It does not eradicate the issue of surprise variables. It does not also use random selection to operate. Hence, this technique possesses greater inner Effectiveness than interdependent studies.

In the experimental method, the researcher can influence the research circumstances. In the quasi-research method, the researcher has got no influence over the research circumstances. The interconnection between cause and impact can be initiated in experimental research and can not be initiated in a quasi-experimental system.

In this study, the experimental research method is applied because the system allows the research to have full control over the research circumstances. The system can be applied in many ways. A reliable and consistent result can be drawn. Success or failure is easy to detect. It permits the replication of information and the researcher has the opportunity to conduct a deep investigation.

● **Data collection and analysis**

This is the last layer in the research onion. It contains the techniques used in gathering information. It explains the means and purpose of collecting information. The research is opportune to choose the research method suitable for the investigation. The type of research decides the method to be chosen. There are three valid methods that can be used in the experimental research system such as Observational study, simulations, and surveys.

● **Observational study**

This kind of study evaluates research variables without altering the original circumstances of the variables. It is



carried out over a long period. This method is very common in the qualitative research system. The respondents' behavior is monitored in a natural circumstance. No matter the kind of behavior displayed by participants, their natural conditions remain unchangeable. Researcher has the option of getting involved in the research environment or view from a distance.

**• Simulations**

In a simulation system, a mathematical, physical, or computer model are used to duplicate a situation. This is used in expensive and in vulnerable situations. This is commonly applied in engineering studies to resolve actual problems. It provides an easy to verify the analysis. A clear insight into a compounding situation is obtained. The study discovers that simulation can not be used as a data-gathering instrument in every experimental research system.

**• Surveys**

A survey is a usual data collection instrument to gather information from the participants. The researcher prepares a group of questions to be responded to by the participants. These questionnaires can be distributed electronically or in person. The researcher has limited influence over the participants' responses. Primary information is gathered through these questionnaires. This method gives clear view

of the understanding capability of the stakeholders regarding the project delay factors. In this study, the survey research method is used because the system is very economical to use. Data gathering is much easier in the survey method. In the survey method, thousands of participants can be reached, if necessary. This system allows participants to fill the questionnaire in the comfort of their homes. Reliable and honest responses are expected in this method.

**3.3 Sampling techniques**

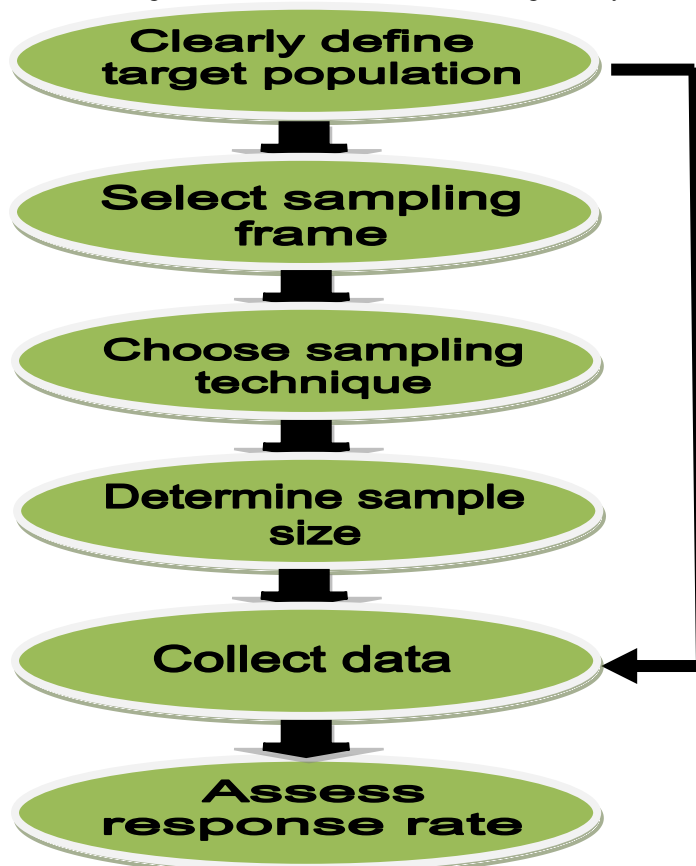
**• Area of research**

This study focuses on measuring stakeholders' awareness level on project setbacks. Furthermore, this investigation is limited to the South African environment.

**• Sampling technique**

Sampling is used in selecting respondents to participate in the research work.

A quantitative model is used in sampling. This technique may not allow the researcher to gather information in every situation. Because of limited time and resources for study, a sampling system is then employed. Figure 1 below shows the steps in the sampling process to be followed when conducting a study.



**Figure 1: Steps in sampling process**  
Source: Taherdoost (2016)



### Step 1: Clearly define target population

This step gives details of the targeted respondents who will partake in the study. 30 established companies were considered. Only established construction companies working on government-funded building projects, road and stormwater projects, and water and sewer projects were considered in the study.

### Step 2: Select sampling frame

This contains the total number of people from where the sample is to be taken. This must be prototypical of the group from where the samples will be taken. This study considered only 96 professionals working in the 30 established companies. In terms of research sampling, only established construction companies working on building projects, road and stormwater projects, and water and sewer projects were

considered in this study. Each of these 30 established companies had at least 2-4 experienced engineers and project managers.

### Step 3: Choose a sampling technique

There is a need to understand what is meant by sampling and the purpose of why the researcher needs to choose a sample, before studying the different types of sampling methods. This system of selecting subsection from the frame is known as sampling. This is useful when deciding a conclusion. It can also be used to draw a broad view of the existing theory. However, this relies on the choice of the sampling method. Basically, sampling techniques are split into two types: Probability sampling and Non-probability sampling. Figure 2 below illustrates different sampling techniques.

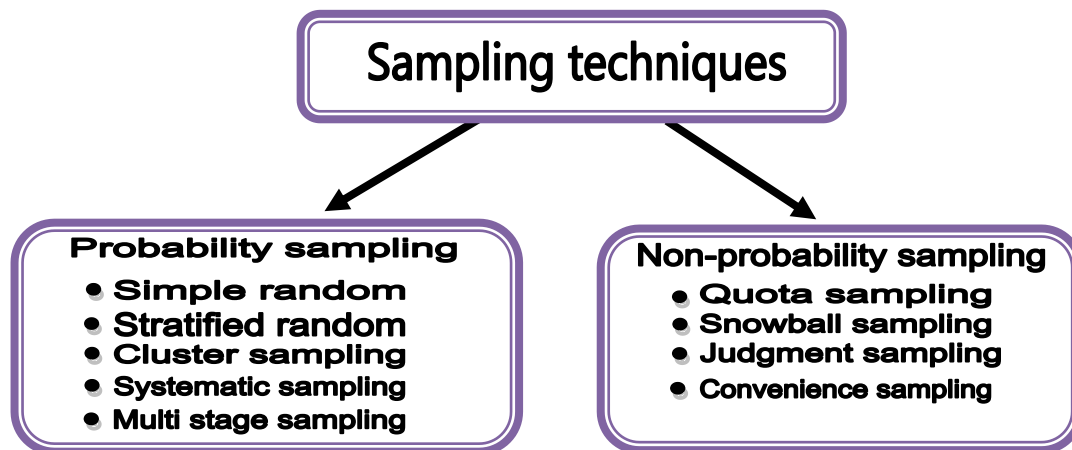


Figure 2: Sampling techniques  
Source: Taherdoost (2016)

#### a. Probability sampling

Probability sampling can accommodate all items into the sample. The study reveals that the best way to conduct random sampling is to design a sampling frame first and then select the sample from the frame using a random number computer program. Probability sampling is expensive to use but it is free from bias (Taherdoost, 2016).

##### • Simple random sampling

This indicates the chances of every case in the group to be accommodated in the sample.

##### • Systematic sampling

Every specific case in the group is chosen after the commencement of random sampling.

##### • Stratified random sampling

Stratified random sampling permits a sampled group to be broken down into subsections. Then a sample is picked from each subsection. This system is used where there are different circumstances in the selected group. Its function is to ensure equal and adequate representation in the study.

##### • Cluster sampling

Cluster sampling allows the entire selected group to be split into sections. Then the sample is taken from each section. All selected samples from every section are then used in the concluding sample.

##### • Multi-stage sampling



This system involves migrating from a bigger sample to a small sample. This ensures the collection of samples concentrating in lesser geographical regions.

**b. Non-probability sampling**

This is connected to a case study and qualitative research designs. Small samples are the main focus in qualitative studies to ensure an actual case is ascertained. There is no need for a representative sample in this situation. The study only needs a clear rationale for considering some respondents in the study (Taherdoost, 2016).

• **Quota sampling**

Quota sampling does not utilize random system. The respondents are picked based on a prearranged process. The total sample has similar characteristics to that of the bigger group (Taherdoost, 2016).

• **Snowball sampling**

Snowball sampling does not apply the system of random selection. Lesser cases are utilized to encourage others to get involved in the study. This has chances of enlarging the sample size. This method is unique in smaller groups that are difficult to assess.

• **Judgmental or purposive sampling**

Judgmental sampling intentionally chooses certain persons to furnish required necessary data that are not easy to acquire from other choices. In this case, the researcher decides to include participants in the sample because they think that they possess the skills to be included.

• **Convenience sampling**

Convenience sampling does not utilize a probability system to do a selection. This technique is simple and economical. In convenience sampling, applicants are chosen due to their

frequently readily and easily available. Many obstacles in research work are reduced using this system. For instance, it is easier to use family or friends as part of a sample than targeting unknown persons.

**Step 4: Determine sample size**

Sufficient sample size is required in this system to draw conclusions. This is to circumvent biases and errors in the study. The entire chosen sample and aims of the research are required in this case. Taherdoost, (2016) reveals that a bigger sample permits minimal chances of bias in the research. Sampling mistakes can be avoided in a bigger sample. To ascertain a suitable size for a huge population and an undetermined number of populations, the degree of confidence, and the limit of error allowance was made by taking engineering judgment (Olaniyi 2019). The sample size for each risk factor was established. The equation below was implemented to calculate the sample size.

$$\text{Sample size, } n = \frac{Z^2}{4E^2}$$

where;

n = sample size, which is 96 in this case.

Z = score for the 57% level of confidence is 1.57

E = limit of error allowance = 0.08

$$\text{For instance; } 96 = \frac{Z^2}{4 \times 0.08^2} \quad Z = 1.57$$

**Table 1 Sample of selected population**

Participants	Sample Size
Stakeholders	96

**Table 2 Response rate of distributed questionnaires**  
**nnaires Frequency Percent**

Questionnaire		Frequency	Percentage
Valid	Returned Questionnaires	55	57
	Unreturned questionnaires	41	43
	<b>Total</b>	<b>96</b>	<b>100</b>

**Step 5: Collect data**

Data collection begins after all required information has been confirmed. During the time of collecting data, all participants in the study sign and date the informed consent form before participating to ensure ethical principles are

fully maintained. In this study, primary data were collected within five-weeks (21<sup>st</sup> September to 25<sup>th</sup> October 2020). The study focused on collecting information from stakeholders working on government-funded building projects, road and stormwater projects, and water and sewer



projects. Table 2 above shows that 96 questionnaires were dispersed to stakeholders and 55 completed questionnaires were returned. 41 questionnaires were not returned. According to Olaniyi (2019), a response rate of 50% is sufficient for data examination and detailing. The study indicates that a rate of 60% is good and that a rate of 70% and over is superb. This means that a response rate of 57% obtained in this study was sufficient for data examination and detailing.

**Step 6: Assess response rate**

The response rate refers to a group of people who have agreed to be part of the investigation. In reality, it may not be easy to gather a 100% response rate in research work because of the inability of some people to respond. The final sample may be in danger if the response rate is low. In this research, the convenience sampling technique in non-probability sampling is selected due to its simplicity to handle. It is also not expensive to use. It saves time. With this method, participants are easily reached or contacted. The researchers can quickly meet their data targets. Multiple studies can be completed simultaneously and in an expeditious manner.

**3.4 Validity and reliability in the research instrument**

Taherdoost, (2016) defines validity as the level of accuracy of an idea in a quantitative study. It simply means computing what is intended to be computed. Implementation of the findings is an evidence-based practice.

Consideration must be accorded to the rigor of the research and not just the outcome of the study. Rigour indicates the degree of quality maintained in the study.

In this case, Rigour means the extent to which the researchers have worked to strengthen the quality of studies. This can only be attained through the computation of the reliability and validity. Validity is of different types:

**The content validity** ensures the entire topic is covered in the study. Face validity is the subsection of this type of validity. Face validity permits people to express their concern on the degree of accuracy of the contents of the study.

**Construct validity** decides if conclusions can be drawn regarding the test scores. However, scoring high points in this regard may or may not signify higher knowledge or understanding of the topic. This shows the degree to which the research instrument( questionnaire) has the theory that is being verified.

**Criterion validity** is a final measure of validity. Convergent validity, Divergent validity, and Predictive validity are the three ways to measure criterion validity. Convergent validity indicates that a research instrument agrees with other research instruments measuring the same topic. Divergent validity indicates that a research instrument

is not in agreement with other research instruments measuring the same topic.

**Reliability** measure the quality of work in a quantitative study. It shows the correctness of the questionnaires. Reliability links to the consistency of a measure. Taherdoost (2016) regards reliability as the level to which a measurement of fact or event gives consistent and stable results. A test is reliable if consistent duplication of it shows the same result. A clear instance of reliability is when your time to wake you up at 7 am in the morning, the clock keeps on ringing daily at the same time. Stability, homogeneity, and equivalence are 3 characters of reliability.

**Homogeneity (internal consistency)** uses Cronbach's  $\alpha$  for the evaluation of results. The result attained in split-half reliability is broken into two parts and comparison is done on both halves. However, an instrument with a high correlation is more reliable and an instrument with a weak correlation is not reliable. The split-half test uses the yes or no principle to answer questions. Cronbach's  $\alpha$  measures inner consistency. It has ranged from 0 to 1 and the agreed reliability is 0.70 and above. Cronbach's Alpha with rate of 0.70 and over stipulates that all the variable indicators measurements denote allowable internal consistency (Olaniyi 2019). An alpha value of 0.00 indicates no uniformity in estimation while a rate of 1.00 shows faultless consistency in estimation.

However, this study uses Cronbach's Alpha as a measure to evaluate the reliability of the questionnaires used to collect data from the participants. The reliability shows the extent to which it is a consistent measure of the data collected from the participants. In this case, Cronbach's Alpha measures the strength of this consistency. Cronbach's alpha is computed using the Pearson correlation coefficient (r). This coefficient reveals the power and direction of the linear relationship between x and y. The correlation coefficient (r) determines whether the linear relationship in the sample data is strong enough to use to model the relationship in the selected population. The reliability of this linear model also relies on the number of observed data points used in the sample. This is why this study considers the correlation coefficient (r) and the sample size (n), together. Cronbach's Alpha ( $\alpha$ ) is calculated using:

$$\alpha = 1 - \frac{kr}{(1 + (k - 1)r)}$$

Where;

k = number of indicators or items; which are 15, 18, 22 in this case.

r = mean inter-indicator correlation or average of correlation coefficients



Y = number of responses from each stakeholder, which is 15, 18, 22

$$\text{Pearson correlation (r)} = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Where; n = number of respondents( from stakeholders); which is 15, 18, 22 in this case

X = number of questionnaires (sampled questionnaire from each stakeholder)

The values of Pearson correlation (r) lies between -1.0 and 1.0. A correlation of 1.0 indicates an absolute positive correlation while a correlation of -1.0 indicates an absolute negative correlation. A calculated number larger than 1.0 or less than -1.0 indicates that there was an error in the correlation estimation. The values range between A calculated number greater than 1.0 or less than -1.0 indicates existence of an error in the correlation quantification. A correlation of 0.0 indicates no linear connection between the movement of the variables.

**Table 1 Calculation of Pearson correlation (r)**

No. of questionnaire (X)	No. of Responses (y)	xy	X <sup>2</sup>	Y <sup>2</sup>
10	15	150	100	225
10	18	180	100	324
10	22	220	100	484
$\Sigma = 30$	55	550	300	1033

**Table 2 Tabulation of Cronbach’s Alpha values**

No. of item (K)	Correlation coefficients (r)	Cronbach’s Alpha (α)
15	0.02	0.75
18	0.02	0.80
22	0.03	0.70

The rate that is acquired for an alpha normally stipulates the percentage of the reliable variance. For instance, the rate of 0.70 indicates 70% of the variance in the scores is authentic, and that 30% indicates an error variance. It must be noted that Cronbach’s alpha does not furnish authentic measurements for individual or independent items. It gives reliable estimates for summed scales or subscales. If it happens to be used for individual or independent units, the reliability of those units may remain unspecified. However, it must be understood that this formula is only appropriate in social and behavioral studies that deal with characters, personalities, perceptions, views, feelings, and interpretations of people’s environment.

**Stability** checks the steadiness of the responses from participants. Responses are reliable when the responses of a particular respondent are the same under similar situations. The research instrument is stable and reliable when similar results are gathered under the same situation.

**Equivalence** is used in qualitative research where the agreement between participants is confirmed. This refers to the degree to which research results can be compared. This approach is used to resolve challenges and can be used to decide how and where the instrument should be used. However, reliability and validity are important aspects to be considered in every research work. A good quality research study is expected to issue evidence of how all these factors have been dealt with. This helps in deciding whether to apply the findings in the area of work.

### 3.5 Research questions and questionnaires

#### 3.5.1 Research questions

A research question is described as a question that a research project sets out to investigate. Ratan, Anand<sup>1</sup>, Ratan<sup>2</sup> (2018) discover that formulating a good research question is very important before commencing any research work. The purpose of this is to investigate existing unreliability. A research question can treat various formats depending on the aspect to be assessed. Research questions can be of different types depending on the availability of facts. Research questions are formulated based on interest. The research question is then framed and evaluated after reducing the scope and focus of the research subject. A good research question should be feasible in the sense that it must be easy to investigate. Suitable methodology, sufficient time, and finance are required to arrive at the conclusions. The question must be novel and not a copy question that has been investigated by other researchers. It must be simple questions that may be targeting to verify or disproving the existing findings or establishing new facts etc. The question should be able to display the interest of the researcher. The interest encourages the researcher to continue with the research question. The research question should be able to keep ethical principles. It must maintain the privacy and confidentiality of the participants. The risk of harm to the respondents should be minimized. The research question must be relevant and manageable. The



question must be of the intellectual and academic interest of people in the field selected for the study. Clear intent must be indicated. In this research study, the research questions are formulated after thorough conduction of existing studies.

**3.5.2 Research questionnaires**

Mcleod (2018) defines a research questionnaire as a research tool that contains numerous questions for the intention of collecting data from the participants. The questionnaire can be in form of closed or open questionnaires. It could be done through physical interviews, emailing, or telephone. The study indicates that the questionnaire is the best system for gathering a substantial amount of data from a larger group. It is the quickest way of collecting data and the researcher does not need to be around when completing the questionnaire. This method is very suitable in a situation where it is impracticable to collect data from large populations. The only issue with questionnaires is that it is very easy for the participants to be untruthful in their responses due to social desirability. Open and closed questions are used in this study. Data from closed questions can be ranked according to their relative importance. Open questions allow participants to express their further views on the study.

Quantitative data is gathered in this study. Likert scale of 1 to 5 is used. Participants select responses from the scale. Table 1 below illustrates the generated questions for the study. 54 questions are generated from the literature review. These questions are used to collect data from the participants. Project delay relief strategies are generated after a literature review of the already existing studies.

In this research study, both open and closed questionnaires are implemented because they are the most affordable ways to gather quantitative information. This system is cost-effective. Questionnaires are also a practical means of gathering data. It serves as a quick and simple way of collecting results with online and mobile instruments. Questionnaires and surveys create an opportunity for the researcher to collect data from a bigger group of people. When the data has been quantified, it can be used to do a comparison with other researches and can also be used to measure change. This system encourages comfort in answering the questions. There is no time limit in mail-in online or email questionnaires. Respondents have enough time to respond. Table 1 below shows the details of questionnaires sent to participants.

**Table 1 Voluntary research questionnaires**

<b>VOLUNTARY RESEARCH QUESTIONNAIRES</b>						
<b>FOR THE DEGREE OF MASTER OF PHILOSOPHY IN ENGINEERING MANAGEMENT AT THE UNIVERSITY OF JOHANNESBURG</b>						
<b>QUESTION: WHAT ARE THE CAUSES OF PROJECT DELAYS?</b>						
<b>Select from the Likert Scale of 1 - 5</b>						
<b>1-Strongly disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly agree</b>						
<b>S/No</b>	<b>Causes of Project Delays</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
1	A wrong costing of the bill of quantities					
2	Bad economic situations					
3	Poor communication system					
4	Financial problems					
5	Unclear project objectives/scope					
6	Late payment to contractors					
7	Neglecting some parties to the project					
8	Using unqualified subcontractors					
9	Shortage of manpower					
10	Unforeseen circumstances					
11	Poor salaries for workers					
12	Vandalism of materials and equipment					



13	Work overloading on the contractors					
14	Engaging inexperience engineers					
15	Change of government					
16	Complete abandonment of the project					
17	Reworking of the completed job					
18	Suspension of work					
19	Unexpected variation orders					
20	Underestimation of quantities of work					
21	Use of lowest bidder system					
22	Market inflation					
23	Uncontrolled accident and injuries					
24	Engaging unskilled sub-contractors					
25	Lateness in land acquisition					
26	Community unrest					
27	Conflicts among the team members					
28	Lateness in delivery of materials and equipment					
29	Poor planning/scheduling					
30	Unrealistic project period imposed by the client					
31	Poor monitoring and control					
32	Legal disputes between parties					
33	Use of weak competitors					
34	Health and safety restrictions					
35	Delays in subcontracted works					
36	Lateness in Approving Design Documents by the Client					
37	Lack of government full commitment to the projects					
38	Lateness in issuing permits to start work					
39	Delay in performing inspections and approval by the consultant					
40	Design errors/changes					
41	Consistent construction errors and defective works					
42	Late relocation of existing services					
43	Lack of safety measures on-site					
44	Government complicated policy					
45	Using sub-standard equipment and materials					
46	Contractors delays in paying salaries to their workers					
47	Poor coordination of the work by parties on the project					
48	Inaccurate construction details					
49	Poor project management					
50	Frequent equipment breakdown					
51	Lack of direction on the project					
52	Negligence of industrial relations					
53	Lack of sufficient materials and equipment on-site					
54	Slow in decision making					
	<b>JOB TITLE:</b>					
	ARE YOU A: <input type="checkbox"/> CONSULTANT <input type="checkbox"/> CONTRACTOR					
	CLIENT OTHER- SPECIFY:					
	<input type="checkbox"/> <input type="checkbox"/>					
	WRITE DOWN ANY OTHER VIEWS:					




**Summary**

The study revealed that research methodology is a technique through which problems that exist in the industry are resolved. Research methodology is a tool that researchers use to sustain and design an action plan to be used to control all the layers of the research. This research onion displays six different layers that must be attended to when the research strategy is being developed. These layers are needed to resolve research problems. The adequacy of the research onion relies on its flexibility to be used for any kind of research methodology. Suitable research methodology can be developed step by step from the research onion model. The study also revealed that research onion can be used in social sciences and in-exact sciences. Research philosophy describes the ways and how the research will be conducted.

In the theory of development, there are 3 major strategies to theory growth such as deductive, inductive, and abductive approaches. This is a system of developing theory from where a general principle is prepared. According to study, the methodological choice is defined using qualitative and quantitative research techniques. The quantitative research technique uses numbers and mathematical operations, while the qualitative system uses a system of gathering illustrative information. Research strategy is a general means of selecting and gathering data. The main research strategies should include action research, case study, experiment, grounded theory, ethnography, surveys, narrative inquiry, and archival research. The study discovered that quantitative and qualitative research methods are the most popular methods of collecting research data.

The research time horizons are the periods over which the researcher handles the research. This layer indicates the time frame to complete the study. The time horizon can be regarded as a diary or snapshot. Snapshot is referred to as a cross-sectional research study, while the diary is a longitudinal research study. Techniques and procedures are useful in responding to research questions. A questionnaire or interview is used as a research instrument. All research onion layers are considered when drafting a questionnaire. Sampling is used in selecting respondents to participate in the research work. A quantitative model is used in sampling. Validity in the research instrument is defined as the level of accuracy of an idea in a quantitative study. Validity is of different types: Content validity, Construct validity, and Criterion validity. Reliability measures the quality of work

in a quantitative study. The homogeneity of questionnaires uses Cronbach's Alpha ( $\alpha$ ) for the evaluation of results. A Cronbach's Alpha value of 0.00 indicates no uniformity in estimation while a rate of 1.00 shows faultless consistency in estimation. The rate that is acquired for an alpha normally stipulates the percentage of the reliable variance. Stability in the research instrument checks the steadiness of the responses from participants. Equivalence is used in qualitative research where the agreement between participants is confirmed. A research question is a question that a research project sets out to investigate. A research questionnaire is a research tool that contains numerous questions used to collect data from the participants. The questionnaire can be in form of closed or open questionnaires.

**IV. CHAPTER 4 RESULTS AND FINDINGS**

**4.1 Introduction**

The research result section is where the report of the findings of the study is recorded. It is regarded as the completeness of outcomes, instead of the conclusions or recommendations drawn from them. Publishing results of research is very important to provide instructions for future studies. This chapter indicates the results of the quantitative research methodology conducted. Chapter 4 outlines the results of questionnaires used in gathering information from the participants and furnishes supporting interpretative discussion of the respective results. It also contains the discussion of how the analysis confines to the research questions. As this study has primarily embraced an interpretative technique, the only statistical analysis in this study is to give descriptive or illustrative statistics that assist to discover preferences amongst the research population. However, this creates a suitable platform from which to begin the quantitative questions which assists to simplify the responses to the previous sections. Additionally, this chapter also includes incorporates sample demographics, using a table to supplement the summary. The present study was an endeavor to have knowledge about the level of understanding of the clients, contractors, and consultants regarding the project setbacks. 96 participants were selected. The scheduled questionnaire contained information such as job title and type of stakeholder, awareness level using Likert point scale 1 to 5 as well as open-ended questions. Scale 1 indicates strongly disagree, scale 2



indicates disagree, scale 3 indicates neutral, scale 4 indicates agree and scale 5 indicates strongly agree. Out of these 96 questionnaires distributed, 55 filled responses were returned to the researcher. Most of the responses were from clients, contractors, and consultants. All the respondents were linked to the construction industry. The results acquired from the study were put through statistical analysis and presented in this chapter. It was observed from the quantitative data analysis that the main issue facing projects is a delay.

54 causes of project delays were identified in the study and ranked according to their relative importance as indicated in table 1 on page 116. Ranking number-1 signifies the most critical cause of delays. Ranking decreases according to relative importance. The least rank signifies the least critical cause of project delays. In addition to 54 identified project delay factors, during the investigation, consulting engineers reported that misunderstanding the scope of work, client issuing instructions directly to the contractors, the use of quantity surveyors to decide on design standards should also be considered. Contractors also maintained that project managers' poor relationship with the subcontractors and inspectors should also be considered as a critical cause of project delays. Table 1 on page 107 shows the Likert scale factors that were used to grade data gathered from the partakers. Table 2 on page 108 shows the summary of stakeholders' responses to 54 causes of project delays. 15 responses were collected from the clients, 18 responses were collected from the consultants, 22 responses were collected from the contractors. Table 3 on page 114 shows the profile of participants and related details. This table indicates the total number and percentage responses from each stakeholder. The relative importance index (RII) method was implemented to explore the most critical and least factors creating project setbacks. The calculation was done as shown in item 4.4 (data analysis). Table 2 on page 108 shows the stakeholders' responses to 54 causes of project setbacks. Table 3 on page 122 shows the mitigation measures against the top 16 project delay factors. These top 16 project setbacks were selected based on their strongly agree effect as shown in table 2 on page 120. Relief

strategies were assigned to each of these top 16 delay factors. These relief strategies were detected out from the existing literature. Table 4 on page 124 shows the comparison of literature and findings from the fieldwork using the RII method. The comparison was done using the relative importance index (RII) computed in table 1 on page 116. Table 5 on page 125 indicates the top 16 factors established in the literature. This table shows the risk factors that were established in the literature review and those that were established during the field investigation. The 'Yes' indicator means that the risk factor was established from the literature review while the 'No' indicator means that the risk factor was established during the field investigation. Figure 1 on page 121 shows the chart representation of the top 16 delay factors to simplify the analysis.

Cronbach Alpha is used to ascertain the reliability of research questionnaires as shown in table 1 and 2 below. The result reveals that the response from the client has the alpha value of 0.75 and Correlation coefficient (r) of 0.02. The consultant has the Alpha value of 0.80 and correlation coefficient (r) of 0.02. The contractor has the alpha value of 0.70 and correlation coefficient (r) of 0.03. Noting that the value of Pearson correlation (r) lies between -1.0 and 1.0, and then the values of the calculated correlations (r) lie between -1.0 and 1.0. The calculated values indicate positive signs. This means an absolute positive correlation. According to Olaniyi (2019), Cronbach's Alpha,  $\alpha$  has ranged from 0 to 1 and the agreed reliability is 0.70 and above. However, Cronbach Alpha,  $\alpha$  obtained for the questionnaires collected from the three stakeholders has values of 0.70 and above. This shows that all the variable indicators measurements denote allowable internal consistency. Since the minimum acceptable alpha is 0.70, this means that the 55 returned research questionnaires fall within the minimum acceptable value. However, this shows that the research instrument is reliable. The reliability of this linear model also relies on the number of observed data points used in the sample. This is why this study considers the correlation coefficient (r) and the sample size (n), together.

**Table 1 Calculation of Pearson correlation (r)**

No. of questionnaire (X)	No. of Responses (y)	xy	X <sup>2</sup>	Y <sup>2</sup>
10	15	150	100	225
10	18	180	100	324
10	22	220	100	484
$\Sigma = 30$	<b>55</b>	<b>550</b>	<b>300</b>	<b>1033</b>

**Table 2 Tabulation of Cronbach's Alpha values**

No. of item (K)	Correlation coefficients (r)	Cronbach's Alpha ( $\alpha$ )
15	0.02	0.75
18	0.02	0.80
22	0.03	0.70



**4.2 Limitations of the study**

This study sampled only a very small part of the construction industry in South African. The study focused only on 30 established companies out of over 265 civil engineering construction and consulting companies operating in the building projects, road and stormwater projects, and water and sewer projects in South Africa. In terms of research sampling from the stakeholders the study considered only established construction companies. At least 2-4 experienced engineers and project managers were

considered from each of these 30 established companies. The sampling was limited to government-funded projects. This research was conducted within a specific time period.

**4.3 Data collection**

Data was gathered for five-weeks starting from 21<sup>st</sup> September to 25<sup>th</sup> October 2020.

The Likert scale factors below was used to rate data collected from the participants.

**Table 1 Likert scale factors**

Scale factor	Weightage
Strongly agree	5
Agree	4
Neutral	3
Disagree	2
Strongly disagree	1

**Table 2 Summary of stakeholders’ responses to 54 causes of project delays**

● From clients’ perspective

1-Strongly disagree    2-Disagree    3- Neutral    4- Agree    5-Strongly agree

S/No	Causes of project delays	1	2	3	4	5
1	A wrong costing of the bill of quantities	0	0	0	13	2
2	Bad economic situations	0	0	1	11	3
3	Poor communication system	0	1	0	1	13
4	Financial problems	0	0	0	5	10
5	Unclear project objectives/scope	0	1	0	2	12
6	Late payment to contractors	0	1	0	2	12
7	Neglecting some parties to the project	0	1	1	3	10
8	Using unqualified subcontractors	0	1	1	4	9
9	Shortage of manpower	0	1	1	1	12
10	Unforeseen circumstances	2	8	1	4	0
11	Poor salaries for workers	0	12	1	2	0
12	Vandalism of materials and equipment	0	4	0	11	0
13	Work overloading on the contractors	1	3	0	7	4
14	Engaging inexperienced engineers	0	3	1	2	9
15	Change of government	4	2	0	6	3
16	Complete abandonment of the project	0	0	0	11	4
17	Reworking of the completed job	0	0	3	8	4
18	Suspension of work	0	0	0	15	0
19	Unexpected variation orders	2	7	4	1	1
20	Underestimation of quantities of work	1	4	3	0	7
21	Use of lowest bidder system	4	8	0	3	0
22	Market inflation	13	1	1	0	0
23	Uncontrolled accident and injuries	10	5	0	0	0
24	Engaging unskilled sub-contractors	0	0	0	9	6
25	Lateness in land acquisition	4	2	2	5	2
26	Community unrest	0	2	0	10	3
27	Conflicts among the team members	1	10	1	3	0
28	Lateness in delivery of materials and equipment	2	0	0	11	2
29	Poor planning/scheduling	0	0	2	8	5



30	Unrealistic project period imposed by the client	3	9	0	3	0
31	Poor monitoring and control	0	0	0	10	5
32	Legal disputes between parties	0	4	0	9	2
33	Use of weak competitors	2	12	0	1	0
34	Health and safety restrictions	11	4	0	0	0
35	Delays in subcontracted works	0	2	0	12	1
36	Lateness in approving design Documents by the client	2	3	0	10	0
37	Lack of government full commitment to the projects	3	3	0	7	2
38	Lateness in issuing permits to start work	0	0	0	9	6
39	Delay in performing inspections and approval by the consultant	0	0	0	10	5
40	Design errors/changes	0	0	0	6	9
41	Consistent construction errors and defective works	0	0	0	11	4
42	Late relocation of existing services	2	5	0	6	2
43	Lack of safety measures on-site	3	12	0	0	0
44	Government complicated policy	4	11	0	0	0
45	Using sub-standard equipment and materials	0	2	0	11	2
46	Contractors delays in paying salaries to their workers	0	3	1	9	2
47	Poor coordination of the work by parties on the project	1	5	0	6	3
48	Inaccurate construction details	0	0	0	11	4
49	Poor project management	0	0	0	11	4
50	Frequent equipment breakdown	0	12	0	3	0
51	Lack of direction on the project	0	6	6	2	1
52	Negligence of industrial relations	1	5	0	7	2
53	Lack of sufficient materials and equipment on-site	0	2	0	10	3
54	Slow in decision making	4	9	1	1	0

• From consultants' perspective

1-Strongly disagree 2-Disagree 3- Neutral 4- Agree 5-Strongly agree

S/No	Causes of project delays	1	2	3	4	5
1	A wrong costing of the bill of quantities	0	0	0	12	6
2	Bad economic situations	0	2	1	12	3
3	Poor communication system	0	9	0		
4	Financial problems	0	0	0	15	3
5	Unclear project objectives/scope	0	0	0	12	4
6	Late payment to contractors	0	0	0	15	3
7	Neglecting some parties to the project	0	6	0	8	4
8	Using unqualified subcontractors	0	0	0	18	0
9	Shortage of manpower	0	0	0	18	0
10	Unforeseen circumstances	0	9	0	7	2
11	Poor salaries for workers	3	2	0	7	6
12	Vandalism of materials and equipment	2	7	0	5	4
13	Work overloading on the contractors	0	2	0	13	3
14	Engaging inexperience engineers	3	3	1	11	0
15	Change of government	3	12	1	2	0
16	Complete abandonment of the project	0	0	1	17	0



17	Reworking of the completed job	0	0	0	13	5
18	Suspension of work	0	0	0	18	0
19	Unexpected variation orders	5	10	0	3	0
20	Underestimation of quantities of work	3	5	0	9	1
21	Use of lowest bidder system	0	12	3	0	3
22	Market inflation	5	7	0	4	2
23	Uncontrolled accident and injuries	4	12	2	0	0
24	Engaging unskilled sub-contractors	0	3	0	8	7
25	Lateness in land acquisition	0	3	7	8	0
26	Community unrest	0	0	0	10	8
27	Conflicts among the team members	2	12	0	4	0
28	Lateness in delivery of materials and equipment	0	0	0	12	6
29	Poor planning/scheduling	3	3	1	11	0
30	Unrealistic project period imposed by the client	0	13	0	5	0
31	Poor monitoring and control	1	2	0	10	5
32	Legal disputes between parties	0	0	0	15	3
33	Use of weak competitors	4	8	2	4	0
34	Health and safety restrictions	1	14	0	1	2
35	Delays in subcontracted works	0	0	0	15	3
36	Lateness in approving design Documents by the client	1	7	0	10	0
37	Lack of government full commitment to the projects	0	3	0	10	5
38	Lateness in issuing permits to start work	2	11	0	5	0
39	Delay in performing inspections and approval by the consultant	1	2	0	12	3
40	Design errors/changes	1	3	0	11	3
41	Consistent construction errors and defective works	0	0	0	11	7
42	Late relocation of existing services	3	10	2	3	0
43	Lack of safety measures on-site	3	14	1	0	0
44	Government complicated policy	2	13	0	3	0
45	Using sub-standard equipment and materials	3	1	0	12	2
46	Contractor's delays in paying salaries to their workers	0	0	0	17	1
47	Poor coordination of the work by parties on the project	0	1	3	12	2
48	Inaccurate construction details	0	0	0	12	6
49	Poor project management	1	5	0	10	2
50	Frequent equipment breakdown	1	1	0	10	6
51	Lack of direction on the project	0	4	6	8	0
52	Negligence of industrial relations	2	5	0	8	3
53	Lack of sufficient materials and equipment on-site	0	0	0	16	2
54	Slow in decision making	1	2	0	12	3

• From contractors' perspective

1-Strongly disagree 2-Disagree 3- Neutral 4- Agree 5-Strongly agree

S/No	Causes of project delays	1	2	3	4	5
1	A wrong costing of the bill of quantities	0	0	0	17	5
2	Bad economic situations	0	3	4	10	5



3	Poor communication system	2	5	5	9	1
4	Financial problems	0	0	0	8	14
5	Unclear project objectives/scope	0	0	3	12	7
6	Late payment to contractors	0	0	0	2	20
7	Neglecting some parties to the project	0	6	7	5	4
8	Using unqualified subcontractors	2	8	4	6	2
9	Shortage of manpower	0	1	0	15	6
10	Unforeseen circumstances	4	9	2	5	2
11	Poor salaries for workers	4	13	3	2	0
12	Vandalism of materials and equipment	0	3	0	16	3
13	Work overloading on the contractors	4	13	2	3	0
14	Engaging inexperience engineers	0	3	4	12	3
15	Change of government	5	14	2	1	0
16	Complete abandonment of the project	0	0	0	12	10
17	Reworking of the completed job	0	0	3	10	9
18	Suspension of work	0	0	0	20	2
19	Unexpected variation orders	0	3	1	10	8
20	Underestimation of quantities of work	0	0	4	13	5
21	Use of lowest bidder system	5	11	0	4	2
22	Market inflation	4	1	0	10	7
23	Uncontrolled accident and injuries	2	17	0	3	0
24	Engaging unskilled sub-contractors	0	3	10	5	4
25	Lateness in land acquisition	0	5	8	9	0
26	Community unrest	0	0	0	17	5
27	Conflicts among the team members	2	3	6	7	4
28	Lateness in delivery of materials and equipment	0	0	0	14	8
29	Poor planning/scheduling	0	0	1	11	10
30	Unrealistic project period imposed by the client	0	4	0	16	2
31	Poor monitoring and control	0	0	3	16	3
32	Legal disputes between parties	0	0	3	19	0
33	Use of weak competitors	3	2	12	5	0
34	Health and safety restrictions	0	14	6	2	0
35	Delays in subcontracted works	0	0	3	12	7
36	Lateness in approving design documents by the client	0	0	2	20	0
37	Lack of government full commitment to the projects	1	1	9	11	0
38	Lateness in issuing permits to start work	0	0	3	15	4
39	Delay in performing inspections and approval by the consultant	0	0	0	18	4
40	Design errors/changes	0	2	0	15	5
41	Consistent construction errors and defective works	0	1	2	15	4
42	Late relocation of existing services	0	6	14	2	0
43	Lack of safety measures on-site	4	12	4	2	0
44	Government complicated policy	4	6	12	0	0
45	Using sub-standard equipment and materials	2	8	1	11	0
46	Contractor's delays in paying salaries to their workers	0	3	9	10	0
47	Poor coordination of the work by parties on the project	0	8	6	4	4



48	Inaccurate construction details	0	0	0	10	12
49	Poor project management	0	2	1	12	7
50	Frequent equipment breakdown	3	3	4	12	0
51	Lack of direction on the project	0	0	12	10	0
52	Negligence of industrial relations	0	0	5	13	4
53	Lack of sufficient materials and equipment on-site	0	0	0	17	5
54	Slow in decision making	1	2	2	14	3

Table 3 Profile of participants and related details

ID	Type of participant	No. of respondents	Percentage %
1	Client	15	27
2	Consultant	18	33
3	Contractor	22	40
	<b>Total</b>	<b>55</b>	<b>100</b>

4.4 Data analysis

A five-point Likert scale from 1 to 5 was implemented to ascertain the significance of each delay factor. Scale-1 signifies strongly disagree, scale-2 signifies disagree, scale-3 means neutral, scale-4 indicates agree and scale 5 indicates strongly agree. The relative importance index (RII) method was implemented to calculate and rank the factors according to their level of importance. The RII for the three stakeholders, namely, client, consultant, and contractor were computed. This was used to ascertain the major project delay factors differently. The RII was computed using the expression below:

$$RII = \frac{\sum W}{A \times N} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$$

Where;

RII = relative importance index;

W = weight given to each factor by the respondents and ranges from 1 to 5; where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

A - highest weight, which is 5 in this study

N - total number of participants.

n – number of responses under a particular rating ( eg., n5 is number of partakers rating strongly agree).

For example, from clients’ perspective,

$$\text{for delay factor No.1, } RII = \frac{5 \times 2 + 4 \times 13 + 3 \times 0 + 2 \times 0 + 1 \times 0}{5 \times 15} = \frac{10 + 52 + 0 + 0 + 0}{75} = 0.83$$

The same procedure was used to calculate RII for the rest of the ratings. Using weighted means, the results were summed up and weighted by 3 as tabulated in Table 1 on page 107 to simplify the analysis. This is used to compare the degree of awareness between the stakeholders regarding the major project sources. According to Tareq and Yasser (2018) and Hatkar and Hedao (2016), to determine the degree of effect by each delay factor, five Likert scales are classified by the uniform intervals:

00.0 ≤ strongly disagree effect (SDE) ≤ 20.0

20.0 ≤ disagree effect ( DE) ≤ 40.0

40.0 ≤ neutral effect (NE) ≤ 60.0

60.0 ≤ agree effect (AE) ≤ 80.0

80.0 ≤ strongly agree effect (SAE) ≤ 100

Table 1 Ranking stakeholders’ responses based on the weighted RII

ID	Delay factor	Client	Consultant	Contractor	Overall		Degree of effect
		RII	RII	RII	Mean RII	Rank	
1	A wrong costing of the bill of quantities	0.83	0.87	0.85	0.85	6	SAE
2	Bad economic situations	0.83	0.78	0.75	0.78	12	AE
3	Poor communication system	0.79	0.64	0.62	0.68	21	AE



4	Financial problems	0.93	0.93	0.93	0.93	<b>2</b>	<b>SAE</b>
5	Unclear project objectives/scope	0.67	0.76	0.84	0.75	<b>15</b>	<b>AE</b>
6	Late payment to contractors	0.93	0.83	0.91	0.89	<b>3</b>	<b>SAE</b>
7	Neglecting some parties to the project	0.81	0.71	0.70	0.74	<b>16</b>	<b>AE</b>
8	Using unqualified subcontractors	0.88	0.80	0.69	0.79	<b>12</b>	<b>AE</b>
9	Shortage of manpower	0.92	0.80	0.84	0.85	<b>6</b>	<b>SAE</b>
10	Unforeseen circumstances	0.49	0.62	0.53	0.54	<b>28</b>	<b>NE</b>
11	Poor salaries for workers	0.47	0.72	0.43	0.54	<b>28</b>	<b>NE</b>
12	Vandalism of materials and equipment	0.69	0.62	0.77	0.69	<b>20</b>	<b>AE</b>
13	Work overloading on the contractors	0.73	0.79	0.44	0.65	<b>24</b>	<b>AE</b>
14	Engaging inexperienced engineers	0.83	0.62	0.74	0.73	<b>17</b>	<b>AE</b>
15	Change of government	0.63	0.42	0.39	0.48	<b>30</b>	<b>NE</b>
16	Complete abandonment of the project	0.93	0.99	0.99	0.97	<b>1</b>	<b>SAE</b>
17	Reworking of the completed job	0.87	0.86	0.92	0.88	<b>4</b>	<b>SAE</b>
18	Suspension of work	0.93	0.99	0.99	0.97	<b>1</b>	<b>SAE</b>
19	Unexpected variation orders	0.49	0.41	0.81	0.57	<b>26</b>	<b>NE</b>
20	Underestimation of quantities of work	0.71	0.60	0.81	0.70	<b>19</b>	<b>AE</b>
21	Use of lowest bidder system	0.43	0.53	0.48	0.48	<b>30</b>	<b>NE</b>
22	Market inflation	0.24	0.50	0.74	0.49	<b>29</b>	<b>NE</b>
23	Uncontrolled accident and injuries	0.27	0.38	0.44	0.36	<b>34</b>	<b>DE</b>
24	Engaging unskilled sub-contractors	0.88	0.81	0.69	0.79	<b>12</b>	<b>AE</b>
25	Lateness in land acquisition	0.59	0.66	0.64	0.63	<b>25</b>	<b>AE</b>
26	Community unrest	0.79	0.89	0.85	0.84	<b>7</b>	<b>SAE</b>
27	Conflicts among the team members	0.48	0.47	0.67	0.54	<b>28</b>	<b>NE</b>



28	Lateness in delivery of materials and equipment	0.75	0.87	0.87	0.83	<b>8</b>	<b>SAE</b>
29	Poor planning/scheduling	0.77	0.62	0.88	0.75	<b>15</b>	<b>AE</b>
30	Unrealistic project period imposed by the client	0.44	0.51	0.75	0.56	<b>27</b>	<b>NE</b>
31	Poor monitoring and control	0.87	0.74	0.80	0.80	<b>11</b>	<b>SAE</b>
32	Legal disputes between parties	0.72	0.83	0.77	0.77	<b>14</b>	<b>AE</b>
33	Use of weak competitors	0.40	0.47	0.57	0.48	<b>30</b>	<b>NE</b>
34	Health and safety restrictions	0.25	0.48	0.49	0.40	<b>32</b>	<b>NE</b>
35	Delays in subcontracted works	0.76	0.83	0.84	0.81	<b>10</b>	<b>SAE</b>
36	Lateness in approving design documents by the client	0.64	0.61	0.78	0.67	<b>22</b>	<b>AE</b>
37	Lack of government full commitment to the projects	0.63	0.79	0.75	0.72	<b>18</b>	<b>AE</b>
38	Lateness in issuing permits to start work	0.88	0.49	0.81	0.72	<b>18</b>	<b>AE</b>
39	Delay in performing inspections and approval by the consultant	0.87	0.73	0.84	0.81	<b>10</b>	<b>SAE</b>
40	Design errors/changes	0.92	0.73	0.81	0.82	<b>9</b>	<b>SAE</b>
41	Consistent construction errors and defective works	0.85	0.88	0.80	0.84	<b>7</b>	<b>SAE</b>
42	Late relocation of existing services	0.61	0.46	0.56	0.54	<b>28</b>	<b>NE</b>
43	Lack of safety measures on-site	0.36	0.38	0.44	0.39	<b>33</b>	<b>DE</b>
44	Government complicated policy	0.35	0.44	0.47	0.42	<b>31</b>	<b>NE</b>
45	Using sub-standard equipment and materials	0.77	0.70	0.75	0.74	<b>16</b>	<b>AE</b>



46	Contractor's delays in paying salaries to their workers	0.73	0.81	0.66	0.73	<b>17</b>	<b>AE</b>
47	Poor coordination of the work by parties on the project	0.67	0.77	0.64	0.69	<b>20</b>	<b>AE</b>
48	Inaccurate construction details	0.85	0.87	0.91	0.87	<b>5</b>	<b>SAE</b>
49	Poor project management	0.85	0.68	0.82	0.78	<b>13</b>	<b>AE</b>
50	Frequent equipment breakdown	0.48	0.81	0.70	0.66	<b>23</b>	<b>AE</b>
51	Lack of direction on the project	0.57	0.64	0.69	0.63	<b>25</b>	<b>AE</b>
52	Negligence of industrial relations	0.65	0.66	0.79	0.70	<b>19</b>	<b>AE</b>
53	Lack of sufficient materials and equipment on-site	0.79	0.82	0.85	0.82	<b>9</b>	<b>SAE</b>
54	Slow in decision making	0.39	0.76	0.75	0.63	<b>25</b>	<b>AE</b>

From the analysis in table 1 above, the top 16 major delay factors facing construction projects were diagnosed and ranked in table 2 below according to their strongly agree effect (SAE). This means that these top 16 factors are the most influential factors affecting project performance

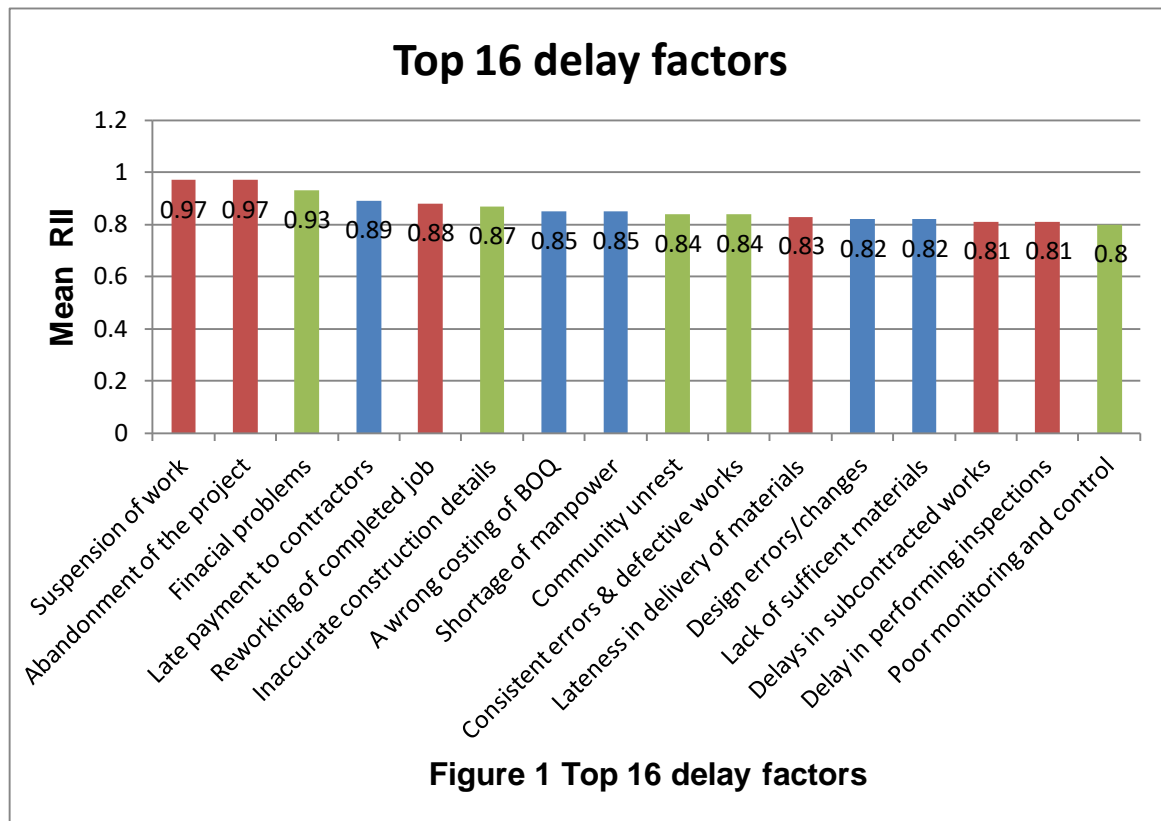
(Tareq and Yasser 2018). These factors may create crucial a budget and time overrun if they eventually happen to occur. If the RII of all the stakeholders are summed up, the three will give equal value of 36.86 each. This is an evidence that the research instrument is stable and reliable.

**Table 2 Assessing the top 16 delay factors based on their strongly agree effect**

<b>S/No</b>	<b>Major delay factor</b>	<b>RII</b>	<b>Rank</b>
1	Suspension of work	<b>0.97</b>	<b>1</b>
2	Complete abandonment of the project	<b>0.97</b>	<b>1</b>
3	Financial problems	<b>0.93</b>	<b>2</b>
4	Late payment to contractors	<b>0.89</b>	<b>3</b>
5	Reworking of the completed job	<b>0.88</b>	<b>4</b>
6	Inaccurate construction details	<b>0.87</b>	<b>5</b>
7	A wrong costing of the bill of quantities	<b>0.85</b>	<b>6</b>
8	Shortage of manpower	<b>0.85</b>	<b>6</b>
9	Community unrest	<b>0.84</b>	<b>7</b>
10	Consistent construction errors and defective works	<b>0.84</b>	<b>7</b>
11	Lateness in delivery of materials and equipment	<b>0.83</b>	<b>8</b>
12	Design errors/changes	<b>0.82</b>	<b>9</b>
13	Lack of sufficient materials and equipment on-site	<b>0.82</b>	<b>9</b>
14	Delays in subcontracted works	<b>0.81</b>	<b>10</b>
15	Delay in performing inspections and approval by the consultant	<b>0.81</b>	<b>10</b>
16	Poor monitoring and control	<b>0.80</b>	<b>11</b>



**Figure 1 Chart representation of top 16 delay factors**



**Figure 1 Top 16 delay factors**

From figure 1 above, it is noticed that suspension of work and abandonment of the project are the most critical issues among 16 delay factors affecting the successful delivery of a project. Both of them are of equal importance. The least factor among the 16 critical delay factors is poor monitoring and control. This chart helps to simplify this analysis.

Table 3 on page 122 shows the relief strategies against the top 16 project delay factors according to the literature review. This proves that every risk affecting the successful delivery of a project has different means of resolving it.

**Table 3 Mitigation measures against the top 16 project delay factors**

S/No	Delay factor	Mitigation measures
1	Suspension of work	All parties on the project must stick to the contractual agreement especially in terms of time, money, and quality
2	Complete abandonment of the project	The client must ensure consistent payment of work done. Late payment or non-payment of work done may give rise to total abandonment of the project due to lack of finance.
3	Financial problems	The client and contractor should ensure that adequate funding is available before embarking on a project
4	Late payment to contractors	The client should prioritize early payment of work done to contractors. The client must maintain consistent payment work done to contractors to minimize the financial crisis
5	Reworking of the completed job	A competent and experienced project manager must be engaged to oversee the project implementation to reworking exercise.
6	Inaccurate construction details	A competent and experienced engineer must be engaged to oversee the project implementation. The engineer must ensure construction drawings are clear and precise



7	A wrong costing of the bill of quantities	Stakeholders should engage an experienced quantity surveyor to handle the costing of the bill of quantities to avoid underestimation of the bill of quantities, which will affect the project performance at the later stage.
8	Shortage of manpower	The contractor must ensure enough manpower on site. The early arrangement should be done prior to commencement of job activities
9	Community unrest	The community must be notified of the project in the initial stage. Local communities need to be engaged in areas they are suitable for.
10	Consistent construction errors and defective works	Effective quality control must be in place. It is the sole responsibility of everyone to avoid defects. Hence, it is a collaborative effort to ensure there are no defects on the job.
11	Lateness in delivery of materials and equipment	The contractor should place an order for materials and equipment on time to ensure early delivery to the site.
12	Design errors/changes	The competent design engineer must be engaged to handle the design work. The engineer must proofread the drawings after designing them before sending them for approval.
13	Lack of sufficient materials and equipment on-site	An early arrangement for the procurement of enough materials and equipment must be in place to avoid sudden shortage.
14	Delays in subcontracted works	Engaging unqualified subcontractors should be discouraged. Select contractors based on knowledge and experience.
15	Delay in performing inspections and approval by the consultant	Consulting engineer should create a favourable time table for early project inspection. Inspection should be done as soon as the job activity is ready for that. The competent engineer must be engaged to carry out inspection activities
16	Poor monitoring and control	Close project monitoring and controlling are encouraged. As a project manager, you need to maintain traces of the commitments of all stakeholders in the project

Table 4 on page 124 compares the results from the existing literature to that of the results acquired from the current fieldwork using the relative importance index method. The comparison shows that most of the delay factors identified in the literature are confirmed to be similar to that of the findings from the current fieldwork. Some factors found in

the literature are different from the findings from the fieldwork. This might be due to the degree to which stakeholders recognize project delay factors. This case refers me to a usual proverb that says “one man’s meat is another man’s poison”. This means that what is the problem to a stakeholder may be different from other stakeholders.

**Table 4 Comparison of literature and findings on top 16 delay factors using RII**

S/No		Literature Rank RII	Findings Rank RII
1	Suspension of work	2	1
2	Complete abandonment of the project	5	1
3	Financial problems	5	2
4	Late payment to contractors	6	3
5	Reworking of the completed job	3	4
6	Inaccurate construction details	5	5
7	A wrong costing of the bill of quantities	6	6
8	Shortage of manpower	5	6
9	Community unrest	7	7
10	Consistent construction errors and defective works	1	7
11	Lateness in delivery of materials and equipment	6	8
12	Design errors/changes	4	9
13	Lack of sufficient materials and equipment on-site	1	9



14	Delays in subcontracted works	4	10
15	Delay in performing inspections and approval by the consultant	10	10
16	Poor monitoring and control	7	11

Table 5 below shows the new and old findings from the fieldwork. The indicator ‘No’ means that this not obtained from the literature. The indicator ‘Yes’ means that such a

variable is already established in the literature. The new findings from the fieldwork show that factors creating project setbacks have not been exhausted in the literature.

**Table 5 The top 16 factors established in literature**

S/No	Major delay factor	The top 16 established in literature
1	Suspension of work	Yes
2	Misunderstanding the scope of work	No
3	Complete abandonment of the project	Yes
4	Financial problems	Yes
5	Client issuing instructions directly to the contractors	No
6	Late payment to contractors	Yes
7	Reworking of the completed job	Yes
8	Use of quantity surveyors to decide on design standards	No
9	Inaccurate construction details	Yes
10	A wrong costing of the bill of quantities	Yes
11	Project managers’ poor relationship with the subcontractors and inspectors	No
12	Shortage of manpower	Yes
13	Community unrest	Yes
14	Consistent construction errors and defective works	Yes
15	Lateness in delivery of materials and equipment	Yes
16	Design errors/changes	Yes

**4.4.1 Observations from the analysis**

From data collection and analysis above, it is quite clear to say that conflict is like a cough, if you do not treat the root cause, it will appear again. In other words, delay in a project is a disease. If the root cause of this delay is not identified and tackled, it will keep on appearing every now and then. Table 2 on page 108 summarizes stakeholders’ responses to 54 causes of project delays and table 1 on page 116 ranked the 54 delay factors according to their relative importance, From table 2 on page 108, it is observed that the main concerns of the client are financial problems, late payment to contractors, complete abandonment of the project, and suspension of work. The consultants’ main concerns are complete abandonment of the project and suspension of work, while the contractors’ main concerns are complete abandonment of the project and suspension of work. The Likert scale factor was used for rating. It was also observed that not many stakeholders rated disagree and neutral points. Many stakeholders are on agree and strongly agree on points. This implies that different participants have a different degree of familiarity with project delays. The participants that rated the Likert scale of 4 and 5 are more familiar with those project delay factors. The participants with the scale factors 1 and 2 must have had little experience with construction project delays, while the

participants with the Likert scale factor 3 must have been hearing of the project setback but have not experienced it on site. They must have heard about the project delays but have not worked on them. From table 2 on page 108, it is also quite clear that many participants from the clients, consultants, and contractors collectively scored high on the agree on rating. However, it is also discovered that those scoring high on the awareness scale are experienced and knowledgeable professional engineers and managers. The responses collected are not as high as expected as shown in table 2 on page 107. This might either be due to some respondents not being available to fill the questionnaires or being reluctant to fill the questionnaires. Lack of adequate knowledge of the construction industry might also be a contributory factor to the non-filling of the questionnaires. Some expected participants might not understand the value of the questionnaires, perhaps due to no benefit was attached.

In table 2 on page 120, the top 16 delay factors were tabulated according to their strongly agree effect. This table summarizes the level of impact each factor has on the project lifecycle. It is noticed that most risk factors affecting the client performance are financial problems, late payment to contractors, complete abandonment of the project, suspension of work, shortage of manpower, design



errors/changes, using unqualified subcontractors, engaging unskilled sub-contractors, lateness in issuing permits to start work, a reworking of the completed job, poor monitoring and control, delay in performing inspections and approval by consultant, consistent construction errors and defective works, inaccurate construction details, poor project management, a wrong costing of the bill of quantities, bad economic situations, engaging inexperience engineers, neglecting some parties to the project, poor communication system, community unrest, lack of sufficient materials and equipment on-site, poor planning/scheduling, using sub-standard equipment and materials, and delays in subcontracted works. These are the major concerns that impact the client's successful delivery of the project. It is also clear that the main concerns of the consultant are on the following attributes: complete abandonment of the project, suspension of work, financial problems, community unrest, consistent construction errors and defective works, wrong costing of the bill of quantities, lateness in delivery of materials and equipment, inaccurate construction details, a reworking of the completed job, late payment to contractors, legal disputes between parties, delays in subcontracted works, lack of sufficient materials and equipment on-site, engaging unskilled sub-contractors, contractor's delays in paying salaries to their workers, design errors/changes, using unqualified subcontractors, shortage of manpower, work overloading on the contractors, and lack of government full commitment to the projects. From the consultant's perspective, these attributes must be addressed properly to enable the successful implementation of a project. The contractor is more concerned about the following risk factors: complete abandonment of the project, suspension of work, financial problems, a reworking of the completed job, late payment to contractors, inaccurate construction details, poor planning/scheduling, lateness in delivery of materials and equipment, wrong costing of the bill of quantities, community unrest, lack of sufficient materials and equipment on-site, unclear project objectives/scope, shortage of manpower, delays in subcontracted works, delay in performing inspections and approval by the consultant, poor project management, unexpected variation orders, underestimation of quantities of work, lateness in issuing permits to start work, and design errors/changes. However, this means that the contractor may be able to deliver a project successfully if the above attributes are attended to.

Generally, it is quite clear that most factors are of equal importance. For instance, in table 1 on page 116, a wrong costing of the bill of quantities and bad economic situations are of equal importance to the client. From the consultants' perspective, using unqualified subcontractors and shortage of manpower are of equal importance, from the contractors' perspective, unclear project objectives/scopes and shortage of manpower are of equal importance. From the RII indicated in table 1 on page 116, it seems that the three

stakeholders have a similar perception of the delay factors influencing the project lifecycle. However, the three stakeholders are deemed to have acquired equal knowledge and experience on the roots of project setbacks. From this analysis, it is evident enough that for a project to be delivered successfully, the three stakeholders need to show equal impacts on the project lifecycle.

Based on the engineering judgment, the three stakeholders have proved to be the only stakeholders with a better understanding of the factors creating project setbacks and therefore hold key to the successful delivery of projects. Table 3 on page 122 revealed the mitigation measures against project setbacks in South Africa. In table 3, it is quite understandable that every project delay has a solution. Every solution depends on the kind of delay factor that is involved. It is also observed in table 1 on page 115 that different stakeholders have different views regarding the major causes of project setbacks. This means that what is the problem to one stakeholder may not be the same to another stakeholder. In some areas, the three stakeholders held similar opinions. Where the three stakeholders have a similar degree of understanding, it means such a delay factor is very critical to the project lifecycle. If this is not immediately resolved, it may eventually bring the whole project down. In table 5 on page 125, it is observed that some major issues affecting the successful delivery of projects have not been addressed in the existing literature. Future studies need to accommodate these backlogs.

## V. CHAPTER 5. CONCLUSION AND RECOMMENDATIONS

### 5.1 Conclusion

The conclusion is the last chapter of the study that intends to assist the readers to understand why this research should matter to them after they have completed reading the research paper. This part of the research study is not merely a summary of the research points. This study identified and analyzed major factors creating project setbacks and their relief strategies. It measured the difference in the view of perceptions among stakeholders regarding factors creating project setbacks. A literature review and questionnaires were conducted. 54 factors were detected and compiled for further assessment. Data gathering in this study focused only on government-funded projects. The result indicated that all three stakeholders in the project generally agreed that out of 54 causes of project delays, the top 16 causes are the most influencing factors creating project setbacks in South Africa. The top 16 crucial factors creating project setbacks were extracted for further examination to ascertain their degree of risk as indicated in figure 1 on page 122. The result of this examination showed that the project delay awareness level of the three stakeholders deemed to be almost the same. The three stakeholders proved to be equally more experienced and knowledgeable on the issue of delays. The findings from this study will enlighten all



professionals operating in the construction industry regarding the issue of project delay sources and their relief strategies. Relief strategies developed in this study can be regarded as a record of good exercise that may assist in controlling and improving successful project delivery in South Africa. It was observed that successful project delivery relies on the efforts invested by the three stakeholders on the project planning and delivery, as they contribute to project delays in different ways. The study discussed the necessity for ethics consideration in research work. Participation was voluntary. There was no risk of harm to the respondents and their anonymity was preserved.

## **5.2. Recommendations**

### **5.2.1 Recommendations for future studies**

Further researches on factors creating project setbacks are required within privately funded projects to ascertain the difference in factors creating project setbacks in the government-funded projects and that of privately funded projects.

### **5.2.2 Recommendations for minimizing future project delays**

The following recommendations will assist in minimizing factors creating project setbacks in South Africa.

#### **Recommendations for the clients**

- There is a need to ensure early payment of all debts and installments to circumvent or minimize delays.
- A well-established consistent cash flow net must be in place prior to commencing a large project.
- The client should avoid consistent interrupting of the project activities with numerous change orders.
- The client should avoid the issue of the low bidder system in order to minimize the constant calling for renegotiation, which if failed might lead to litigation that would eventually delay the project.
- The clients should always verify the financial capacity of the other stakeholders prior to engaging them in the project.
- There is a need for the client to focus on awarding contracts to honest and experienced service providers who will comply with service level agreements and complete the project without delay.
- The client should verify the competence level of the consulting engineers before engaging them in order to minimize the issue of design errors or omissions that might eventually set the project behind if occur.
- Client should desist from issuing instructions directly to the contractors.
- The use of quantity surveyors to decide on design standards should not be implemented.

#### **Recommendations for the consultants**

- Consulting engineers should ensure that all design works are well perused prior to final submission for approval.

- There is a need to have an experienced permanent engineer representative on-site in order to monitor and control the work activities to ensure quality is maintained.
- Consulting engineers and contractors should do a joint work done measurement to avoid unnecessary inflating of the work quantities that might alter the original contract amount thereby creating variation order.

#### **Recommendations for the contractors**

- There is a need to have all the necessary materials and equipment on-site before commencing any project activity.
- The contractor should also engage in re-checking the design details with the consulting engineers to understand fully the contents of the design.
- During the time of construction, the contractor should immediately alert the consulting engineer in a situation whereby the design details do not fit into the site conditions.
- The contractor should engage an experienced and knowledgeable site engineer or site manager who will monitor and control the work and personnel on-site to minimize defective work that will eventually end up in reworking.
- There is a need to ensure effective project planning and management are in place before commencing work activities in order to circumvent project cost and time overruns.
- Good health and safety procedures must be in place in order to minimize site accidents that might end in project delays or additional costs to the project.
- There is a need for the contractor to create a motivation system that will encourage the workers to perform well.
- The contractor should ensure the scope of work is clear and precise before proceeding to work.
- Project managers should create good relationship on-site to encourage teamwork.

#### **Dedication**

This research is devoted to the Holy Spirit for the inspiration to move ahead.

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VI. REFERENCES

- [1]. Abdullah<sup>1</sup> M. S., Alaloul<sup>1\*</sup> W. S., Liew<sup>1</sup> M. S., and Mohammed<sup>1</sup> B. S. (2018). ‘Delays and Cost Overruns Causes During Construction of Palm Oil Refinery Projects MATEC Web of Conferences 203, 02004 (2018), <https://doi.org/10.1051/mateconf/201820302004>.
- [2]. Agyekum-Mensah G., and Knight, A. D. (2017). The Professionals’ Perspective on the Causes of Project Delay in the Construction Industry. *Engineering, Construction and Architectural Management*, vol. 24 No. 5, 2017, (pp.828-84). <https://doi.org/10.1108/ECAM-03-2016-0085>
- [3]. Akaranga S. I., and Makau B. K. (2016). Ethical Considerations and their Applications to Research: A Case of the University of Nairobi. *Journal of Educational Policy and Entrepreneurial Research*, Vol. 3, NO.12. 2016. (pp. 1-9).
- [4]. Alnuaimi A. S., and Al Mohsin M. A. (2013). Causes of Delay in Completion of Construction Projects in Oman. *International Conference on Innovations in Engineering and Technology (ICIET 2013) Dec 25-26. 2013*, (pp. 267–270). <http://dx.doi.org/10.15242/IIIE.E1213590>
- [5]. Alsuliman J. A. (2019). Causes of Delay in Saudi Public Construction Projects. *Alexandria Engineering Journal* (2019) 58, (pp. 801–808). [https://doi.org/10.1016/j.aej.2019.07.0021110-0168\\_2019](https://doi.org/10.1016/j.aej.2019.07.0021110-0168_2019)
- [7]. Alzara\* M., Kashiwagib J., Kashiwagic D., and Al-Tassand A. (2016). Using PIPS to Minimize Causes of Delay in Saudi Arabian Construction Projects: University Case Study. *Procedia Engineering* 145 ( 2016 ) (pp. 932 – 939). doi: 10.1016/j.proeng.2016.04.121
- [8]. Amoatey C. T., Ameyaw Y. A., Adaku E., and Famiyeh S. (2015). Analysing Delay Causes and Effects in Ghanaian State Housing Construction Projects. *International Journal of Managing Projects in Business*, Vol. 8 No. 1, 2015, (pp. 198-214). DOI 10.1108/IJMPB-04-2014-0035
- [9]. Amoatey C. T., and Ankrah A. N. O. (2017). Exploring Critical Road Project Delay Factors in Ghana. *Journal of Facilities Management*, Vol. 15 No. 2, 2017, (pp. 110-127). DOI 10.1108/JFM-09-2016-0036
- [10]. Ansah R. H., and Sorooshian S. (2018). 4P Delays in Project Management. *Engineering, Construction and Architectural Management*, Vol. 25 No. 1, 2018, (pp. 62-76). DOI 10.1108/ECAM-09-2016-0199
- [11]. Aziz R. F. (2013). Ranking of Delay Factors in Construction Projects after Egyptian Revolution. *Alexandria Engineering Journal* (2013) 52, (pp. 387-406). <http://dx.doi.org/10.1016/j.aej.2013.03.002>
- [12]. Banobi E. T., and Jung \* W. (2019). Causes and Mitigation Strategies of Delay in Power Construction Projects: Gaps between Owners and Contractors in Successful and Unsuccessful Projects. *Sustainability* 2019, 11, 5973; doi:10.3390/su11215973
- [13]. Chen G., Shan M., Albert P. C., Chan X. L. and Zhao Y. (2019). Investigating the Causes of Delay in Grain Bin Construction Projects: The Case of China. *International Journal of Construction Management*, 19:1, (pp.1-14). DOI: 10.1080/15623599.2017.1354514
- [14]. Durdyev S., and Hosseini M. R. (2018). Causes of Delays on Construction Projects: A Comprehensive List. *International Journal of Managing Projects in Business*. DOI 10.1108/IJMPB-09-2018-0178
- [15]. Elaati A. A. N. (2016). Postmodernism Theory. DOI: 10.13140/RG.2.1.4515.0327
- [16]. Elawi<sup>a\*</sup> G. S. A., Algahtany<sup>b</sup> M., and Kashiwagi<sup>c</sup> D. (2016). Owners’ Perspective of Factors Contributing to Project Delay: Case Studies of Road and Bridge Projects in Saudi Arabia *Procedia Engineering* 145 ( 2016 ), (pp. 1402–1409). Doi: 10.1016/j.proeng.2016.04.176
- [17]. Famiyeh S., Amoatey C. T., and Adaku E. (2017). Major Causes of Construction Time and Cost Overruns: A case of selected Educational sector Projects in Ghana. *Journal of Engineering, Design and Technology* Vol. 15 No. 2, 2017, (pp. 181-198). DOI 10.1108/JEDT-11-2015-0075
- [18]. Fugar F. D. K., and Agyakwah-Baah A. B. (2010). Delays in Building Construction Projects in Ghana. *Australasian Journal of Construction Economics and Building*, 10 (1/2), (pp. 103-116).
- [19]. Gebrehiweta T., and Luob H. (2017). Analysis of Delay Impact on Construction Project Based on RII and Correlation Coefficient: Empirical Study. *Procedia Engineering* 196 (2017), (pp. 366 – 374). Doi: 10.1016/j.proeng.2017.07.212
- [20]. Hamzah<sup>a\*</sup> N., Khoiry<sup>a</sup> M.A., Arshad<sup>a</sup> I., Tawil<sup>b</sup> N.M., and Che Ani<sup>b</sup> A.I. (2011). Cause of Construction Delay – Theoretical Framework. The 2nd International Building Control Conference 2011. *Procedia Engineering* 20 (2011), (pp. 490–495). doi:10.1016/j.proeng.2011.11.192
- [21]. Hatkar K., and Hedaoo N. ( 2016). Delay Analysis by Using Relative Importance Index Method in Infrastructure Projects. *International Journal of Civil Engineering and Concrete Structures*, 1(3).
- [22]. Islam<sup>1</sup> M. S., Trigunaryah<sup>2</sup> B., Hassanain<sup>3</sup> M., and Assaf<sup>4</sup> S. (2015), Causes of Delay in Construction Projects in Bangladesh. *The 6th International*



- Conference on Construction Engineering and Project Management (ICCEPM 2015), (pp. 82-86).
- [23]. Jongo<sup>1</sup> J. S., Dennis N. G., Tesha<sup>2</sup> A. K., Kasonga<sup>1</sup> R., Teyanga<sup>1</sup> J. J., and Lyimo<sup>2</sup> K. S. (2019). Mitigation Measures in Dealing with Delays and Cost Overrun in Public Building Projects in Dar-Es-Salaam, Tanzania. *International Journal of Construction Engineering and Management* 2019, 8(3): (pp. 81-96). DOI: 10.5923/j.ijcem.20190803.01
- [24]. Kazaz<sup>1</sup> A., Ulubeyli<sup>2</sup>, S., and Tuncbilekli<sup>3</sup> N. A. (2012). Causes of Delays in Construction Projects in Turkey. *Journal of Civil Engineering and Management*, 2012 volume 18(3), (pp. 426-435). Doi:10.3846/13923730.2012.698913
- [25]. Kikwasi G. (2012). Causes and Effects of Delays and Disruptions in Construction Projects in Tanzania. *Australasian Journal of Construction Economics and Building - Conference Series*, Vol 1 No 2 (2012). DOI: <https://doi.org/10.5130/ajcebcs.v1i2.3166>
- [26]. Koshe<sup>1</sup> W., and Jha<sup>2</sup> K. N. (2016). Investigating Causes of Construction Delay in Ethiopian Construction Industries. *Journal of Civil, Construction and Environmental Engineering*. Vol.1, No.1, 2016, (pp.18-29). Doi: 10.11648/j.jceee.20160101.13
- [27]. Kosow H., and Gaßner R. (2008). *Methods of Future and Scenario Analysis: Overview, Assessment, and Selection Criteria*. (DIE Studies, 39). Bonn: Deutsches Institut für Entwicklungspolitik gGmbH. <https://nbn-resolving.org/urn:nbn:de:0168-ssoar-193660>
- [28]. Lessing<sup>a</sup> B., Thurnell<sup>b</sup> D., and Durdyev<sup>b</sup> S. (2017). Main Factors Causing Delays in Large Construction Projects: Evidence from New Zealand. *Journal of Management, Economics, and Industrial Organization*, Vol.1 No.2, 2017,(pp. 63-82).
- [29]. Mahamid I. (2013). Common Risks affecting Time Overrun in Road Construction Projects in Palestine: Contractors' Perspective. *Australasian Journal of Construction Economics and Building*, **13** (2), (pp. 45-53).
- [30]. Marzouk\* M. M., and El-Rasas T. I. (2014). Analyzing Delay Causes in Egyptian Construction Projects. *Journal of Advanced Research* (2014) 5, (pp. 49-55). <http://dx.doi.org/10.1016/j.jare.2012.11.005>
- [31]. Masood<sup>1</sup> R., Ali<sup>2</sup> M., Shafique<sup>3</sup> F., Shafique<sup>3</sup> M. A., Zafar<sup>4</sup> B., Maqsoom<sup>5</sup> A., and Ullah<sup>6</sup> Z. (2015). Investigating the Delay Factors of Construction Projects in Metropolitan City of a Developing Country. *Journal of Civil Engineering and Architecture Research*, Vol. 2, No. 9, 2015, (pp. 947-955).
- [32]. McLeod S. A. (2018). Questionnaire: Definition, Examples, Design and
- [33]. Types. *Simply Psychology*. <https://www.simplypsychology.org/questionnaires.html>
- [34]. Mello M. H., Strandhagen J. O., and Alfnes E. (2015). The Role of Coordination in Avoiding Project Delays in an Engineer-to-Order Supply Chain. *Journal of Manufacturing Technology Management*, Vol. 26 No. 3, 2015, (pp. 429-454). DOI 10.1108/JMTM-03-2013-0021
- [35]. Mydin<sup>1</sup> M. A. O., Sani<sup>2</sup> N., Taib<sup>3</sup> M., and Alias<sup>4</sup> N. M. (2014). Imperative Causes of Delays in Construction Projects from Developers' Outlook. *MATEC Web of Conferences* 10, 06005 (2014). DOI: 10.1051/mateconf/201410005
- [36]. Nawab M. S., and Al Hammadi S. (2016). Study of Delay Factors in Construction Projects. *International Advanced Research Journal in Science, Engineering and Technology* Vol. 3, Issue 4, (pp. 87-93). DOI 10.17148/IARJSET.2016.3420
- [37]. Ntshangase B., and Tuan N. (2019). A systemic Inquiry into the Delay Factors in South African Electrical Distribution Projects. *International Journal of Managing Projects in Business*, Vol. 12 No. 3, 2019, (pp. 808-824). DOI 10.1108/IJMPB-07-2018-0122
- [38]. Ogunde<sup>1\*</sup> A. O., Dafe<sup>1</sup> O. E., Akinola<sup>1</sup> G. A., Ogundipe<sup>1</sup> K. E. Oloke<sup>2</sup> O. C., Ademola<sup>1</sup> S. A., and Akuete<sup>1</sup> E. (2017). Factors Militating against Prompt Delivery of Construction Projects in Lagos Megacity, Nigeria: Contractors' Perspective. *Mediterranean Journal of Social Sciences*, MCSER Publishing, Rome-Italy, Vol 8 No 3, (pp. 233-242). Doi:10.5901/mjss.2017.v8n3p233
- [39]. Ojoko<sup>1\*</sup> E.O., Tanko<sup>2</sup> B. I., Jibrin<sup>3</sup> M., Ojoko<sup>4</sup> O., and Enegbuma<sup>5</sup> W. I. (2016). Project Delay Causes and Effects in the Construction Industry. *IGCESH2016*, (pp. 221-223).
- [40]. Olaniyi A. A. (2019). Application of Likert Scale's Type and Cronbach's Alpha Analysis in an Airport Perception Study. *Scholar Journal of Applied Sciences and Research* 2019, Volume 2, Issue 4, (pp. 01-05).
- [41]. Panova Y., and Hilletoft P. (2018). Managing Supply Chain Risks and Delays in Construction Project. *Industrial Management & Data Systems*, Vol. 118 No. 7, 2018, (pp. 1413-1431). DOI 10.1108/IMDS-09-2017-0422
- [42]. Pourroostam T., and Ismail A. B. (2012). Causes and Effects of Delay in Iranian Construction Projects. *IACSIT International Journal of*



- Engineering and Technology, Vol. 4, No. 5, (pp. 598-601). DOI: 10.7763/IJET.2012.V4.441
- [43]. Prasad K. V., Vasugi V., Venkatesan R., and Bhat N. S. (2019). Critical Causes of Time Overrun in Indian Construction Projects and Mitigation Measures. *International Journal of Construction Education and Research*, 15:3, (pp. 216-238). DOI: 10.1080/15578771.2018.1499569
- [44]. Rachid Z., Boudouh Toufik B., and Mohammed B. (2019). Causes of Schedule Delays in Construction Projects in Algeria. *International Journal of Construction Management*, 19:5, (pp. 371-381). DOI: 10.1080/15623599.2018.1435234
- [45]. Rahimipour<sup>1</sup> S., and Shahhosseini<sup>2</sup> V. (2013). A comparison of Effective factors in Creating Delays from the Contractors' and the Employers' Point of View in Construction of Schools in Tehran. *European Online Journal of Natural and Social Sciences* 2013; Vol. 2, No. 3 Special Issue on Accounting and Management, (pp. 3350 – 3358)
- [46]. Ratan S. K., Anand T., and Ratan J. (2019). Formulation of Research Question - Stepwise Approach. *J Indian Assoc Pediatr Surg.* 2019 Jan-Mar;24(1), (pp. 15-20). doi: 10.4103/jiaps.JIAPS\_76\_18. PMID: 30686882; PMCID: PMC6322175.
- [47]. Raymond D. Esq (2014). Best Practices for Managing Construction Delays. <https://hbfiles.blob.core.windows.net/files/8817b50f-f925-471b-94c8-2f582c524918.pdf>
- [48]. Samarah<sup>1</sup> A. Dr., Ghanim A. Dr., and Bekr G. Dr. (2016). Causes and Effects of Delay in Public Construction Projects in Jordan. *American Journal of Engineering Research (AJER)*, Volume-5, Issue-5, (pp. 87-94).
- [49]. Saunders M. N. K., Lewis P., and Thornhill A. (2016). *Research Methods for Business Students. Understanding Research Philosophy and approaches to theory development*, 8<sup>th</sup> Edition. M04 Research Methods for Business 08787.indd, (pp. 128-171)
- [50]. Serdar<sup>1</sup> D., Maksat<sup>2</sup> O., and Syuhaida<sup>2</sup> I. (2017). Causes of Delay in Residential Construction Projects in Cambodia. *Cogent Engineering*; January 2017, Vol. 4 Issue: No. 1. DOI: <http://dx.doi.org/10.1080/23311916.2017.1291117>
- [51]. Shahsavand P., Marefat A., and Parchamijalal M. (2018). Causes of Delays in Construction Industry and Comparative Delay Analysis Techniques with SCL Protocol. *Engineering, Construction and Architectural Management*, Vol. 25 No. 4, 2018, (pp. 497-533). DOI 10.1108/ECAM-10-2016-0220
- [52]. Shebob A., Dawood N., and Xu Q. (2011). Analysing Construction Delay Factors: A Case Study of Building Construction Project in Libya In: Egbu, C. and Lou, E.C.W. (Eds.) *Procs 27th Annual ARCOM Conference, 5-7 September 2011, Bristol, UK, Association of Researchers in Construction Management*, (pp. 1005-1012).
- [53]. Sivaprakasam<sup>1</sup> S., Dinesh<sup>2</sup> S., and Jayashree<sup>3</sup> J. (2017). A Review on Causes of Delay in Construction Projects. *International Journal for Scientific Research & Development* Vol. 5, Issue 02, 2017. (Pp 1108-1110).
- [54]. Srdić A. (2015). Delays in Construction Projects: Causes and Mitigation, Organization, Technology and Management in Construction. *An International Journal* · 7(3) 2015, (pp. 1383-1389). DOI 10.5592/otmcj.2015.3.5
- [55]. Sunjka<sup>1</sup> B. P., and Jacob<sup>2</sup> U. (2013). Significant Causes and Effects of Project Delays in the Niger Delta Region, Nigeria, SAIEE25 Proceedings, 9th – 11th of July 2013, Stellenbosch, South Africa © 2013 saiee, (pp. 641-1- 641-14).
- [56]. Sweis R., Moarefi, A., and Amiri M. H., Moarefi, S., and Saleh R. (2019). Causes of Delay in Iranian Oil and Gas Projects: A Root Causes Analysis. *International Journal of Energy Sector Management*, Vol. 13 No. 3, (pp. 630-650). DOI 10.1108/IJESM-04-2018-0014
- [57]. Taherdoost H., (2016). Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. *International Journal of Academic Research in Management (IJARM)*, Vol. 5, No. 2, (pp. 18-27). <http://dx.doi.org/10.2139/ssrn.3205035>
- [58]. Taherdoost H. (2016). Validity and Reliability of the Research Instrument; How to Test the Validation of a Questionnaire/Survey in a Research. *International Journal of Academic Research in Management (IJARM)* Vol. 5, No. 3, (pp. 28-36). <http://dx.doi.org/10.2139/ssrn.3205040>
- [59]. Tareq K., and Yasser N. (2018). Identification and Analysis of Factors affecting Labour Productivity in Iraq. *MATEC Web of Conferences*, Vol. 162, (pp. 02032). DOI: 10.1051/mateconf/201816202032
- [60]. Thapanont<sup>1,2\*</sup> P., Santi<sup>1</sup> C., and Pruethipong<sup>2</sup> X. (2018). Causes of delay on highway construction projects in Thailand. *MATEC Web of Conferences* 192, 02014. <https://doi.org/10.1051/mateconf/201819202014>
- [61]. Trochim W. M. (2007). *The Research Methods Knowledge Base*. <http://trochim.human.cornell.edu/kb/index.htm> (1 of 2) [7/21/2002 1:29:54]
- [62]. Uddin<sup>1</sup> M. A., Dr. Ahmad<sup>2</sup> S. K., and Danish<sup>3</sup> M. (2017). Types and Causes in Construction Delays. *International Research Journal of Engineering and*



- Technology (IRJET), Volume: 04 Issue: 07, (pp. 2236-2242).
- [63]. Varghese<sup>1</sup> A. R., and Varghese<sup>2</sup> S. (2015). Analysis of Delays in Construction Projects. *International Journal of Engineering Research and General Science* Volume 3, Issue 6, (pp. 108-112).
- [64]. Viles E., Rudeli N. C., and Santilli A. (2019). Causes of Delay in Construction Projects: A Quantitative Analysis. *Engineering, Construction and Architectural Management*. DOI 10.1108/ECAM-01-2019-0024
- [65]. Vyas S. (2013). Causes of Delay in Project Construction in Developing Countries. *Indian Journal of Commerce and Management Studies*, **Volume IV Issue 2(1), May 2013**
- [67]. Wang T., Ford D. N., Chong H., and Zhang W. (2018). Causes of Delays in the Construction Phase of Chinese Building Projects. *Engineering, Construction and Architectural Management*, Vol. 25, 2018, (pp. 1534-1551). DOI 10.1108/ECAM-10-2016-0227
- [68]. Zidane Y. J. T., and Andersen B. (2017). The Top 10 Universal Delay Factors in Construction Projects. *International Journal of Managing Projects in Business*, Vol. 11 No. 3, 2018, (pp. 650-672). DOI 10.1108/IJMPB-05-2017-0052

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